Hinkley Point C | Development Consent Order Application

Environmental Statement
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Environmental Statement - Volume 2

Hinkley Point C Development Site

Appendices

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APPENDIX 2A: HINKLEY POINT C SITE DRAINAGE STRATEGY

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FIGURE

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APPENDIX 2A: SITE DRAINAGE STRATEGY

2A.1 Introduction

2A.1.1 EDF Energy is proposing to build two new nuclear reactors, known collectively as Hinkley Point C. This report considers drainage issues relating to the development of the site at all stages through the construction phase to commissioning, future operation and ultimate decommissioning.

2A.1.2 It identifies:

- the key regulatory stakeholders who have been consulted to date, approved elements of Site Preparation Works and who will need to consent new future drainage measures;
- the level of protection required against flood risk at various stages of development;
- measures that will be adopted to ensure that required level of flood risk criteria can be achieved;
- measures that will be adopted to ensure current water quality standards will be maintained in the water environment; and
- critically, how acceptable standards of site drainage (surface and foul) will continue to operate through the various stages of site development up to permanent operational function.

2A.1.3 Details of required conceptual drainage provision are provided. However whilst location of drainage features such as outfall discharge points and water management zones are identified, precise arrangement and sizing of structures cannot in all cases be defined in detail. Reservation of such detail to appropriate Development Consent Order (DCO) Requirements is proposed.

2A.1.4 The report covers the drainage within the HPC development site area and does not cover associated development outside of this area. However the impact of works within the site on flood risk to the immediate surrounding area is identified.

2A.2 Existing Site Drainage Features and Key Development Impacts

2A.2.1 The development site currently drains to one of three catchments, these being:

- Hinkley Point C drainage ditch network;
- Holford Stream; and
- Bum Brook.

2A.2.2 The extent of these catchments is shown in **Figure A.1.1**.

2A.2.3 The relationship of these catchments with other defined watercourses and hydrological salient features is shown in **Figure A.1.2**.

2A.2.4 The Bum Brook runs adjacent to the southern boundary of the HPC development site. There will be no site preparation earthworks undertaken within proximity to Bum Brook which could impact on flood risk or water quality. However permanent works include the construction of an emergency road which provides an alternative vehicular access to the Hinkley Point C site in the event that the C182 road is impassable due to extreme rainfall or overtopping/breach of coastal defences.

2A.2.5 The emergency road will include a bridge over the Bum Brook and a crossing of its flood plain. An indicative bridge crossing has been proposed and its impact assessed as part of the DCO Flood Risk Assessment (FRA). The modelling assessment confirms that the indicative bridge crossing of Bum Brook would not give rise to significant increase of water levels and flood risk frequency. The bridge would not affect upstream 3rd party receptors. However the extent of any increase of water levels will be more accurately determined as part of future detailed design. Holford Stream will be affected as a result of construction of the development because it will be necessary to infill the valley within which the stream is located. The EA has endorsed the findings of the Holford Stream Culverting Justification report provided by EDF Energy. The existing open stream will be replaced by a culvert within the site boundary.

2A.2.6 The culvert capacity is well in excess of that required to pass flows generated from the 59Ha catchment upstream of the development site.

2A.2.7 The majority of Hinkley Point C drainage ditch catchment is located within the development site. As a result the ditch necessary to make provision for the draining of the small 243,000m^2 extent of network will be largely abandoned being replaced by a more formal drainage infrastructure. It will be nice catchment, to the west, which will in future be located outside the boundary of the completed development. This will be provided with a headwall and outfall pipe which will connect to the temporary and permanent HPC internal drainage system.

2A.3 Regulatory Stakeholders and Consultation Summary

2A.3.1 The direct or deemed consent of a number of regulatory stakeholders will be required to enable development to proceed.

2A.3.2 Hinkley Point C development is classed as a nationally significant infrastructure project (NSIP). Consequently a Development Consent Order (DCO) application will be submitted to the Infrastructure Planning Commission. It is expected that an approved DCO would apply conditions (requirements) with respect to drainage. The IPC standard condition relating to drainage is:

> *“No [stage of the] authorised development shall commence until [for that stage,] written details of the surface and foul water drainage system (including means of pollution control) have, after consultation with the relevant planning authority and the sewerage and drainage authority, been submitted to and approved by the Commission.*
>
> *The surface and foul water drainage system must be constructed in accordance with the approved details. (Model Provision, Schedule 4, 14)”.*

2A.3.3 Drainage details pursuant to the planning application permission for the Site Preparation works were approved on 28 July 2011, by West Somerset Council (WSC) following liaison with other regulatory stakeholders. Whilst the main site construction and operational details outlined herein will be determined by the IPC, all future drainage works require similar liaison with the same regulatory stakeholders identified below.

a) Drainage Authorities

2A.3.4 The Environment Agency (EA) is the primary regulator responsible for managing flood risk and pollution with regard to the water environment. It is responsible for permitting of discharges to watercourses. It manages directly watercourses designated as main river.

2A.3.5 The, commonly EA maintains a fluvial (river) flood map which shows the extent of land which would be flooded as a result of a 1% annual exceedance probability flood (1.0% AEP). This is a flood that has a 1% chance of being equaled or exceeded in any single yearreferred to as a 1in 100 year flood. The EA also maintains a tidal flood map which shows the extent of land which would be flooded as a result of a 0.5% annual exceedance probability tidal flood or coastal defense breach (0.5% AEP). This is a flood that has a 0.5% chance of being equaled or exceeded in any single year, commonly referred to as a 1in 200 year flood. This land forms Flood Zone 3a/b for the purpose of Planning Policy Statement 25 (PPS25) and Strategic Flood Risk Assessment.

2A.3.6 It is noted that whilst the EA flood map is used for identification of areas currently at risk of flooding, climate change is expected to increase the intensity of rainfall and increase the extent of area at risk of flooding and depth of flooding to existing at risk areas. The impact of climate change up to 2100 has been taken into account both in the associated Flood Risk Assessment and this Site Drainage Strategy. Decommissioning plans which form part of the DCO submission estimate that the decommissioning of the site would be achieved in 2100, approximately 20 years after the end of generation in 2080. At the end of this stage all buildings on the site will have been removed with the exception of the Interim Spent Fuel Store and any associated support facilities. The ISFS will continue to operate until a Geological Disposal Facility becomes available, currently estimated to be in 2128 and the spent fuel is able to be disposed of. Final decommissioning of the ISFS is planned to be completed by approximately 2136. The need for adaption of drainage arrangements for the ISFS can be addressed at an appropriate further time when the impact of climate change beyond 2100 is more certain.

2A.3.7 The EA Flood Map is shown in **Figure A.1.3**

2A.3.8 Internal Drainage Boards or in their absence the local district council have permissive powers to manage and maintain non main rivers located in their area. Where they choose not to undertake maintenance, the riparian owner (owner of the land in which the watercourse is located) is responsible for channel maintenance. The river Parrett as a main river is the responsibility of the EA. Non main rivers within its catchment including, Bum Brook and Holford Stream, within the development site are the permissive maintenance responsibility of the Parrett Internal Drainage Board (PIDB). PIDB require to be consulted on any issues which may impact on the watercourse drainage network such as culverting the Holford Stream or constructing the

Bum Brook bridge. EA require to undertake a flood risk overview to ensure that such structures are hydraulically adequate.

2A.3.9 West Somerset Council (WSC) is a land drainage authority with powers to regulate activities affecting non main rivers, within its boundaries, which are not maintained by an Internal Drainage Board. The local Hinkley Point Drainage Ditch catchment is outside the PIDB boundary and thus the regulatory responsibility of the council.

2A.3.10 At present both Parrett Internal Drainage Board and West Somerset Council would expect to be consulted regarding development affecting watercourses in the Hinkley Point area. Both would seek in conjunction with the Environment Agency to ensure that any development is compliant with PPS25 both in terms of location, surface water management and mitigation of flood risk.

2A.3.11 The interests of the drainage authorities will be safeguarded both directly and indirectly. In addition to flood risk assessment of proposals which are physically located within or adjacent to a watercourse, the EA also have primary responsibility for water quality impacts. They will require to consent any discharge to controlled waters (effectively any existing watercourse). The Council will consult with the drainage authorities in respect of any discharge of conditions relating to drainage matters.

b) Sewerage Authority

2A.3.12 The sewerage authority is Wessex Water. Wessex Water does not have any sewerage infrastructure within the development site or which could be affected by the development. It is not proposed that Wessex Water be requested to adopt either site drainage or the sewage treatment works.

2A.3.13 As a result whilst they will have to opportunity to comment on the DCO, Wessex Water drainage and waste water treatment interests will not be affected and they will not provide future services. It is considered unlikely that they will wish to express interest or want to influence drainage of the development.

c) Local Planning Authority

2A.3.14 The planning authority is West Somerset Council (WSC). They are responsible for considering any planning application and subject to its compliance with local, regional and national policies grant planning consent.

2A.3.15 Conditions are normally attached to planning consents. These are in place to protect the interests of both the planning authority and other regulators. Thus drainage conditions will protect the interests of the EA and PIDB. They will only be discharged following consultation with these regulators.

2A.3.16 In respect of the DCO, the IPC will have responsibility for granting of consent. However WSC have a remit to provide a Local Impact Report (in addition to advising the IPC as to the adequacy of consultation) which will consider the local impacts of the development with regard to both the NPS, existing Development Plan policies, and other material considerations. They may also deal with applications to discharge DCO requirements.

d) Office of Nuclear Regulation

2A.3.17 ONR require a safety case to be made for any nuclear plant, under the conditions attached to the nuclear site license. The safety case addresses such issues as flood risk due to extreme rainfall or other causes. The required level of protection to be provided at Hinkley Point C for safety case is protection against flood hazards arising from a 0.01% AEP commonly referred to as a 1 in 10,000 year event.

e) Infrastructure Planning Commission Scoping Opinion

2A.3.18 As with the normal planning process followed by local planning authorities, the IPC require the provision of an Environmental Statement in support of a DCO submission. EDF Energy submitted an Environmental Impact Assessment Scoping Report seeking guidance from IPC in January 2010. Following a period of consultation with regulatory bodies and interested parties, the IPC issued a Scoping Opinion in April 2010. This Opinion indicated what issues the IPC would expect to addressed in the ES and FRA to be submitted with the DCO application. This scoping opinion included responses obtained from interested parties.

2A.3.19 Clear concerns regarding potential adverse drainage impact and flood risk, resultant on the implementation of the Site Preparation Works were registered by stakeholders including:

- The Environment Agency.
- Parrett Internal Drainage Board.
- West Somerset Council.
- Sedgemoor District Council.
- Stogursey Parish Council.
- Stringston Parish Council.

f) Summary

2A.3.20 The development of Hinkley Point C will be progressed in several key stages, including initial site preparation works, temporary and permanent construction works, final commissioning and operation. Each stage will require input to drainage design by both designers and contractors, in many cases yet to be appointed. There will also be a requirement to ensure that this Drainage Strategy aligns with other approved strategies relating to Hinkley Point C site development. In order to ensure that effective coordination takes place and that all work is compliant with the requirements of regulatory stakeholders, EDF Energy will take responsibility for direct liaison with regulators to negotiate discharge of planning conditions and obtaining the necessary consents/licenses.

2A.4 Flood Risk Assessment

a) PPS25 Compliance and Sequential Test

2A.4.2 The principle of PPS25 is to seek to ensure that development is directed to areas at lowest risk of flooding, defined as Flood Zone 1, resulting in an average 1,000 year protection against fluvial or tidal flooding events. Where due to lack of land availability or nature of activity, Flood Zone 1 land is unavailable or unsuitable, development may be permitted in Flood Zone 2, giving an average protection against fluvial or tidal flooding events of between 100 and 1,000 years.

2A.4.3 Development in Flood Zone 3 which has less than 100 year average protection against flooding from fluvial and tidal events and may be functional flood plain is permitted only in exceptional circumstances and application of the sequential test. This takes into account the nature of development and its vulnerability.

2A.4.4 Development at Hinkley Point C will take place in 2 stages; Site Preparation Works (which cover the whole of the development site), pursuant to planning permission granted by WSC and associated conditions, followed by permanent drainage and site infrastructure (pursuant to grant of DCO). In considering the Site Preparation Works planning application the Council have applied the tests set out in PPS25, considering the location of the site to identified Flood Zones (notably if within Flood Zone 2 or 3).

2A.4.5 As shown in **Figure A.1.3** the area of Holford Stream which is to be infilled and culverted is located in Flood Zone 3. The area directly next to the coast where a foreshore drainage outfall structure is to be constructed is also in Flood Zone 3. In accordance with PPS25 Table D.2, Annex D these development works are classed as Water Compatible thus being appropriate.

2A.4.6 The remaining area of the Holford valley located in Flood Zone 3 being earthworks is classified as Less Vulnerable and hence also appropriate.

2A.4.7 As a result of their consideration of the SPW FRA, WSC have concluded that the Hinkley Point C proposed works are compliant with PPS25 Sequential Test and planning consent has been granted.

2A.4.8 Following on from the Site Preparation Works and the obtaining of DCO from the IPC, development of permanent infrastructure and drainage will commence. The area of power station construction works is known as Built Development Area East and West. The majority of the development will take place in Flood Zone 1. A small area of development consisting of sea wall construction will take place in Flood Zone 3. However the Strategic Siting Assessment 2009 has stated that the Sequential Test for the Hinkley Point C Power Station Development is passed.

2A.4.9 As a result of the above considerations the location of all proposed development is demonstrated to be appropriate and siting of the Site Preparation Works and Hinkley Point C Development are compliant with PPS25.

b) Environmental Impact Assessment and Flood Risk Assessment

2A.4.10 As part of the planning application for the Site Preparation Works an Environmental Impact Assessment (EIA) was undertaken, results of which are reported in the Environmental Statement November 2010. In parallel a Flood Risk Assessment (FRA) was undertaken. Results of the FRA in part informed the EIA.

2A.4.11 The FRA conclusions were accepted by the EA who subsequently gave advice and agreed parameters to be used in the subsequent FRA undertaken to support the application for DCO for Hinkley Point C. This DCO FRA builds on the work undertaken for the previous FRA. By using updated surveys, tidal boundaries provided by the EA and other EA agreed refinements; it provides greater accuracy in predicting present day base conditions.

2A.4.12 The FRA model was amended to include Bum Brook emergency crossing and bridge, the Holford Stream culvert and associated structures Water Management Zones 4 and 5.

2A.4.13 The model has been run with a 2017 baseline and with an allowance for climate change at 2100, when with the exception of the ISFS and associated support structures, decommissioning of the development site will be complete. An assessment of drainage adaption requirements for these remaining structures will be undertaken at a time when climate change impacts beyond 2100 and up to 2140 become more certain.

c) Potential Flood Risk Impact of Proposed Development on Surrounding Areas

2A.4.14 By comparing the present day situation and the development models the effect of development has been confirmed. The FRA demonstrates that the local authority's expressed concerns regarding flooding are adequately addressed.

2A.4.15 The element of development work which has greatest potential for adversely impacting on current level of protection against flooding is the infilling of the Holford Stream valley and its substitution with a culvert. The valley currently provides storage volume during fluvial flooding events. It also provides storage volume in the event of overtopping or breach of sea defences in the Stolford area.

2A.4.16 The DCO FRA confirms the previous FRA conclusions that due to the removal of storage volume which results from infilling of the Holford Stream valley and creation of the construction platform some increase in flood depth is predicted in the Holford Stream catchment. This results from the combination of a low probability tidal surge together with a breach of the coastal flood defences. However as a result of attenuation of flow through attenuation and associated SuDS there is a reduction in fluvial flood risk.

2A.4.17 The Bum Brook, Bayleys Brook and Stogursey Brook catchments to the south are unaffected thus implementation of the Site Preparation Work and full development will create no adverse change in level of flood protection currently provided in these areas.

2A.4.18 Further refinements to the overtopping calculations and flood modelling as part of the DCO FRA has found that whilst the defences immediately east of Hinkley Point limit overtopping, those further east of Stolford still result in substantial volumes entering the Wick Moor flood cell. Under climate change scenarios this overtopping crosses the Stolford Peninsula and due to the infilling of the valley can lead to raised flood levels in the Wick Moor Flood Cell.

2A.4.19 The Holford Stream catchment locations affected are residential properties in the Stolford area and the C182 road crossing of the Holford valley. The previously predicted flood risk to the existing Hinkley Point sewage treatment works is removed for the 2017 completed development situation. Although flooding is predicted as a result of climate change by 2100, it is unlikely that the sewage treatment works will remain in use by that time.

2A.4.20 The Holford Stream culvert has been sized so as to pass fluvial flows under the platform. Security screens prevent access into the culvert and will be designed and maintained in accordance with best practice guidance. As a result the FRA has concluded that increased flood risk impacts due to blockage are negligible.

2A.4.21 With respect to predicted longer term increased flood risk at Stolford, EDF Energy will seek discussions with the EA based on the FRA findings to agree on appropriate mitigation against flood risk over the life of the Hinkley Point C development. However since any mitigation may only be required in the longer term and expected to be applicable at distance from the Hinkley Point C development site, further consideration is outside the scope of the Site Drainage Strategy.

2A.4.22 Provision of flood protection/resilience works to the sewage treatment works can be considered at a later date if they remain in longer term use such that as a result of climate change they become at risk.

2A.4.23 No mitigation of flood risk at the C182 road crossing of Holford Stream valley is proposed. Alternative access will be provided to Hinkley Point, initially by use of Site Preparation Works haul roads and on completion by use of the Visitor Access Road or Emergency Road via a bridge over the Bum Brook.

2A.4.24 The construction of the power station also results in the need to divert the Hinkley Point C ditch and the interception of other minor watercourses at the site boundary. The FRA concluded that as drainage will be designed and maintained through construction operation and decommissioning of the power station this will ensure no increase in residual flood risk as a result of the development. Suitably sized pipes will be provided to allow watercourses to discharge under the perimeter fence.

2A.4.25 The change in land use will result in rates of runoff being increased. The SPW FRA calculated the likely flow rates and storage volumes required in WMZs to control the rate of runoff into watercourses, during construction, to greenfield rates. Within the future power station site the Hinkley Point C drainage ditch will be abandoned during the course of construction. The watercourse will be replaced with a temporary drainage system which will discharge to the Bristol Channel via the Foreshore Outfall. The EA has confirmed that once discharge direct to the Bristol Channel is in place attenuation of flow through WMZs 1, 2 and 3 to control rate of flow to greenfield rates is not required. WMZs have an alternative function in treating runoff and other flows so that discharges are compliant with Environmental Permitting. WMZs 1, 2 and 3 are required for this purpose and will have the incidental effect of attenuating flows. The extent of this attenuation will be determined by the design of the WMZs. Upon completion of construction and commissioning of the power station, operational drainage discharge point will transfer from the Foreshore Outfall to the Cooling Water Outfall Tunnel and WMZs 1, 2 and 3 abandoned removing any attenuation. The EA have confirmed that operational drainage discharged via the Cooling Water Outfall Tunnel does not need to be attenuated.

2A.4.26 Hinkley Point C development does include for the provision of an Emergency Road which will include a bridge and associated crossing of the Bum Brook at Shurton. The DCO FRA demonstrates that the bridge arrangement as modelled does not have any impact on upstream 3rd party receptors. The bridge will be subject to detailed design at a later stage and will be subject to EA/PIDB approval.

2A.5 Drainage Strategy - Overview

a) Governing Principles

2A.5.2 The high level purpose of the Drainage Strategy is to ensure that throughout the course of development, from Site Preparation Work, Hinkley Point C power station construction, subsequent operation to decommissioning, appropriate systems of drainage are provided, maintained and operated. It sets out the required performance standards for levels of flood protection and avoidance of pollution of the water environment which is to be achieved at all stages.

2A.5.3 A regulator approved detailed strategy for Site Preparation Work is already available together with a concept strategy for Hinkley Point C construction. It is intended that the technical detail of this Drainage Strategy will evolve with design, through co-ordination with other strategies and as further regulatory consents are obtained. Consequently, whilst there is a necessary reliance upon reserving details to DCO requirements as appropriate, it is important that this strategy sets the conceptual framework for a site drainage infrastructure that meets regulatory requirements on an ‘in principle’ basis and provides reassurance, for both regulator and applicant, that such compliance will be maintained throughout the development process.

2A.5.4 During construction the level of protection agreed with stakeholders is that drainage systems will be required to discharge runoff from a 30 year return period rainfall event without flooding. Surface water discharge rates into existing water bodies (Bum Brook, Holford Stream & Hinkley Point C drainage ditch) are to be maintained at existing greenfield (Q_{bar}) runoff. This will be achieved by routing all flow through Water Management Zones (WMZs). However once the Foreshore Outfall is constructed Hinkley C drainage ditch can be abandoned. At this stage the Built Development Area will discharge directly into the Bristol Channel. The EA has confirmed that at this stage attenuation of flow in WMZs 1, 2 and 3 will not be required.

2A.5.5 Water Management Zones will also be used to ensure that potential pollutants which result from construction activity, however well managed, for example sediment, turbidity and hydrocarbons can be contained so that existing water quality within Bum Brook, Holford Stream and Hinkley Point C drainage ditch/Foreshore Outfall is maintained.

2A.5.6 The permanent drainage works will be required to provide a level of protection against flooding for that part of the site comprising Build Development Areas East and West, access roads and car parks such that there will be no surface flooding during a 100 year return period rainfall event (1.0%AEP).

2A.5.7 In addition to the normal drainage related standards, the Strategy will:

- set out how compliance with Nuclear Safety Case 10,000 year return period (0.01%AEP) protection against internal flooding of safety related buildings will be achieved;
- address the impact of exceedance rainfall events on the drainage network and development site;
- identify the need for mitigation measures;

- address requirements for provision of temporary and permanent foul water drainage, sewage treatment and discharge of final effluent; and
- be used as a plan to manage a transition/evolution of drainage systems from current basic provision through temporary works to permanent drainage provision and ultimate decommissioning.

2A.5.8 It is intended that the Drainage Strategy will ensure compliance with performance standards formally set as conditions by regulatory stakeholders, planning policies and national guidance such as Pollution Prevention Guidelines issued by the Environment Agency. This will allow regulators to issue consents and discharge planning conditions such that construction may proceed.

b) High level Indicative Programme

2A.5.9 An indicative high level programme is shown in **Table A1.1**. The programme identifies stages of development being:

- Enabling Works.
- Site Preparation Works design, consents and construction of temporary drainage.
- Operational Works design, consents, construction and commissioning of permanent drainage.
- Transitional Drainage from temporary arrangements to operational drainage.
- Decommissioning Works.

2A.5.10 Plans showing stages of development with time are shown in phasing plans as presented in the Construction Method Statement. The operational site will be designed and constructed in 4 phases. The areas covered in each phase are shown in **Figure A.1.4**.

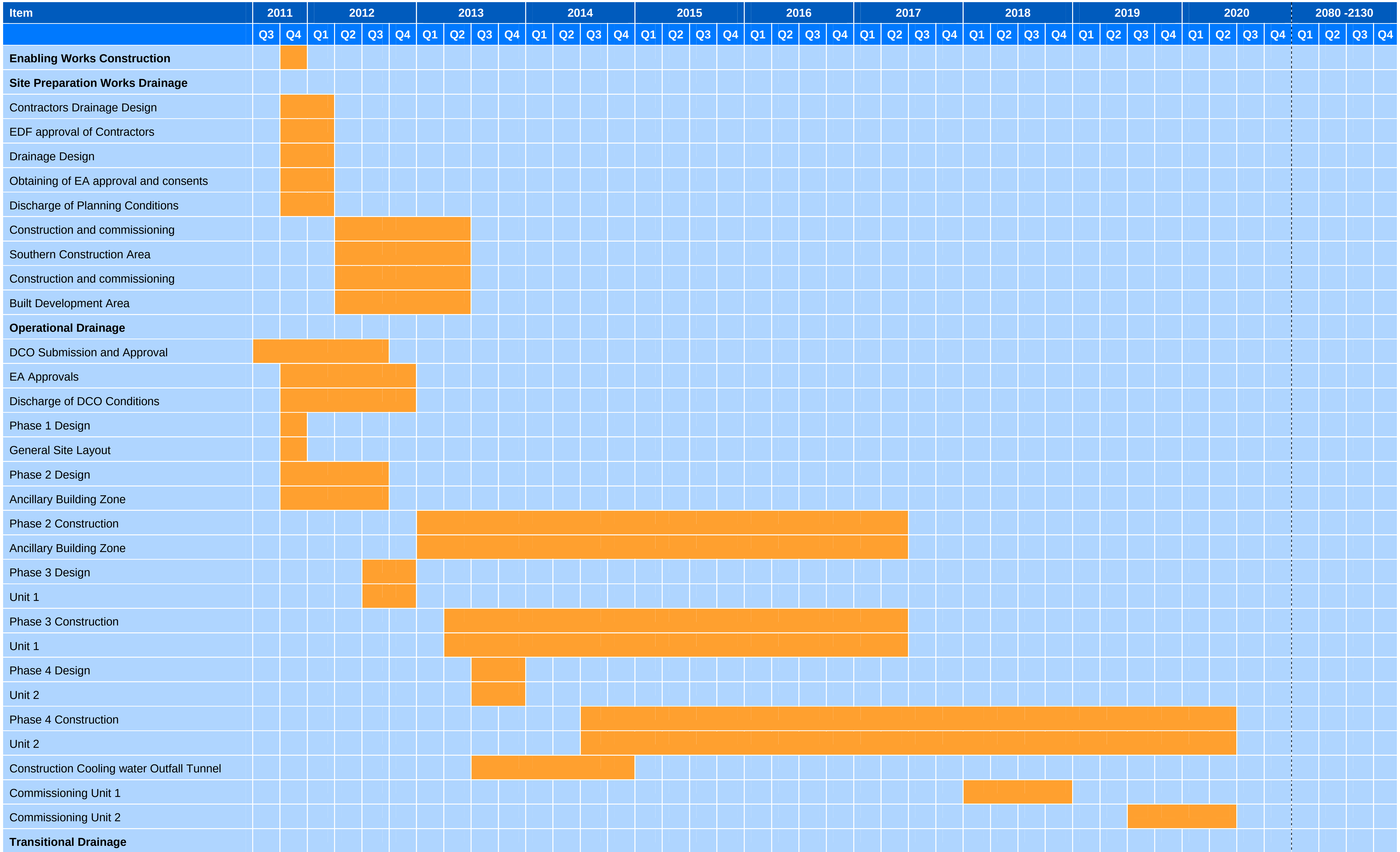
2A.5.11 Phase 1 covers design of the general layout and siting of buildings, roads and infrastructure. It shows the maximum size of buildings. These may be subject to reduction at detailed design stage in Phases 2, 3 and 4.

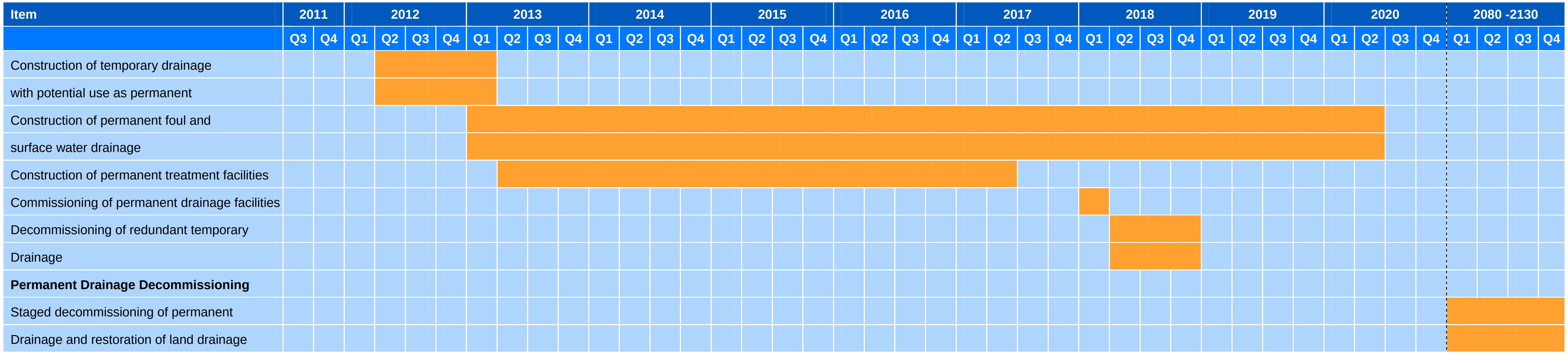
2A.5.12 Phase 2 shown yellow covers detailed design of the Ancillary Building Zone. It is currently anticipated that main construction will take place between 2013 and 2017. However construction of the access connection with the C182 road may commence in 2012.

2A.5.13 Phase 3 shown green covers detailed design of Unit 1. It is currently anticipated that this will be constructed between 2013 and 2017 with commissioning commencing in 2018. The permanent Sewage Treatment Plant (PSTP) and Attenuation Pond surface water treatment facility will be constructed as part of Phase 3.

2A.5.14 Since Phase 2 works and parts of Phase 3 will be complete and generating foul and surface water discharges before completion and commissioning of the treatment facilities it follows that the temporary treatment facilities provided by WMZs 1, 2 and 3 will need to remain in use whilst draining permanent drainage facilities. Similarly the Foreshore Outfall structure will need to remain in use to dispose of treated foul and surface water flows until the Cooling Water Discharge Tunnel is commissioned and in use.

Table 2A.1: Hinkley Point C Development Indicative Programme High Level Programme




Item
2011
2012
2013
2014
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2016
2017
2018
2019
2020
2080 -2130
Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
Construction of temporary drainage
with potential use as permanent
Construction of permanent foul and
surface water drainage
Construction of permanent treatment facilities
Commissioning of permanent drainage facilities
Decommissioning of redundant temporary
Drainage
Permanent Drainage Decommissioning
Staged decommissioning of permanent
Drainage and restoration of land drainage

2A.5.15 Phase 4 shown blue covers detailed design of Unit 2. It is currently anticipated that this will be constructed between 2014 and 2020 with commissioning in 2020. Catchment 10 to the west of the Built Development Area drains into the Phase 4 area and its flows must be accommodated at all times, currently via the existing Hinkley Point C drainage ditch, subsequently through the temporary drainage system and ultimately via the permanent drainage system before being reinstated as a watercourse upon decommissioning.

2A.5.16 Whilst the indicative construction dates quoted may be subject to some variation the sequence of phasing is fixed. The above examples demonstrate the interdependence of temporary and permanent operational drainage systems which the Drainage Strategy addresses.

c) Site Preparation Works Drainage Impacts

2A.5.17 The development as approved by WSC under planning consent consists of:

- general site clearance;
- erection of site boundary fences which cut across existing ditches;
- earthworks consisting of topsoil stripping and storage, deep excavation, site levelling for the creation of construction platforms and backfilling;
- dewatering of deep excavations;
- drainage works consisting of modification of existing drainage network, diversion and culverting of the Holford Stream, construction of coastal outfall, creation of water management zones; and
- stockpiling of excavated materials.

2A.5.18 In order to undertake the work there will be a need for the provision of site services and facilities which will include site establishment works (compounds, welfare facilities, haul roads, site access, vehicle parking, utility services) and provision and operation of construction plant and machinery (concrete batching, refuelling, aggregate crushing, wheel and plant washing).

2A.5.19 The general site layout during the preparation works is shown in the Construction Method Statement. These works will have potential impacts on drainage and hydrology in a number of respects including:

- conversion of greenfield to more impermeable surface with increased volume of overland flow;
- increased peak rate of flow due to reduced time of concentration;
- increased sediment transport loading on watercourses, increased risk of flooding and pollution;
- ground water pollution;
- ground water elevation changes due to dewatering and potential reduction in Holford Stream water levels;
- obstruction of existing ditches and watercourses by erection of site boundary fences;

- potential effects of operation of plant and construction activity; and
- disposal of treated final effluent to watercourse.

2A.5.20 The Drainage Strategy seeks to eliminate or mitigate increased flood risk, water quality and hydrological impacts through the design and location of structures and the provision of Water Management Zones.

d) Site Boundary Fencing

2A.5.21 There will be a requirement to provide a boundary fence to secure the site prior to full commencement of site preparation works. A total of nine locations have been identified where the fence will cross local ditches or watercourses. In order to prevent flow restrictions and increased flood risk each crossing will be culverted with an appropriately sized pipe. For pipes exceeding 300mm diameter security grilles will be provided to prevent unauthorised access.

2A.5.22 The culverting proposals have been submitted to and approved by the EA.

2A.5.23 The culverting proposals located within the Holford Stream catchment have been submitted to and approved by PIDB.

2A.5.24 The culverting proposals located within the HPC Drainage Ditch have been submitted to WSC who have made no formal response.

e) Drainage Catchments and Water Management Zones

2A.5.25 Initial site preparation works will take place within the catchment of the Hinkley Point C drainage ditch. Area of work and approximate location of Early Water Management Zones (EWMZ) 1 & 2 is shown in **Figure A.1.5**. The FRA estimated required storage volume required to contain runoff flows from a 30 year rainfall event whilst limiting outflow to greenfield runoff is estimated to be of the order of 29,500m^3. Following the initial site preparation works, main earthworks and construction will commence. For the purpose of drainage and water management the whole of the development site and upstream Hinkley Point C drainage ditch/Holford Stream catchments have been divided up into sub catchments and Water Management Zones (WMZ).

2A.5.26 With the exception of sub catchment 11 which drains to the Holford Stream upstream of the development site, all sub catchments are required to pass through a WMZ in order to achieve outflow to the required greenfield runoff whilst storing runoff from a 30 year rainfall (3.3%AEP) event without flooding. The WMZs are also required to control pollution so that existing water quality in the Hinkley Point C ditch outfall and Holford Stream can be maintained.

2A.5.27 The arrangement of sub catchments and WMZs developed by EDF Energy and approved in principle by the EA are shown in **Figure A.1.6.** The Site Preparation Works contractor will provide a suitable design for drainage systems and WMZs in the approximate positions shown. The designs shall ensure compliance with flood protection standards agreed by the EA and EDF Energy. The designs shall also comply with the terms of Environmental Permits issued by the EA which relate to water quality.

2A.5.28 Sub catchment areas 12 and 14 which naturally drain to the Bum Brook will not be affected by Site Preparation Works.

2A.5.29 Water quality standards are based on baseline conditions for water quality in the Hinkley Point C ditch and the Holford Stream. They are based on compliance with legislation, primarily the Water Framework Directive (WFD) and Freshwater Fish Directive.

2A.5.30 The SPW EIA concludes that freshwater quality status of Holford Stream is high. The freshwater quality of the Hinkley Point C drainage ditch is low. Hinkley Point C drainage ditch was found to have variable conditions with high suspended solids content and to dry out for extended periods. Given the observed differences in water quality and the Hinkley Point C ditch discharge direct to foreshore the Environmental Permit requirements will not be the same for both watercourses.

2A.5.31 For the purpose of Drainage Strategy it is also convenient to consider areas of work by site preparation, temporary, permanent and activity in order that drainage issues and impacts can be addressed.

2A.5.32 The areas and stages of development relating to surface water drainage are:

- Site Preparation Works Built Development Areas East & West – covered initially by EWMZs 1 & 2, subsequently by WMZs 1, 2 and 3.
- Site Preparation Works Southern Construction Area – covered by WMZs 4 & 5.
- Holford Stream culverting and infill of valley.
- Hinkley Point C coastal outfall.
- Permanent works Built Development Areas East & West.
- Emergency Road.

2A.5.33 The provision of temporary and permanent foul water network and sewage treatment is considered as a separate element.

f) Built Development Area

2A.5.34 Initial Site Preparation Works consisting of surface clearance will commence at the same time as that of the Southern Construction Area. It will be necessary to retain a drainage facility to pass any flows from land to the west of the development site (catchment 10), through the site and discharge to the foreshore.

Initial use of Hinkley Point C Drainage Ditch

2A.5.35 During this initial phase and pending construction and commissioning of a new Foreshore Outfall structure, all flows will continue to pass through the existing Hinkley Point C drainage ditch discharge point to the foreshore. Discharge will be routed via EWMZ1. The estimated required size for EWMZ1 is 29,500m^3. However this is for guidance and the contractor will need to undertake their own assessment.

2A.5.36 The appointed contractor will be responsible for providing a design for layout of the WMZ. They will be required to provide design details, method statements and other required documents including an Accident and Incident Response Plan, Water and Sediment Management Plan which demonstrate how their construction and operation will be undertaken in such a way as to comply with the Drainage Strategy and water quality/greenfield runoff standards agreed with the EA confirming in particular:

- how overland flow will be removed so as not to degrade the platform surface;
- how overland flow will be removed so as to ensure no surface flooding or ponding of water;
- how runoff will be directed to the WMZ;
- that the WMZ will have capacity to contain run off from a 30 year (3.3%AEP) rainfall event whilst allowing greenfield runoff discharge to Hinkley Point C ditch;
- how exceedance rainfall events will be managed without risk to the WMZ structure and other construction works in progress;
- how silt will be removed prior to discharge into the Hinkley Point C ditch;
- how hydrocarbons and other pollutants can be contained within the WMZ; and
- what arrangements are in place to shut down the outfall to Hinkley Point C ditch in an emergency.

2A.5.37 It is anticipated that as work adjacent to the foreshore proceeds it may be necessary to move location of EWMZ1 to a new location EWMZ2. Alternatively the contractor may create EWMZ2 and divert the piped flows from the east such that EWMZ1 is not required.

Temporary Drainage Network Foreshore Outfall Structure

2A.5.38 Construction of drainage for Site Preparation Works will commence with the construction of the Foreshore Outfall structure. The location for the outfall has been selected to ensure least environmental impact following marine ecology assessment and approved by the EA in principle.

2A.5.39 The invert level of the outfall pipe is set above highest astronomical tide level. Energy of water which is estimated to discharge at a peak rate of 13.5m3/s during the 30 year rainfall event will be dissipated by provision of baffle blocks on the base of the outlet bay. The invert level of the outfall pipe is set above highest astronomical tide level at a level of 7.5mAOD. As part of the SPW FRA, calculations were undertaken to confirm that all of the Built Development Areas and the Hinkley Point C drainage ditch to the west could be drained by gravity to an outfall set at this level. Flow rate at the outfall has been estimated to be at a peak rate of 13.5m3/s during the 30 year (3.3%AEP) rainfall event. This does not take account of any incidental attenuation produced by WMZs 1, 2 and 3. The calculations assume the outfall downstream of the collector drain will be 2100mm diameter set at a gradient of 1/166. The formal design of the outfall and temporary works drainage will be undertaken by the site preparation works contractor and demonstrate compliance with flood risk criteria. There will be a requirement for energy dissipation provision at the outfall headwall.

2A.5.40 The outfall structure will need to be located such that it does not conflict with the construction of the permanent sea wall. Arrangement shall be made to ensure safe access for pedestrians along the foreshore. It is anticipated that such access will be to the rear of the outfall structure.

2A.5.41 The outfall structure and pipe shall be capable of removal to a point within the permanent sea wall such that the seaward face of the sea wall can be reinstated flush with the adjacent profile.

g) Temporary Drainage Network Collector Drain and Spine Drains

2A.5.42 Collector drain will be provided to connect from the Foreshore Outfall to a manhole at the rear of the proposed sea wall. It will then run parallel to the foreshore and clear of the sea wall construction area. It will provide an outfall for 3 spine drains which will cross the site from south to north. The indicative position of these spine drains A, B and C are shown in **Figure A.1.6**.

2A.5.43 This basic drainage network will provide an outfall for conveyance of all surface water flows arising during site preparation and construction and will be required to remain in use until commissioning of the power station is sufficiently advanced that the permanent drainage systems can be used and the Cooling Water Outfall Tunnel is available to discharge treated surface water flows and final effluent. For this reason it is necessary to ensure that the line and level of the temporary drainage system will not conflict with proposed buildings, structures and other services.

2A.5.44 The drain provided at time of site strip and clearance which transfers any flows from land to the west of the development site (catchment 10) will need to be diverted into spine drain C.

Temporary Drainage Network Water Management Zones

2A.5.45 Each spine drain will discharge to the collector drain via a WMZ. Because WMZs 1, 2 and 3 will discharge to the foreshore rather than to watercourse the EA has accepted that attenuation to greenfield runoff is not required. The contractor will need to undertake their own assessment as to required size based on the requirement to comply with water quality and passing runoff from a 30 year (3.3%AEP) rainfall event.

2A.5.46 The contractor will also provide design calculations to show that the drains have suitable capacity to drain all surface water runoff derived at any stage in construction for a 30 year (3.3%AEP) rainfall event, without surface flooding. Details will also be required to demonstrate how exceedance rainfall event runoff will be conveyed overland so as not to flood excavations, damage the works or halt construction.

2A.5.47 Design criteria for the drains will be that applied to the permanent drains in order to provide an option for them to be incorporated into permanent works. If design of permanent drainage is completed prior to design of spine drains and routes/locations are capable of use for temporary spine drains then the contractor will be provided with the design and the spine drains will be treated as permanent.

Temporary Groundwater Dewatering

2A.5.48 Once the temporary drainage is complete and construction terraces have been constructed it will be necessary to undertake deep excavation for construction of the EPR reactor units. Platform level is 14mOD and foundation depth is approximately 3mOD. Geological and Hydrogeological review indicates that groundwater levels range from 6 to 10mOD. As a result it will be necessary to lower the groundwater levels to a sufficient depth that excavation and subsequent construction can take place in the dry.

2A.5.49 It is intended that dewatering be undertaken by the installation of deep wells. These would be installed in boreholes. Once working the dewatering system will draw down groundwater and any accumulation of surface water ponding in the base of the excavation. It has been estimated that total of 6,300m^3 groundwater will be removed in order that construction within the base of the excavation can be undertaken. Routine periodic pumping will be required to prevent groundwater build up.

2A.5.50 The design of deep wells and collector drains is the responsibility of the contractor. Based on site investigation and assessment of geological information a potential contractor has indicated that approximately 40 wells will be required and discharge rate during draw down will be in the range 60 – 140 l/s. Once a dry base of excavation has been achieved the deep wells will be operated as required to maintain reduced ground level.

2A.5.51 A drainage system will be installed around the perimeter of the deep excavation to intercept and remove and surface runoff so as to minimise surface water accumulation in the base. This will discharge to the spine drain system.

2A.5.52 Dewatering the deep excavation area will result in drawing down ground water levels in the surrounding strata. However it is not anticipated that the draw down will impact on base flow in the Holford Stream to the south.

2A.5.53 The groundwater dewatering network will be handed over to the permanent works contractor for use until the permanent groundwater galleries are commissioned.

2A.5.54 Temporary Foul Water Drainage and Sewage Treatment Temporary foul water drains and temporary sewage treatment plants (TSTP) are proposed for collection of domestic sewage, its treatment and disposal of final effluent. The proposed locations are shown in **Figure A.1.6**. Details of the foul drainage network and sewage loadings for treatment are to be determined. The TSTPs will require consents to discharge from the EA and UWWT final effluent sampling points will need to be provided.

2A.5.55 All TSTPs are located in sub catchment 1. Treated final effluent is shown to be connected into Main Spine Drain C for disposal. However this would pass final effluent through WMZ1 before discharge via the collector drain and outfall to the foreshore. The contractor may choose to provide a separate final effluent pipe bypassing WMZ1 and connecting direct to the collector drain.

h) Southern Construction Area

Holford Stream Culverting

2A.5.56 In order to provide room for construction of the permanent works in Built Development Areas East & West it is necessary to occupy area to the south both for stockpiling of excavated material, provision of compounds and support services. A direct consequence is the need for culverting of the Holford Stream to allow infilling of the valley and creation of construction platforms.

2A.5.57 The need for culverting has been accepted by the EA and an outline feasibility design has been agreed with the PIDB. The hydraulic performance of the culvert has been the subject of study as part of the FRA.

2A.5.58 There are two streams within the valley which enter the site from upstream. The crossing points have references CP5 and CP6. CP5 is at a higher level and will need to be diverted to the valley floor downstream of CP6.

2A.5.59 The culvert will extend over a distance of approximately 690m and will run parallel to the existing stream in the valley bottom. It is proposed to offset by a distance of approximately 50m to the north. This position has been selected in order to obtain better ground conditions to support the culvert. Following diversion of the higher level stream at CP5, it also has the benefit of providing separation from the remaining stream in the valley floor, minimising risk of disturbance or pollution.

2A.5.60 During construction of the culvert there will be a potential need to undertake dewatering of the excavation. Environmental Permits have been obtained which will allow discharge to the Holford Stream at 5 points along the length of the culvert. The appointed contractor will provide appropriate measures to ensure that water quality of discharge is compliant.

2A.5.61 Sufficient room is provided at either end of the culvert to construct inlet/outlet headwalls and divert, within the development site, the route of the stream via the culvert. The streams at CP5 and CP6 will be diverted into the inlet. The outlet from the culvert will discharge to the stream in the valley bottom which exits the site at CP8.

2A.5.62 The size of the culvert has been determined by access rather than hydraulic capacity considerations. Given the length of culvert and its confined space health & safety status, it is intended that routine inspection will be undertaken by driving through the culvert. Accordingly the culvert will be a minimum of 2.5m wide and 2.5m high or such larger size that is available as standard from box culvert manufacturers.

2A.5.63 Based on these dimensions and gradient the hydraulic capacity of the culvert will be $18m^3/s$. The 100 year (1.0%AEP) rainfall event runoff calculated for the FRA is $1.8m^3/s$. The velocity of flow for this discharge is 1.5m/s. However it is not intended that the culvert would be accessed in time of rainfall.

2A.5.64 Unauthorised access will be prevented by the installation of grilles at inlet and outlet headwalls. The inlet grille will also serve as a trash screen to prevent ingress of debris to the culvert. The area of the grille is such that full blockage of the culvert is extremely unlikely. In any event it will be subject to routine maintenance inspection and any accumulation of debris removed.

2A.5.65 Given the length of culvert three intermediate shafts are to be provided for ventilation purposes. It is not intended that these be used to access the culvert and no ladders or staging will be provided.

2A.5.66 In order to prevent elevated groundwater levels and avoid risk of floatation a land drainage system will be installed on either side of the culvert. The land drains will discharge through the culvert outlet headwall into the stream.

2A.5.67 The sections of watercourse forming the diversion into and out of the culvert will be protected against erosion. This will be in the form of in situ concrete or stone pitched bed and sides. In addition there will be a water cushion sump at outlet which will cause reduction in exit velocity of flow.

2A.5.68 In the event that DCO is not obtained then the culvert will be removed and the Holford Stream reinstated. In the event that DCO is granted then the EA have accepted that the culvert will remain as a permanent feature.

Infilling of Valley

2A.5.69 Once the culvert construction is complete, site strip and filling of the valley can commence. Finished levels for platforms will range from 17 to 23mOD relative to the current low point of 6mOD at Holford Stream. Maximum height of stockpiled topsoil for reuse will not exceed 32mOD.

2A.5.70 The platforms will tie into existing ground levels to the south and required levels for Built Development Areas East and West to the north.

2A.5.71 The contractor will be responsible for the design and provision of drainage systems to manage and control surface water runoff (pluvial flow). The contractor has indicated in Environmental Permit Supporting Information MS002 that a system of open drainage ditches will be provided. The ditches will intercept and route all flow to WMZs.

2A.5.72 The ditches will require adjustment as ground levels rise, until they reach required construction platform level. The ditches will be required to have capacity to discharge runoff from a 30 year (3.3%AEP) rainfall event without flooding of the site.

2A.5.73 The ditches will subsequently remove runoff from the stockpiles. A potential risk of acid rock runoff reducing pH to levels not compliant with Environmental Permitting has been identified. The contractor has indicated that measures to control acidic leachate will be provided at source prior to discharge into the ditches.

Haul Roads

2A.5.74 Haul roads will be located to the east and west edges of the platforms beyond which side slopes of variable width and gradient will be constructed to tie into existing ground levels.

2A.5.75 The haul roads will be constructed to current British Standards and Design Manual for Roads and Bridges (DMRB). Final surface finish will be compacted granular material. Surface water drainage will be required in order to ensure that the haul roads remain useable during and after rainfall events. This will be in the form of a surface crossfall and provision of a swale ditch to collect runoff. To the extent that runoff does not infiltrate into the ground it will be routed to the WMZs via the system of ditches used to drain the construction platform.

2A.5.76 Once completed, the haul roads will be available as an emergency access in the event that flooding of the C182 occurs during a major tidal surge/breach of coastal defence. The haul roads will tie into the C182 through the construction of a north east and south east roundabout. The south east roundabout will be of normal DMRB construction and include the provision of formal highway drainage.

The highway drainage will have capacity to remove runoff from a 30-year rainfall event without surface flooding.

Water Management Zones 4 and 5

2A.5.77 WMZ4 will be located to the east and south of Holford Stream. WMZ5 will be located at the base of the slope to the west.

2A.5.78 The appointed contractor will be responsible for providing a design for layout of the WMZ as described in paragraph A1.5.48 above. The appointed contractor will be responsible for providing a design for layout of the WMZ as described in paragraph A1.5.48 above. However guidance has been provided though both the SPW FRA and SPW Environmental Statement. The design must ensure that the flood risk and quality standards agreed by EDF Energy with the EA are met.

2A.5.79 The FRA estimated required size for the WMZ4 is 16,000m^3 and for WMZ5 8,000m^3. However, the contractor will need to undertake their own assessment as part of their design.

2A.5.80 The Site Preparation Works Environmental Statement provides an indicative description of what WMZs 4 and 5 are expected to comprise but this is not prescriptive.

2A.5.81 It is assumed that WMZ ponds would be no more than 3m deep with shallow side slopes for stability. They would be lined with MDPE sheeting which would be tied into the banks.

2A.5.82 They would have a formal outfall structure. Greenfield flow rate would be achieved by some form of throttle control on the outfall pipe.

2A.5.83 The WMZs would have a second high level overflow arrangement as it is necessary to ensure that overtopping of the WMZ will not result in breach and failure of the pond. Whilst the setting of an overflow level has not been formally specified within the Environmental Statement it is considered that it should be set at the predicted 100 year (1.0%AEP) FRA fluvial flood level to ensure that back up of flooding from the Holford Stream will not overtop the WMZ bund crest and wash out the WMZ contents. As a precaution the bund crest should be set with a freeboard level 300mm above the overflow. The surface finish of the overflow should be protected so as to avoid erosion during operation. It is also necessary to ensure that the WMZ water level should not reach overflow crest during the 100 year (1.0%AEP) event. Confirmation of exceedance event flow paths both to and from the WMZs is also required.

2A.5.84 Once completed, the haul roads will be available as an emergency access in the event that flooding of the C182 occurs during a major tidal surge/breach of coastal defence. The haul roads will tie into the C182 through the construction of a north east and south east roundabout. The south east roundabout will be of normal DMRB construction and include the provision of formal highway drainage. The highway drainage will have capacity to remove runoff from a 30-year rainfall event without surface flooding On Site Campus Drainage.

2A.5.85 The On-site campus will be constructed adjacent to the south east roundabout and require provision of surface water drainage connecting to WMZ4 to the north. This drainage system will also need to remove final effluent. The On-site campus will be constructed adjacent to the south east roundabout and require provision of surface water drainage. An indicative layout for a traditional piped drainage network is shown in the DCO FRA. The drainage network will be required to have capacity to remove runoff from a 30 year rainfall event without surface flooding. Provision for managing exceedance rainfall overland flow so as to mitigate risk of internal flooding is also required.

2A.5.86 A foul water drain will be provided to collect sewage and wastewater which will be treated in a temporary sewage treatment plant TSTP. The final effluent will need to comply with the requirements of the Environmental Permit. The final effluent pipe will discharge to the same outfall pipe as the surface water drain. All foul water infrastructure will be removed as part of decommissioning of the On-site campus.

2A.5.87 The common outfall pipe will discharge via a headwall to a ditch which will convey flows to WMZ4.

Groundwater and Land Drainage

2A.5.88 No significant dewatering of excavations is anticipated and since groundwater movements tend to be from the south, groundwater input to base flow in Bum Brook is not expected to be affected.

2A.5.89 Holford Stream catchment is closer to the area of dewatering within the Built Development Areas but from previous investigation there is a discontinuity in the Green Lane ridge area that should prevent lowering of groundwater levels which could affect stream base flow.

2A.5.90 The infilling of the valley may have some impact on groundwater migration and levels but land drains installed on either side of the Holford Stream culvert will allow any groundwater to discharge downstream of the culvert. Outflow from WMZs 4 and 5 will also contribute to base flow through attenuation of runoff.

2A.6 Operational Power Station Permanent Drainage Network in Built Development Areas

a) Site Layout Determinants

2A.6.2 The layout of the operational power station and its component parts has been set in Phase 1 design. Maximum required sizes of operational buildings were determined to provide footprints. Road networks have been superimposed on the layout to provide suitable access and all infrastructure including drainage networks will be generally located along the line of roads in order to maximize access for maintenance.

2A.6.3 The power station is provided with a number of permanent drainage systems comprising:

- surface water drainage;
- plant drainage;

- foul drainage; and
- groundwater drainage.

2A.6.4 Following appropriate treatment and monitoring, the ultimate discharge point of most of these systems is the main power station Cooling Water Outfall Tunnel which extends approximately 1.8km offshore in the Bristol Channel.

2A.6.5 Flow rate from the above sources will be small relative to the cooling water component which will have a flow rate in the order of $130m^3/s$. Surface water flow rate resulting from a 100 year (1.0%AEP) rainfall event would be in the range of 15 to $28m^3/s$ whilst the other components would not exceed $1m^3/s$.

2A.6.6 Sea wall groundwater drainage – through penetrations in the sea wall to the foreshore. The exceptions to the common cooling water outfall tunnel discharge point are:

- Cooling water forebay overflow – through penetrations in the sea wall to the foreshore.
- Sea wall groundwater drainage – through penetrations in the sea wall to the foreshore.
- Groundwater gallery – discharging to the forebay.

2A.6.7 In addition, for rainfall events of a lower frequency than the 100 year (1.0%AEP) design rainfall, run-off which cannot enter the surface water drainage network will be routed by overland flow to an open channel at the base of the slope which runs from the 14.0m platform to the rear of the coastal path. The channel will be drained through penetrations in the sea wall to the foreshore. In more extreme rainfall events, if the capacity of the channel is exceeded water levels will be controlled since there will be a flow path across the sea wall through the pedestrian and vehicle gaps in the crest of the wall.

2A.6.8 Consideration was given to permanent use of the Foreshore Outfall Structure through the sea wall for the discharges not routed through the Cooling Water Outfall Tunnel. However this has been discounted on grounds of security and operational risk. The sea wall will be constructed as a mass concrete structure and the penetrations will be in the form of pipes with diameter not exceeding 225mm. The pipes will not project forward of the sea wall profile. As a result the penetrations created by the pipes will not have any adverse effect on the sea wall flood protection performance.

2A.6.9 The layout of surface water drainage networks is determined by the need to drain impermeable roofs, roads and car parks discharging to the Attenuation Pond prior to combined discharge to the Surge Tank and Cooling Water Outfall Tunnel.

2A.6.10 The layout of foul drainage is determined by the location of buildings which generate foul sewage and the requirement to route all flows via the road network to the permanent sewage treatment works (PSTW).

b) Flood Risk Factors

2A.6.11 Drainage regulator required level of protection against flood risk is that the surface water drainage networks within the operational power station site have capacity to remove runoff resulting from a 100 year (1.0%AEP) rainfall event without surface flooding. The 100 year rainfall event intensity to be used for design is adjusted for predicted climate change up to 2100. Base rainfall and climatic change data has been determined by the Meteorological Office and is contained in their report "Extreme Precipitation Analysis at Hinkley Point.

2A.6.12 The worst case rainfall in terms of summer or winter profile and duration will be determined by drainage network simulation using the InfoWorks or similar acceptable computer modelling package.

2A.6.13 Safety Case required level of protection is that there must be no detrimental flooding as a result of a 10,000 year rainfall event. This is taken as meaning that there must be no risk of floodwater entering safety-related buildings. It is expected that such extreme rainfall will result in the engineered drainage networks being overwhelmed and superficial flooding of the site platforms. Protection will be achieved primarily through a combination of engineered falls of the site platform to direct the superficial floodwater away from critical buildings and raising the entrance thresholds for such buildings to above the assessed flood levels. However, other options will be reviewed at design stage.

c) Proposed Surface Water Networks

2A.6.14 In addition to providing sufficient protection against flooding it is also necessary to ensure that flows which will be disposed to sea in the Bristol Channel the cooling water outfall tunnel are of satisfactory quality.

2A.6.15 In order to ensure acceptable water quality, three separate drainage systems will be provided:

- roof drainage – EDF Energy designation SEO-EP (Roof);
- road and car park drainage – EDF Energy designation SEO-EP (Roads); and
- areas with high risk of hydrocarbon contamination – EDF Energy designation SEH.

2A.6.16 Drainage from roofs is considered to have no potential to be contaminated by hydrocarbons and hence can be disposed to sea without any form of treatment. Given the relative area of roof to be drained there is a benefit keeping roof water separate and reducing volume of rainwater flow which requires some form of treatment.

2A.6.17 Drainage from roads and car parks will have some level of contamination by hydrocarbons, to an extent variable and dependent on antecedent rainfall conditions. In general the initial runoff from surfaces will tend to be more polluting. As a result it is necessary that provision be made for the ability to treat runoff if required.

2A.6.18 The network SEH is provided to drain areas at high risk of pollution due to hydrocarbon pollution or major spillage incident. Areas which are expected to be connected to the network will include bunded oil, storage areas, transformer areas and unbunded higher contaminated hardstanding areas. Buildings and structures which are likely to have potential oil flows either in general or as a result of an incident are identified in the document "Site discharge Source List" prepared by EDF

Energy. However precise details and locations will be determined as a consequence of risk assessment.

2A.6.19 The SEE network will be sized on the basis of worst case discharge from impermeable area, oil spill, fire hydrant operation individually or in combination. Fire stop manholes and means of isolation will be provided for incident control and safeguarding of the network.

2A.6.20 All three drainage systems will outfall to the Attenuation Pond at which they will converge after passing through a containment tank for settlement of solids and oil separation as required, before discharging via a common outfall pipe to the Cooling Water Outfall tunnel for disposal.

2A.6.21 Details of route and arrangement for connection to the Cooling Water Outfall tunnel are subject to detailed design.

d) Proposed Groundwater Interception and Disposal

2A.6.22 Following completion of construction and removal of the deep well dewatering facility, it is anticipated that groundwater levels will recover to their original levels in the range of 6–10mOD. This creates a potential risk of groundwater flooding of operational buildings and floatation pressures which could impact on structural stability. In order to mitigate these risks, groundwater galleries will be constructed around the perimeter of critical buildings to the south and west. Any ingress water will be intercepted and removed, being disposed to the Unit 2 Forebay. Groundwater levels will be controlled at a level of 8mOD.

2A.6.23 The rate of groundwater ingress cannot be determined with precision nor can its quality. However relative to cooling water discharge as stated in A1.6.3 quantity/quality impacts will be minimal.

2A.6.24 Geotechnical investigation indicates that groundwater tends to flow from south to north. If in practice it is found that groundwater flow from the east creates potential problems construction of an additional eastern groundwater gallery may be considered.

e) Surface Water Network Design

2A.6.25 Design of roof drainage and underground pipework will be in accordance with:

- BS EN 752 Drain and Sewer Systems outside Buildings.
- BS EN 12056 Gravity drainage systems inside Buildings.
- Building Regulations Approved Document H.

2A.6.26 Specification of works will be in accordance with:

- Civil Engineering specification for the Water Industry (CESWI).
- Sewers for Adoption.
- Building Regulations Approved Document H.
- Highways Agency Design Manual for Roads & Bridges (DMRB).

2A.6.27 Given the location, layout and ground levels within the development the design will need to address specific issues.

2A.6.28 The flood risk requirement is that there shall be no surface water flooding as a result of a 100 year (1.0%AEP) rainfall event. It is necessary to ensure that all drainage pipes have capacity to pass the 100-year flows without surface flooding. This can be established by modelling of the network and routing of flows, whilst allowing the network to surcharge in manholes but not permitting surcharge levels to reach ground level. This ensures that all water which enters the drainage network can be removed for disposal.

2A.6.29 The design must also ensure that rainwater can be removed from impermeable surfaces such as roads. Since road design is normally based on lesser flood risk standards with permitted temporary ponding of water in gutter areas, typical gulley, channel drain, kerb drain sizing and spacing will be inadequate. Highway gullies are normally effective where there are reasonable longitudinal gradients which will direct flow along the gutter to the nearest gulley. In this case the site ground levels are flat although it is accepted that there must be some fall.

2A.6.30 Report “Networks Conceptual Design – Onsite Highways” specifies that if gullies are provided the minimum fall required is 0.5%. For channel and slot drains this can reduce to 0.1%.

2A.6.31 Given the exposed location and the extent of vertical faces of buildings there will be a need to make provision for removal of wind-blown rain which runs down the sides of buildings. BS EN 12056 requires that for design purposes an impermeable area of 50% of total vertical face should be allowed in runoff calculations. By virtue of the runoff collecting at ground level it is likely to be more contaminated and will be discharged to the SEO-EP road drainage network.

f) Surface Water Network Design – Safety Case

2A.6.32 Given that the surface water drainage network is designed to ensure that no surface flooding will occur due to a 100-year rainfall event it follows that a more extreme event will result in surface flooding of roads and paved areas due to either drains being overloaded such that water level reaches ground level or inability of gullies, channel drains and kerb drains to remove surface water from roads.

2A.6.33 In the case of roofs, the capacity of outlets and downpipes will start to be exceeded such that ponding on flat roofs will occur.

2A.6.34 Consideration has been given to increasing the size and capacity of drains so that a 10,000 year (0.01%AEP) rainfall event does not cause surface flooding and roofs are adequately drained. This would result in a need for excessively large diameter pipes and the disadvantage that under more frequent rainfall events there would be low proportional depths resulting in lack of self-cleansing flows. There would also be difficulty in providing sufficient road gullies and channel drains with capacity to remove all surface water from the roads.

2A.6.35 Accordingly Safety Case 10,000 year (0.01%AEP) runoff will be handled by a combination of Sustainable Drainage (SuDs) and Flooding Resiliences measures.

2A.6.36 Measures considered included a combination of:

- provision or ramps or steps at points of access to critical buildings so as to create a threshold above general ground level;
- managed overland flow flood routing within roads and away from buildings directing towards the lowest point at the sea wall;
- diversion of flow into groundwater galleries;
- underground or above ground designated storage; and
- high-level overflows to drain roofs.

2A.6.37 Taking account of relevent factors such as site layout, security, operational resiliance and health and safety, the measures to be incorporated in detailed design will consist of:

- provision or ramps or steps at points of access to critical buildings so as to create a threshold above general ground level;
- managed overland flow flood routing within roads and away from buildings directing towards the lowest point at the sea wall; and
- provision of drainage capacity to remove safety case rainfall intensity event flows from critical building roofs.

g) Sustainable Drainage

2A.6.38 The normal benefit of SuDS infiltration through recharging of groundwater is detrimental since there will be a requirement to control groundwater levels in order to protect the structural stability of critical infrastructure.

2A.6.39 Given the intensity of development and the criticality of the operational site there is limited scope for use of SuDs storage techniques in the form of ponds or tanks. It is also the case that since surface water disposal is to be through the Cooling Water Outfall tunnel the usual requirement for attenuation and greenfield runoff to mitigate effect of increased flow rate in receiving watercourse is not applicable.

2A.6.40 However above ground SuDs in the form of rainwater harvesting and green roofs will be provided. Whilst the primary driver for use of these techniques is ecological, they will attenuate surface water runoff.

2A.6.41 Rainwater harvesting is proposed for the Training and Simulator building. The extent and arrangement of the system is subject to detailed design.

2A.6.42 Sedum green roofs are specifically designed to support plant and wildlife providing a natural replacement for the footprint of the building. They also reduce peak rate of flow to the drainage system through the absorption of rainwater. Sedum roofs will be provided for a number of buildings including the Main Access Control Building, Outage Access Control Building, Medical Centre, Garage for Handling facilities, Oil and Grease storage and Oil Ancillary Building, the Simulator Building/Training Centre, the Public Information Centre and the EDF Site Offices. The total area of sedum roof coverage is approximately 14,500m^2.

2A.6.43 Green roofs are not suitable for some operational buildings since green roofs provide insulation and there is a requirement to dissipate heat through the roof structure.

h) Permanent Sea Wall

2A.6.44 A mass concrete permanent sea wall will be constructed over approximately 760m along the coastal frontage of the site. The dual purpose of the sea wall is to protect against erosion and limit the risk of flooding of the operational site due to wave overtopping.

2A.6.45 The soffit level of the precast concrete balustrade which is set on top of the mass concrete structure is 13.50mOD. The ground level of the coastal path located behind the balustrade is 12.40mOD. A slope of variable gradient links the operational platform (level 14.0mOD) with the coastal path.

2A.6.46 The Sea Wall is designed to allow removal of water which may accumulate through the wall for discharge to the foreshore. The sources of water are:

- Overland flow due to rainfall exceedance events of greater than 1 in 100 year.
- Wave overtopping of the sea wall.
- Groundwater flows.

2A.6.47 A channel will be installed at the base of the slope and rear of the coastal path. This channel will provide drainage for the coastal path and also collect surface water runoff and wave overtopping water. Pipes of suitable diameter and spacing to be confirmed as part of detailed design will discharge water from the channel through the sea wall. In the event that the pipes are unable to cope, water level will build up and discharge through the two 1.5m pedestrian access breaks points and the 5.0m vehicular access break in the sea wall. If water levels back up the slope to the rear of the channel water will infiltrate into the ground where it will be removed with other groundwater.

2A.6.48 A layer of free draining backfill will be placed to the rear of the mass concrete wall. This will allow water which infiltrates the ground and groundwater to migrate to a lower level drainage system. This will prevent pressure build up behind the sea wall which could result from groundwater mounding. Under baseline conditions groundwater runs in a south to north direction and exits the existing cliff face via seepage.

2A.6.49 The design of this low level drainage system has been set with the provision of 150mm pipes which will pass through the mass concrete wall at a spacing of one pipe per 10 linear metres. The invert levels of the pipes on the landward side will be in the range 4.5 – 5.5mOD and each pipe will have a vertical fall of 0.5m to the seaward side. It is intended that this arrangement will control groundwater levels such that they will not exceed 6.0mOD.

2A.6.50 The construction of the Sea wall will have to accommodate the temporary Foreshore Outfall pipe. This pipe with a diameter of approximately 2.1m. It will require to remain in use until such time that all flows from the Built Development can discharge via the Cooling Water Outfall Tunnel.

i) Water Quality Measures

2A.6.51 Whilst the volume of surface water discharged into Bridgewater Bay via the Cooling Water Outfall tunnel is not significant relative to the receiving water body, the quality of the discharge needs to be effectively controlled.

2A.6.52 Car park drainage will be compliant with recommendations contained in EA Pollution Prevention Guidance Note 3 and passed through suitably sized Class 1 bypass interceptors.

2A.6.53 Where roads are drained via gullies, silt and debris will be held within the gulley pot. For channel drains and kerb drains, inline silt traps will be provided to manufacturers recommendations.

2A.6.54 All of these facilities will be maintained in accordance with an asset maintenance plan and cleansed in order to minimise reduction in water quality and siltation of drainage systems.

2A.6.55 All three surface water networks will pass through the Attenuation Pond. The roof drainage will pass through without treatment. The road drainage will pass through without treatment but with a facility to divert to treatment if there are concerns regarding water quality.

2A.6.56 All SEH network flows which have a high risk of hydrocarbon contamination will be treated within the Attenuation Pond containment tank before merging with the roof and road drainage flows. Treatment will consist of passing flow through separator and settlement tanks. There will be a facility to divert and retain flows which arise from dealing with fires. The estimated volume is 1,635m^3 but actual volume will be confirmed in the course of detailed design. Contaminated water held in retention will be disposed offsite to an approved facility.

j) Permanent Foul Water Sewer Network

2A.6.57 A separate foul water drainage system will be provided for collection and disposal of sewage and wastewater. The system has the EDF Energy designation SEO-EU/EV. No surface water will be connected to the foul water drains and measures to prevent ingress of surface water runoff during exceedance events will be considered.

2A.6.58 Flow rates from each building will be calculated from information provided by EDF Energy which will include number of persons based in the building and the presence of any catering facilities. Discharge units and flow rate will then be calculated in accordance with BS EN 12056 Gravity drainage systems inside Buildings. Flow rates from individual buildings will be cumulated from points of connection to the main foul drains in order to ensure sufficient capacity.

2A.6.59 Design of internal building foul water drains and connections to the main drains will be in accordance with:

- BS EN 752 Drain and Sewer Systems outside Buildings.
- BS EN 12056 Gravity drainage systems inside Buildings.
- Building Regulations Approved Document H.

2A.6.60 Design of main foul water drains will be in accordance with:

- BS EN 752 Drain and Sewer Systems outside Buildings.
- Sewers for Adoption.

2A.6.61 Specification of works will be in accordance with:

- Civil Engineering specification for the Water Industry (CESWI).
- Sewers for Adoption.
- Building Regulations Approved Document H.

2A.6.62 The drainage runs will be located along the line of roads in order to maximize access for maintenance. Given that the site is effectively flat with limited fall towards the PSTP it is anticipated that a wholly gravity network, compliant with design criteria for self-cleansing velocities will not be achievable. It is likely that there will be a need for one or more pumping stations. In terms of sewage treatment terminal inlet pumping stations can assist with consistency of treatment by delivering a more consistent trickle flow.

k) Permanent Sewage Treatment Plant

2A.6.63 Biological, chemicals and water loadings on the PSTP will be determined using the Table of Loadings for Sewage Treatment Systems from “Code of Practice Flows and Loads – 3 Sizing Criteria, Treatment Capacity for Sewage Treatment Systems” issued by British Water.

2A.6.64 At this time it is not possible to state with precision the number of persons on site and using sewage facilities. This will vary both over 24 hours and also dependent on site activity. Initial assessments were of the order of:

- Normal daytime 700
- During outage 1,100
- Night time 100
- Weekends 100

2A.6.65 The British Water document quoted gives loadings of:

- Flow 100 litres/person/day
- BOD 38 grams/person/day
- Ammonia 5 grams/person/day

2A.6.66 Typical specification for PSTP performance is:

- Suspended solids 20mg/litre
- BOD 30mg/litre
- Ammonia 5mg/litre

2A.6.67 It is accepted that consent to discharge will be required from the EA. Such consent may require higher standards than previous due to implementation of the Priority Substances Daughter Directive in 2016. An Environmental Permit Application has been made with a stated maximum loading of 1,750 persons and a treated volume of 175m^3/day. Discussion with the EA is in progress. Response to the application An UWWT final effluent sampling point will need to be provided. It is understood that the EA will require this to be at the outfall to the PSTP. The outfall will discharge to the Cooling Water Outfall Tunnel.

2A.6.68 Details of route and arrangement for connection to the Cooling Water Outfall tunnel are subject to detailed design.

2A.7 Permanent Surface Water Drainage Network - Southern Construction Area

a) Flood Risk Factors Holford Stream Catchment

2A.7.2 Holford Stream culvert and its associated headwalls and channels, constructed as part of Site Preparation Works will be retained as permanent structures.

2A.7.3 The Emergency Road will pass through the catchment linking Hinkley Point C site to the national road network at Shurton. The road should not be flooded during a 100 year (1.0%AEP) rainfall event.

b) Proposed Surface Water Networks

2A.7.4 Restoration of the land which will involve deep ploughing of subsoil and reintroduction of topsoil together with re-profiling of the surface levels will have the effect of improving the permeability of the strata.

2A.7.5 Measures will be introduced to prevent erosion of the surface due to runoff whilst vegetation is re-established.

2A.7.6 In addition it is intended that water features will be provided on the site of WMZs 4 and 5. It may be possible to modify the WMZs to form part of the water features. If this is not possible then they will require demolition.

2A.7.7 The impact of restoration as proposed will be to reduce rate of surface water runoff and peak flow rate in the Holford Stream with a return towards more normal greenfield runoff rates, currently achieved, over time. This will result in an overall reduction in flood risk.

2A.7.8 It is intended to use sustainable drainage (SUDs) techniques such as swales for disposing of runoff from the Emergency Road.

c) Flood Risk Factors Bum Brook Catchment

2A.7.9 The Emergency Road will pass through the catchment linking Hinkley Point C site to the national road network at Shurton. The road should not be flooded during a 100 year (1.0%AEP) rainfall event.

2A.7.10 The Emergency Road will have to cross the Bum Brook. A concept design has been prepared for a bridge over the Bum Brook. Arch soffit has been set at the Site Preparation Works FRA 1000 year flood level plus 600mm freeboard. It is anticipated that this will ensure conveyance of the 10,000 year (0.01%AEP) flood without drowning out of the bridge structure. However this will be confirmed as part of detailed design.

2A.7.11 Predicted levels have been calculated as part of the DCO FRA. Negotiations will take place with the EA regarding acceptable impact of the bridge and associated embankments on the flood plain. If necessary mitigation works can be undertaken to prevent increased level of flood risk.

d) Proposed Surface Water Networks

2A.7.12 There is a requirement to re-profile the side of the Bum Brook valley in order to both provide a barrier to mitigate visual intrusion of the HPC construction works and also match the Southern Construction Platform ground levels. This will require removal of topsoil and placing of material to create the required slopes. This work which will be undertaken after completion of Site Preparation Works will result in an increase in rate of surface water runoff and pluvial flow. In order to mitigate this increase WMZ6 will be created and will be required to hold runoff from a 30 year (3.33% AEP) flooding event whilst being permitted to discharge to the Bum Brook stream at greenfield runoff (Qbar) rates.

2A.7.13 The re-profiling of land surface and change of levels is expected to move the Bum Brook/Holford Stream watershed to a more southerly position thus marginally reducing runoff to the Bum Brook.

2A.7.14 Once re-profiling is complete, cultivation and restoration will be undertaken in the same way for the Holford Stream catchment. WMZ6 will be replaced by a water feature.

2A.7.15 The impact of restoration as proposed will be to reduce the rate of surface water runoff and peak flow rate in the Bum Brook with a return towards more normal greenfield runoff rates over time. Taking into account the adjustment in watershed, an overall reduction in flood risk is anticipated.

2A.7.16 It is intended to use sustainable drainage (SUDs) techniques such as swales for disposing of runoff from the Emergency Road.

2A.8 Temporary – Permanent Drainage Transition and Management

a) Built Development Areas East and West

2A.8.2 Site layout and drainage work required as part of Site Preparation Works construction is well understood. Approval of the temporary/permanent drainage works included in Site Preparation has been obtained from the EA, PIDB and WSC. Site layout and drainage work required as part of Site Preparation Works construction is well understood. Approval of the temporary/permanent drainage works included in Site Preparation will be obtained from the EA, PIDB and WSC.

2A.8.3 Permanent layout of the power station together with associated buildings and support infrastructure has been confirmed through completion of design Phase 1. Locations of the Attenuation Pond, permanent STP and final points of discharge for disposal of treated final effluent and surface water are fixed.

2A.8.4 The fixing of permanent final layout of the power station also establishes routes for both permanent and temporary foul water and surface water drainage.

2A.8.5 Based on the original programme, it was intended that Site Preparation Works contractor would be required to provide a temporary works drainage design based on the WMZ concept shown in **Figure A.1.6.** This would include design of the WMZs, spine drains, collector drain and foreshore outfall structure. This design arrangement was based on the belief that design of permanent drainage would not be undertaken before Site Preparation Works construction had commenced. However the current programme shown in **Table A.1.1** indicates that design of permanent drainage will commence in the fourth quarter of 2011 whilst construction of Site Preparation Works drainage will not commence until the second quarter of 2012. As a result and subject to suitable levels/WMZ design, it may be possible for the spine drains and collector drains to be designed for incorporation in permanent works.

2A.8.6 Whilst it may be possible subject to detailed design to construct some Site Preparations Work drains as permanent, there will still be a need for temporary drains and transitional structures, including WMZs and Foreshore Outfall.

2A.8.7 The existing Hinkley Point C drainage ditch and its foreshore outfall will require to remain in place and in use until the temporary Foreshore Outfall structure is complete. EWMZ1/2 will be required in order to control flow rate and ensure water quality standards are maintained. The existing Hinkley Point C drainage ditch and its foreshore outfall will require to remain in place and in use until the temporary Foreshore Outfall structure is complete. EWMZ1/2 will be required in order to control flow rate and ensure water quality standards are maintained in compliance with Environmental Permit specified criteria.

2A.8.8 Once the temporary foreshore outfall structure is complete and available for use the collector drain can be constructed. At this point permanent/temporary drainage can be diverted into the collector drain via WMZs 1, 2 and 3.

2A.8.9 Ancillary Building Zone will be the first area to be constructed. Because it is at the upstream limit of the site, permanent drainage will need to pass through temporary spine drains designed by the SPW contractor. Permanent drainage constructed as part of this phase will be sized for the 100 year (1% AEP) rainfall event with no surface flooding but will connect into temporary spine drains which are designed for the 30 year (3.3% AEP) rainfall event. However there is a requirement to plan for exceedance and manage overland flow. As a result the downstream lack of 100 year (1% AEP) spine drain capacity will not create unacceptable risk of flooding. In fact the additional capacity in permanent drains will create additional underground storage volume available in a 30 year (3.3% AEP) event potentially reducing flood risk. This will be subject to hydraulic modelling as part of permanent works design.

2A.8.10 As an alternative the spine drains may be designed as permanent in which case they will also be sized for the 100 year (1% AEP) rainfall event with no surface flooding.

2A.8.11 Power Station Unit 1 located to the east and downstream of the Ancillary Building Zone will be the next area to be constructed. This will include construction of the Attenuation Pond and the permanent sewage treatment works. Permanent foul and surface water sewers constructed in the Ancillary Building Zone will be extended to these outfall points. The effect of this will be to provide a greater and level of flood risk protection to the Ancillary Building Area whilst providing 100 year (1% AEP) rainfall event protection, with no surface flooding.

2A.8.12 Construction of Power Station Unit 2 will be the last main area of construction. Permanent foul and surface water sewers constructed in the Ancillary Building Zone will be connected to the new drains.

2A.8.13 At this stage all permanent surface water and foul water drains will be in place and available for use. However some elements of temporary drainage will need to remain in place.

2A.8.14 WMZs 1, 2 and 3 will need to remain in place and use until such time as the Attenuation Pond treatment facility is complete, commissioned and in operation. At this stage the WMZs can be abandoned and all surface water flows will pass through Attenuation Pond.

2A.8.15 There will be a need for a temporary connection from the Attenuation Pond to the collector drain and Foreshore Outfall structure to provide a discharge point for all surface water and groundwater. This outfall will be required until such time as the Surge Chamber and Cooling Water Outfall are in operation. Once all flows have been diverted to the Surge Chamber on a permanent basis the collector drain and Foreshore Outfall are no longer required.

2A.8.16 Although it is expected that the TSTPs will be constructed and commissioned without delay, during initial construction there will be a need to provide temporary holding tank facilities for collection of sewage. Sewage will be removed by tankering.

2A.8.17 TSTPs will be provided for use during construction of Phase 2, 3 and 4 permanent works. The location of TSTPs is in catchment 1, Phase 4. These facilities will need to remain in place and available until such time as the PSTP is complete, commissioned and in use at which time they can be either abandoned or outfalls transferred to permanent foul water drains.

2A.8.18 Phase 2 Ancillary Building Zone will be complete prior to construction of the PSTP, as part of Phase 3. If the facilities are occupied at this stage temporary sewage disposal arrangements will be required. It is likely that flows could be passed to one of the TSTPs pending permanent treatment availability.

2A.8.19 There will be a need for a temporary connection from the PSTP to the collector drain and Foreshore Outfall structure to provide a discharge point for all surface water and groundwater. This outfall will be required until such time as the Surge Chamber and Cooling Water Outfall are in operation. Once all flows have been diverted to the Surge Chamber on a permanent basis the collector drain and Foreshore Outfall are no longer required.

2A.8.20 Consideration was given to continued use of the temporary Foreshore Outfall structure but discounted on grounds of security and maintenance liability. It will be removed and the Sea Wall made good. However consideration will be given to method of abandonment and Sea Wall finishing works with a view to recreation of an outfall at the same location upon decommissioning of the power station.

2A.8.21 The final construction will be of the Interim Spent Fuel Facility. Drainage of this facility will connect into the permanent drainage network constructed as part of Unit 1Southern Construction Area Holford Stream and Bum Brook catchments

2A.8.22 Significant elements of work undertaken as part of Site Preparation Work such as the Holford Stream culvert will be permanent structures. Drainage provision in the form of ditches and gravel filled drains will be kept in the same approximate position but require continuous modification as construction platforms are raised. However once platforms and stockpiles are complete it is anticipated that the drainage facilities will be effectively permanent until restoration of the land to form a nature reserve.

2A.8.23 As part of the proposed landscape restoration scheme it is intended that water features will be provided on the site of WMZs 4, 5 & 6. It may be possible to modify the WMZs to form part of the water features. If this is not possible then they will require demolition.

2A.8.24 Effectively the distinction between temporary and permanent works is blurred and the final drainage arrangements are expected to be an adaption of temporary rather than a new drainage system.

2A.9 Permanent Drainage Asset Maintenance

2A.9.1 The permanent drainage network has been designed with capacity to provide the level of protection against flood risk as specified by EA and ONR. The specification of drainage assets will be compliant with standards referred to in A1.6.49. This will minimise risk of operational failure of drainage assets which could result in a flooding incident.

2A.9.2 It remains the case that operational failure due to blockage or other asset failure presents a risk of flooding. This risk will be mitigated by a programme of planned asset maintenance, cleansing and inspection which will be undertaken by EDF Energy as owner of the development site.

2A.9.3 All drainage assets are located within the development. As a result it is not proposed that any drainage asset will be offered for adoption and all assets will remain in the ownership of EDF. Under the provisions of Floods and Water Management Act 2010, Schedule 3, there is no legal requirement to have SuDs drainage facilities located in private land offered for adoption.

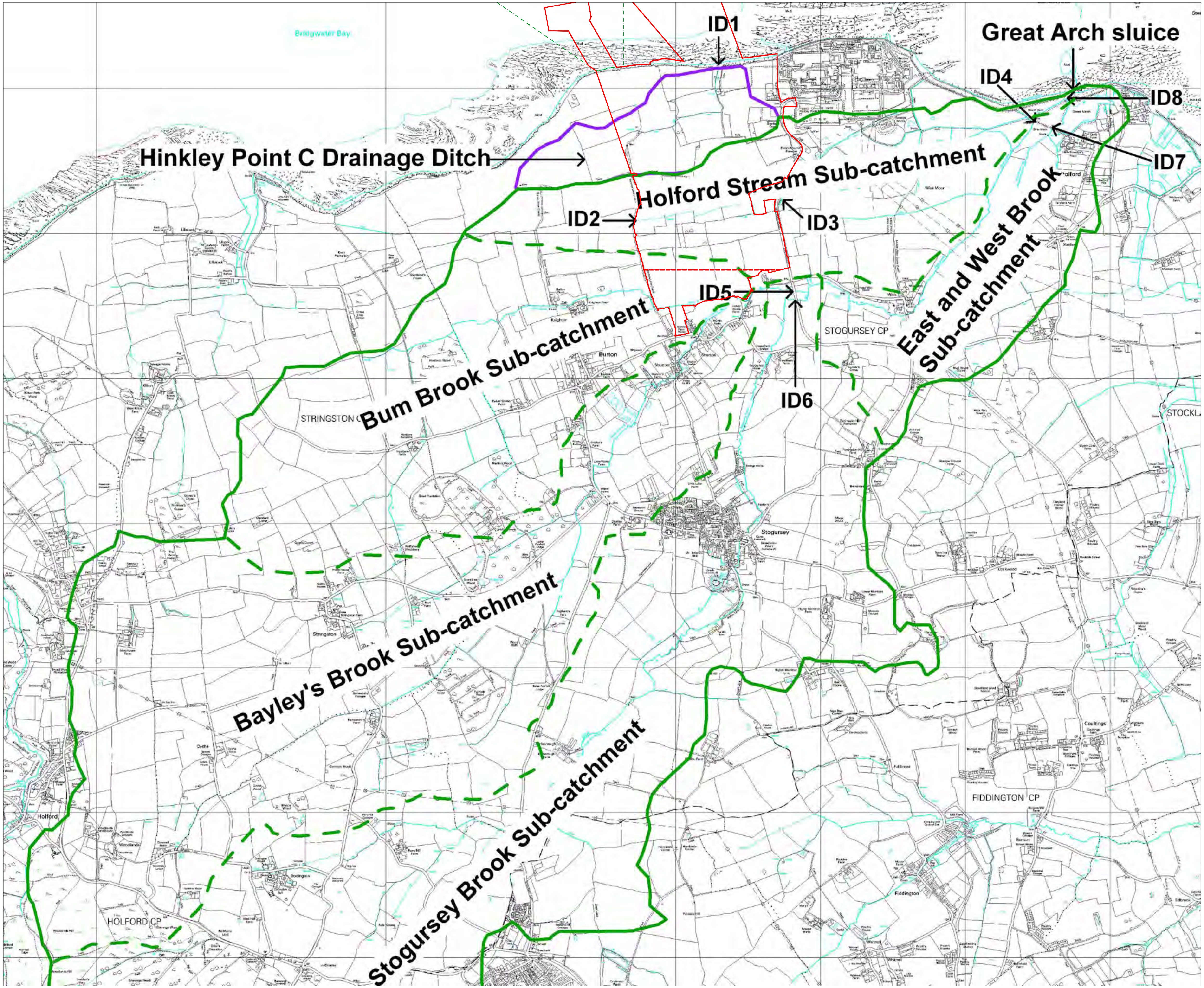
2A.10 Decommissioning and Demolition of Hinkley Point C Power Station

2A.10.1 It is intended that the Hinkley C power station will cease to operate after approximately 60 years in around 2080. The Built Development Area will then be demolished in stages and it is currently expected that the land will be made available for further industrial use but with an interim period of grassland. It will be necessary to retain the Spent Fuel Storage Facility until approximately 2028 when the Government proposed Deep Waste Repository is due to become available. Final decommissioning is expected to be complete by 2036.

2A.10.2 As decommissioning proceeds, the drainage facilities will require gradual modification to continue effective operation, provision of flood protection and treatment of effluent/surface water runoff. Modification will need to take account of changed flow regimes and impacts on self-cleansing flows. Reduced loadings on the PSTP may impact on standard of final effluent will also need to be considered.

2A.10.3 At some point the Attenuation Pond surface water treatment facility will be demolished and there will be a requirement to replace it with a Class 1 bypass road drainage. The PSTP will need to remain in place until ultimate demolition of the Spent Fuel Storage Facility.

2A.10.4 As part of decommissioning the Cooling Water Outfall Tunnel will be sealed and above ground and sea bed features dismantled. It is intended that at this time all flow from surface water drains and treated final effluent from the PSTP will be diverted to a new outfall in the same location as the Foreshore Outfall Structure. The area occupied by the Build Development Area will be returned initially to its current undeveloped state but will subsequently be available for future development. Drainage ditches will be required to provide for the effective drainage of catchment 10 to the west and catchments 1-3.



KEY

- HPC DEVELOPMENT SITE BOUNDARY
- TEMPORARY JETTY SEAWARD HARBOUR LIMITS
- GREAT ARCH SLUICE CATCHMENT
- GREAT ARCH SLUICE SUB-CATCHMENTS
- HINKLEY POINT C DRAINAGE DITCH CATCHMENT
- DEVELOPMENT SITE INDICATIVE BOUNDARY

EDF ENERGY

DOCUMENT:
HINKLEY POINT C
SITE DRAINAGE STRATEGY

FIGURE TITLE:
HINKLEY POINT C DRAINAGE DITCH, HOLFORD STREAM AND BUM BROOK CATCHMENT PLAN

FIGURE NO:		REVISION:
FIGURE A 1.1		01
DATE: SEPT 2011	DRAWN: E.D	SCALE: 1:25,000@A3

SCALE BAR
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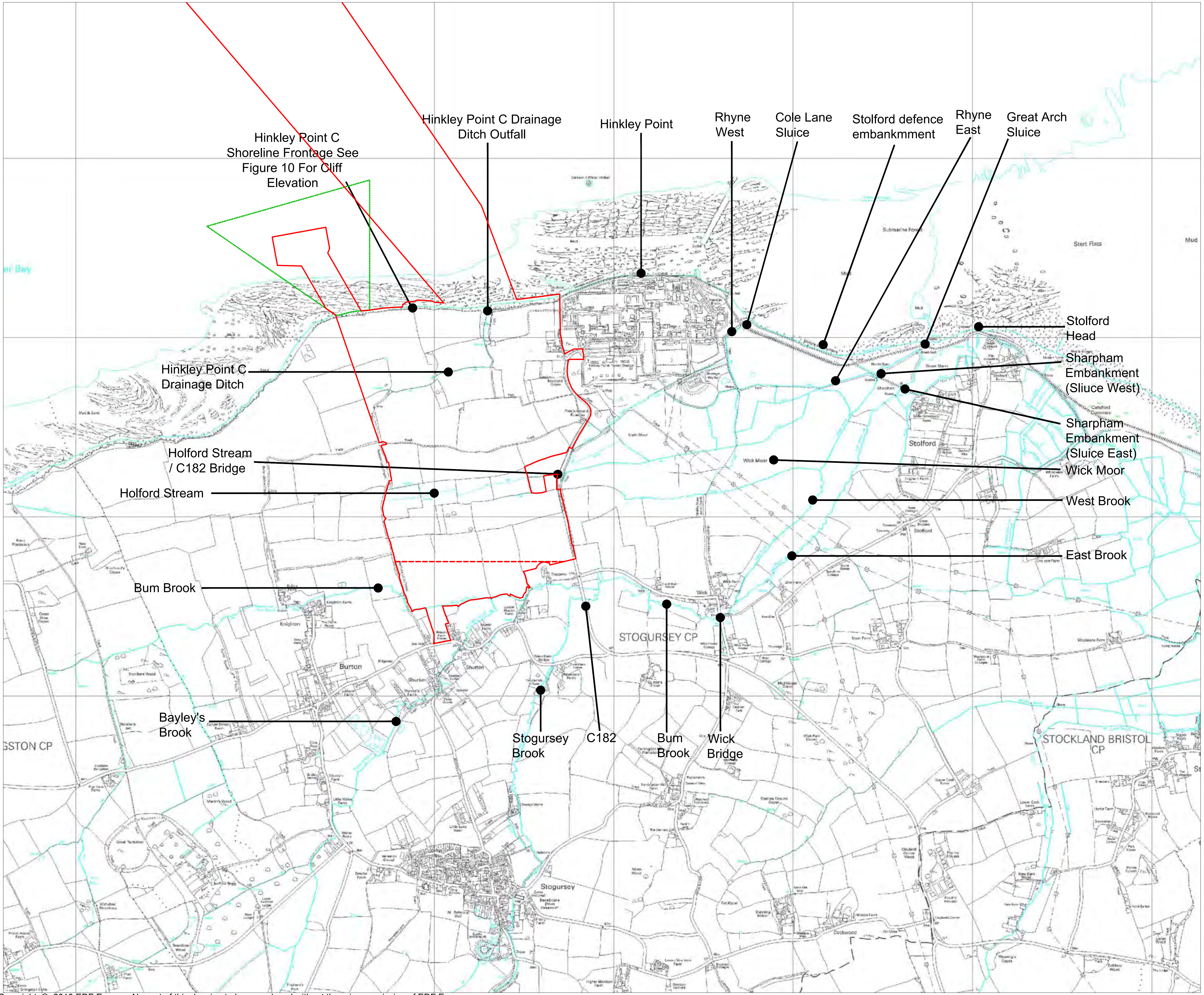

KEY

- HTC DEVELOPMENT SITE BOUNDARY
- TEMPORARY JETTY SEAWARD HARBOUR LIMITS
- DEVELOPMENT SITE INDICATIVE BOUNDARY

EDF ENERGY

DOCUMENT:
HINKLEY POINT C
SITE DRAINAGE STRATEGY

FIGURE TITLE:
DEFINED WATER COURSE AND HYDROLOGICAL SALIENT FEATURES

FIGURE NO:		REVISION:
FIGURE A 1.2		01
DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:20,000@A3

SCALE BAR
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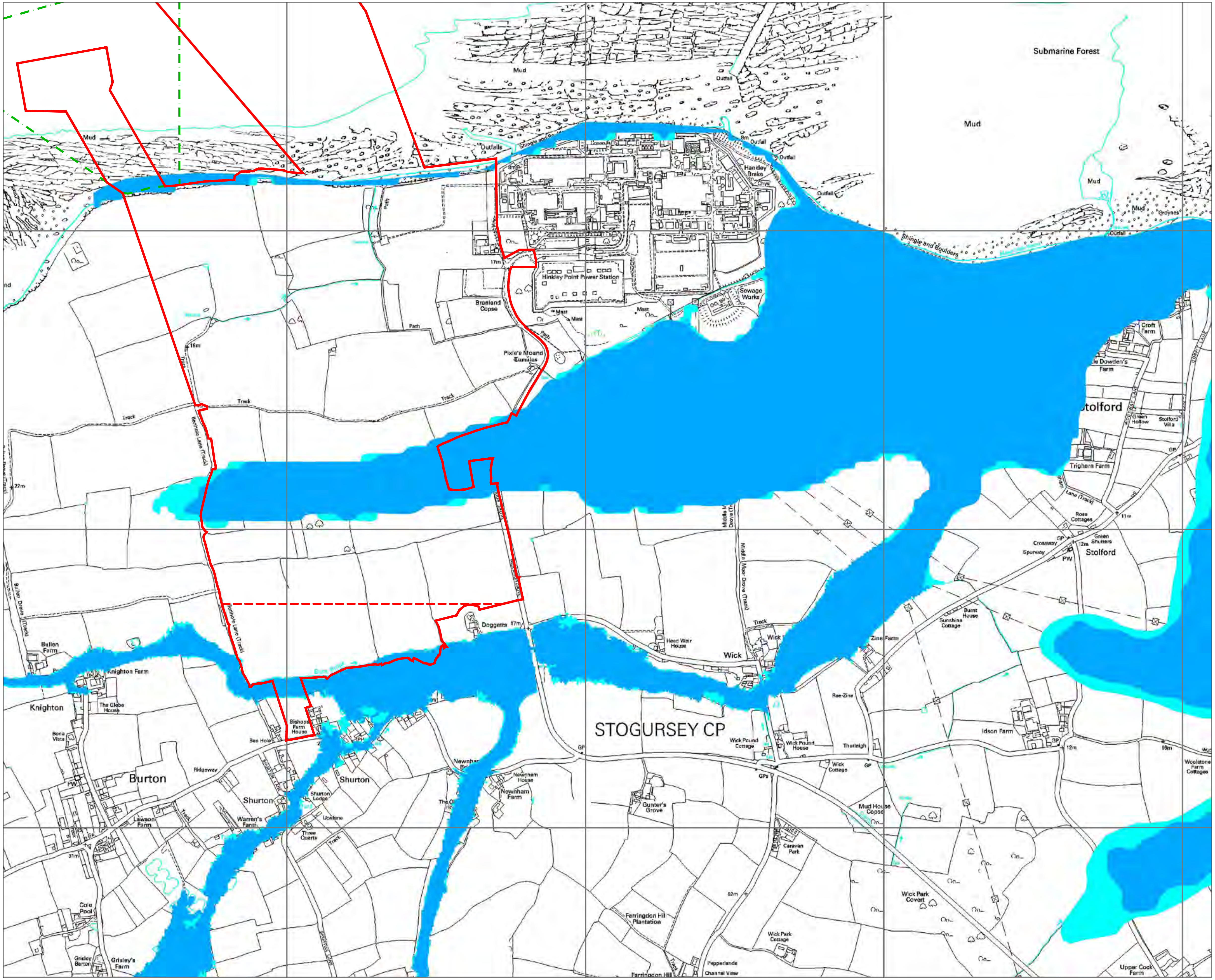


KEY

- HPC DEVELOPMENT SITE BOUNDARY
- TEMPORARY JETTY SEAWARD HARBOUR LIMITS
- ENVIRONMENT AGENCY FLOOD ZONE 3
- ENVIRONMENT AGENCY FLOOD ZONE 2
- ORDNANCE SURVEY MARKED WATER FEATURE
- DEVELOPMENT SITE INDICATIVE BOUNDARY

N
W E
S

DOCUMENT:

HINKLEY POINT C
SITE DRAINAGE STRATEGY

FIGURE TITLE:

ENVIRONMENT AGENCY COMBINED TIDAL AND FLUVIAL FLOOD ZONE MAP

FIGURE NO:		REVISION:
FIGURE A 1.3		01
DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:12,500@A3

SCALE BAR

0 100 500m

KEY

PLANNING APPLICATION SITE BOUNDARY

DEVELOPMENT SITE – INDICATIVE BOUNDARY

EXISTING DRAINAGE

WATER MANAGEMENT ZONE (PROPOSED)

COMMON LAND

MH MANHOLE LOCATION

EXISTING STREAM

EW EARLY WORKS

NOTES

1. WATER MANAGEMENT ZONE (EW-WMZ1) CONSISTING OF A SERIES OF POOLS THAT WILL BE FORMED BY THE SITE PREPARATION CONTRACTOR AS PART OF THEIR EARLY WORKS ACTIVITIES.

2. WATER MANAGEMENT ZONE (EW-WMZ2) CONSISTING OF PONDS, SHALL REPLACE EW-WMZ1. THIS WORK WILL BE CARRIED OUT BY THE PRELIMINARY WORKS CONTRACTOR.

N
W E
S

100 200

Scale: 1:2500 @ A1 OS Grid at 500m

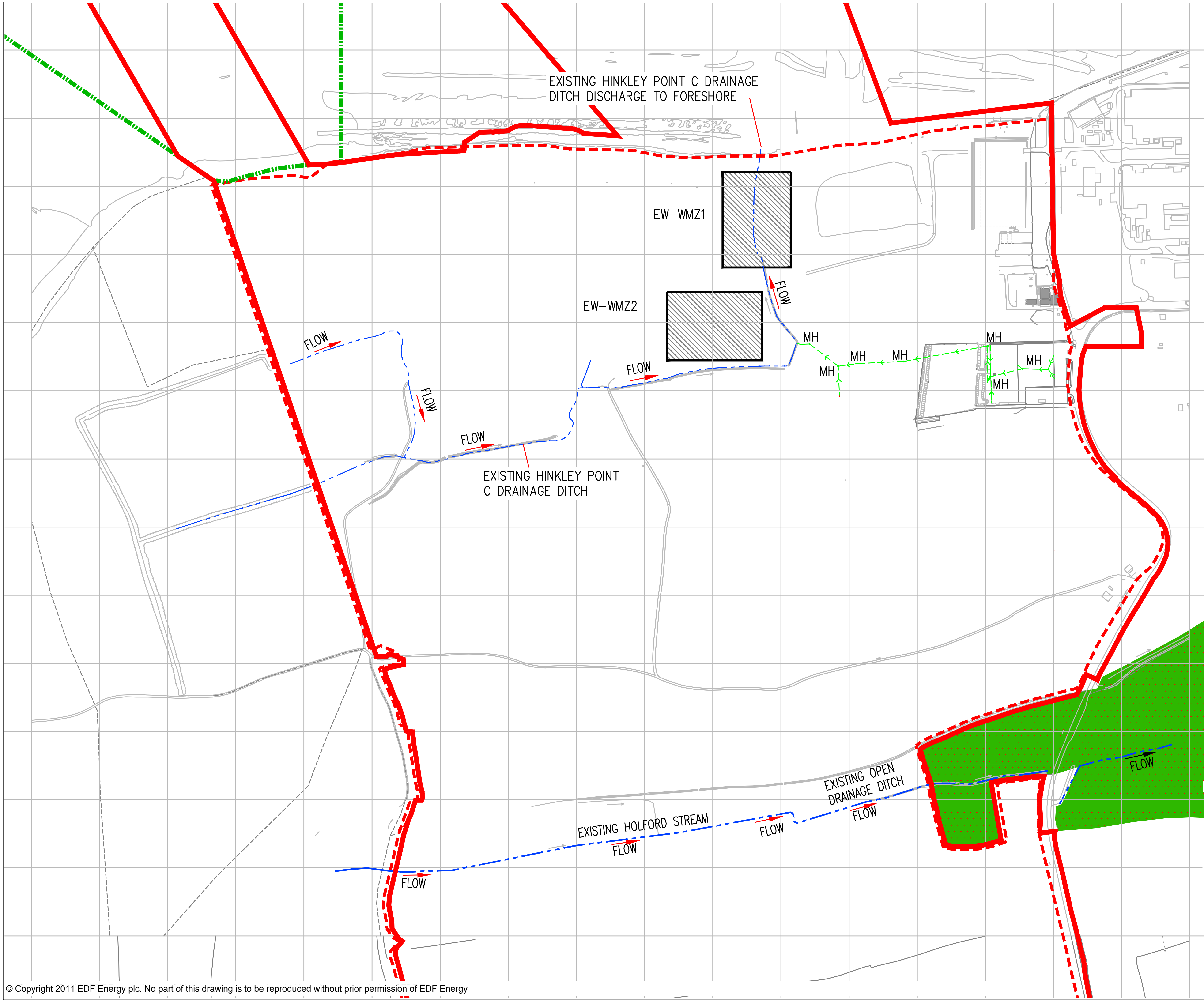
Drawn : R.B.	Date : 12/10/11

edf ENERGY

Hinkley Point C
Site Drainage Strategy

Drainage Phasing Zones

FIG A 1.4



KEY

- HTC DEVELOPMENT SITE BOUNDARY
- TEMPORARY JETTY SEAWARD HARBOUR LIMITS
- DEVELOPMENT SITE INDICATIVE BOUNDARY
- WATER MANAGEMENT ZONE (PROPOSED)
- COMMON LAND
- EXISTING DRAINAGE
- EXISTING STREAM
- MH MANHOLE LOCATION
- EW EARLY WORKS

NOTES

1. WATER MANAGEMENT ZONE (EW-WMZ1) CONSISTING OF A SERIES OF POOLS THAT WILL BE FORMED BY THE SITE PREPARATION CONTRACTOR AS PART OF THEIR EARLY WORKS ACTIVITIES.
2. WATER MANAGEMENT ZONE (EW-WMZ2) CONSISTING OF PONDS, SHALL REPLACE EW-WMZ1. THIS WORK WILL BE CARRIED OUT BY THE PRELIMINARY WORKS CONTRACTOR.

edf ENERGY

DOCUMENT:
HINKLEY POINT C
SITE DRAINAGE STRATEGY

FIGURE TITLE:
EARLY WORKS WATER MANAGEMENT ZONES (1&2 LOCATION PLAN)

FIGURE NO:		REVISION:
FIGURE A 1.5		01
DATE: SEPT 2011	DRAWN: M.P	SCALE: 1:2,500@A1

SCALE BAR
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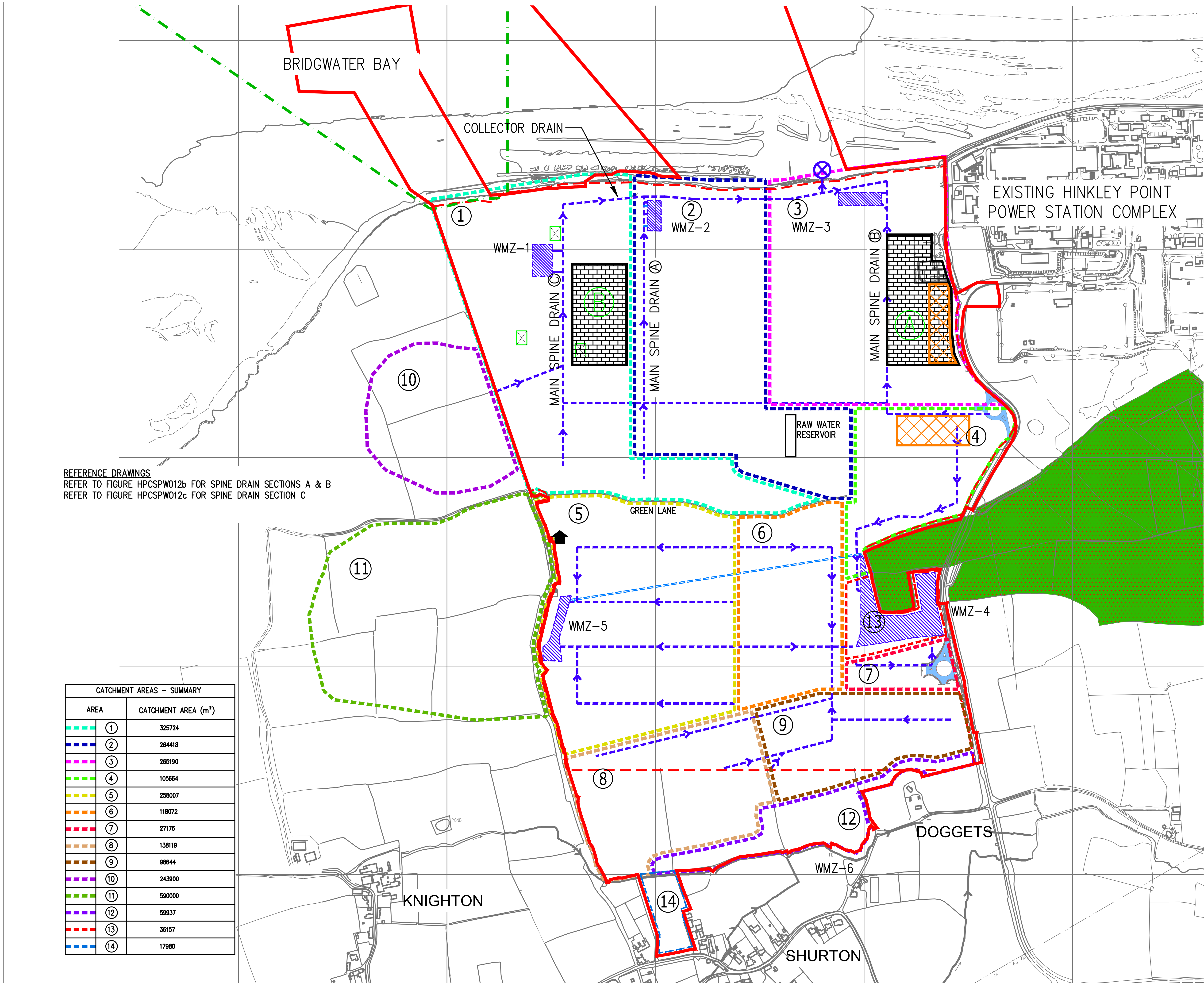

REFERENCE DRAWINGS
REFER TO FIGURE HPCSPW012b FOR SPINE DRAIN SECTIONS A & B
REFER TO FIGURE HPCSPW012c FOR SPINE DRAIN SECTION C

CATCHMENT AREAS – SUMMARY	
AREA	CATCHMENT AREA (m^2)
1	325724
2	264418
3	265190
4	105664
5	258007
6	118072
7	27176
8	138119
9	98644
10	243900
11	590000
12	59937
13	36157
14	17980

KEY

- HTC DEVELOPMENT SITE BOUNDARY
- TEMPORARY JETTY SEAWARD HARBOUR LIMITS
- DEVELOPMENT SITE INDICATIVE BOUNDARY
- WATER MANAGEMENT ZONE (INDICATIVE)
- COMMON LAND
- PROPOSED OUTFALL LOCATION
- A COMPOUND AREAS A & B
- 2 CATCHMENT AREA
- CATCHMENT AREA BOUNDARY
- COMPOUND AREAS
- CAR PARKING AREAS
- TEMPORARY SEWAGE TREATMENT PLANT
- PROPOSED VEHICULAR ACCESS POINTS
- CONSTRUCTION PHASE SURFACE WATER DRAINAGE
- CULVERT FOR HOLFORD STREAM DIVERSION

EDF ENERGY

DOCUMENT:
HINKLEY POINT C
SITE DRAWINAGE STRATEGY

FIGURE TITLE:
SURFACE WATER CATCHMENT AREA OVERALL GENERAL ARRANGEMENT

FIGURE NO: FIGURE A 1.6
REVISION: 01
DATE: SEPT 2011
DRAWN: M.P
SCALE: 1:3,000@A1
SCALE BAR 0 100 200 300m

APPENDIX 2B: OPERATIONAL LIGHTING STRATEGY

CONTENTS

TABLES

FIGURES

FIGURES IN TECHNICAL APPENDIX

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2B.1 Introduction

a) Outline

2B.1.1 This document, together with its appendices, describes the lighting strategy for the operational Hinkley Point C (HPC), and supports the DCO application to the Infrastructure Planning Commission (IPC). It also informs the Environmental Impact Assessment (EIA) and preparation of the Environmental Statement (ES).

2B.1.2 The lighting strategy for the construction of the HPC proposed development is available as a separate appendix to the **Construction Method Statement**.

2B.1.3 The HPC operational phase would commence at the start of Unit 1 generation, expected in 2019.

b) Project Description

2B.1.4 A detailed description of the HPC development is provided in the Description of Proposed Development, **Volume 2, Chapter 2** of the ES.

2B.1.5 The HPC permanent development would be located within the northern part of the HPC development site. The HPC development site is bisected by a track (Green Lane) running east-west, which would be retained and protected for most of its length. The landscape within the remaining parts of the HPC development site would be restored (see **Volume 2, Chapter 22** of the ES).

c) Aim of the Report

2B.1.6 This report provides the lighting strategy for the operational HPC development which complies with the Department for Communities and Local Government (CLG) guidance 'Lighting in the Countryside: Towards Good Practice' (Ref.1), other relevant guidance and British Standards (BS), and addresses the relevant technical, planning and environmental considerations.

2B.1.7 The strategy is focused on the external lighting proposals. Internal lighting of the HPC buildings is described in the **Hinkley Point C Development Site Design and Access Statement**.

2B.1.8 The strategy is supplemented by a Technical Appendix (see section 6), which describes technical details of the indicative operational lighting design.

d) Scope

2B.1.9 The scope of this report has been prepared in line with the outlined guidelines and, following this introduction (section 1), it contains the following sections:

- section 2: Site Context, which examines the relevant environmental conditions (predominantly landscape, visual and ecological) within and around the HPC development site as well as a summary of the relevant legislation, standards, good practice guidelines and policies;
- section 3: Objectives and Mitigation, which identifies the objectives for the lighting strategy (taking into account the opportunities and constraints identified in the previous section) and proposes mitigation measures;

- section 4: HPC operational lighting strategy for the operational phase of the HPC proposed development;
- section 5: Summary; and
- section 6: Technical Appendix.

2B.2 Site Context

a) Introduction

2B.2.1 This section examines the planning, legislative and environmental issues of relevance to the lighting strategy. A desktop study has been carried out to identify the main planning and environmental issues that should be taken into account when considering the impact of the operational HPC development on the local and wider area.

b) Site Location

2B.2.2 The HPC development site is located within the district of West Somerset (see **Figure 2B.1**). Two other local planning authority areas, namely Sedgemoor and Taunton Deane, lie within 10km of the site.

Figure 2B.1: Site Location

c) Study Area

2B.2.3 The study area for the site context appraisal covers the Landscape and Visual Impact Assessment (LVIA) wide study area described in detail in **Volume 2, Chapter 22** of the Environmental Statement (ES).

2B.2.4 The geographical extent of the LVIA study area under consideration includes:

- Lowland Somerset – up to 18km from the HPC development site;
- Exmoor National Park – up to 25km from the HPC development site;
- Mendip Hills AONB – up to 21km from the HPC development site; and
- Welsh coastline – up to 21km from the HPC development site.

d) Landscape Character

2B.2.5 For a detailed assessment of the landscape character within and around the site, see **Volume 2, Chapter 22** of the ES. A brief summary of the local landscape character is provided below.

2B.2.6 The HPC development site is located within the Quantock Vale Local Landscape Character Area (LLCA), on the northern coast of Somerset, which is characterised by rolling farmland containing wide valleys and gentle hills which are rarely above 60m Above Ordnance Datum (AOD).

2B.2.7 The Quantock ridge is a dominant feature to the south-west and the landform around the site is predominantly overlain by essentially an agricultural landscape of small fields, hedges, hedgerow trees and small woodlands. The local area of particular sensitivity to lighting is the strip of farmland located adjacent to the coast to the north-west of the site.

e) Legislation, Policy and Guidance

2B.2.8 The lighting strategy should comply with the following legislation:

- Health and Safety at Work Act 1974;
- The Environmental Protection Act 1990; and
- Wildlife and Countryside Act 1990 (as amended) and Conservation of Habitats and Species Regulations 2010.

i. Health and Safety at Work Act 1974

2B.2.9 The Health and Safety at Work etc. Act 1974, provides that suitable and sufficient lighting must be provided at all workplaces, including outdoor places. The Regulations cover activities to be carried out during the operation of the power station. EDF Energy's Health, Safety, Environmental and Quality policy statement places safety at the heart of the construction project and as such the primary aim of the lighting strategy is to ensure a safe working environment is maintained even in the absence of natural light.

ii. The Environmental Protection Act 1990

2B.2.10 The Environmental Protection Act 1990 (EPA 1990) was amended by section 102 of the Clean Neighbourhoods and Environment Act 2005 to add 'artificial light emitted from premises so as to be prejudicial to health or a nuisance' to the list of statutory nuisances set out in the EPA 1990. This does not apply to artificial light from lighthouses, prisons, airports, harbours and railway or tramway premises, nor to street lighting for public service or goods vehicles, however it would apply to the lighting emitted from the HPC development site.

2B.2.11 The lighting strategy will comply with relevant British Standards and the best practice guidelines prepared by the Chartered Institution of Building Services Engineers (CIBSE), Institute of Lighting Engineers, and the Dark Sky Association to minimise obtrusive light and ensure compliance with the Clean Neighbourhoods and Environment Act 2005/EPA1990.

iii. Wildlife and Countryside Act 1990 (as amended) and Conservation of Habitats and Species Regulations 2010

2B.2.12 All species of bat are protected by the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2010. These Regulations make it an offence to harm or disturb bats (see **Volume 2, Chapter 20** of the ES for a full explanation of offences).

2B.2.13 A full list of Statutory Regulations and Electrical Works British Standards applicable to the Hinkley Point C proposed development is provided in the Technical Appendix. The key British Standards relevant to the operational lighting design are:

- BS EN 12464-2:2007 Lighting of Workplaces – Part 2: Outdoor Work Places; and
- BS 5489-1:2003 + A2:2008 Code of practice for the design of road lighting – Part 1: Lighting of Roads and Public Amenity Area.

iv. BS EN 12464-2:2007

2B.2.14 To enable people to perform outdoor visual tasks efficiently and accurately, especially during the night, adequate and appropriate lighting has to be provided. The degree of visibility and comfort required in a wide range of outdoor work places is governed by the type and duration of activity.

2B.2.15 This standard specifies requirements for lighting tasks in most outdoor work places and their associated areas in terms of quantity and quality of illumination.

2B.2.16 Tables scheduling areas, tasks and activities relevant to this development are as follows:

- Table 5.1 General Circulation Areas
- Table 5.2 Building Sites
- Annex A Additional recommendations with respect to safety and health of workers at work.

v. BS 5489-1:2003 + A2:2008

2B.2.17 This standard gives recommendations on the general principles of road lighting, as well as on aesthetical and technical aspects, and advises on statutory provisions, operations and maintenance.

2B.2.18 It gives recommendations for the design of lighting for all types of highways and public thoroughfares, including those specifically for pedestrians and cyclists, and for pedestrian subways and bridges.

2B.2.19 The standard will be used to ensure that statutory design criteria are met where the primary roads in the development site interface with the surrounding public road network.

2B.2.20 The HPC Operational Lighting Strategy takes into account the relevant guidance, namely:

- Lighting in the Countryside: Towards Good Practice;
- The Society of Light and Lighting (SLL) Lighting Handbook 2009;
- Institute of Lighting Engineers (ILE) (2005) Guidance notes for the reduction of obtrusive light;
- Bat Conservation Trust – Bats and Lighting in the UK version 3 May 2009; and
- International Dark Sky Association.

vi. Lighting in the Countryside: Towards Good Practice

2B.2.21 Lighting in the Countryside: Towards Good Practice was issued by the then Department of the Environment in 1997. The purpose of the Good Practice Guide is to provide practical advice on the prevention and control of lighting impacts and identifies a number of objectives that should be considered when developing the lighting strategy.

vii. The SLL Lighting Handbook

2B.2.22 The SLL Lighting Handbook provides further guidance behind the specific requirements of the British Standards and also identifies other sources of technical information.

viii. ILE Guidance Notes

2B.2.23 The ILE guide specifically identifies the sources of obtrusive lighting and provides further explanation of the British Standard requirements.

ix. Bats and Lighting in the UK (Version 3, May 2009)

2B.2.24 The Bat Conservation Trust report aims to raise awareness of the impact of lighting on bats and suggests mitigation measures to minimise the impact resulting from various scenarios.

x. International Dark Sky Association

2B.2.25 Dark Sky policy refers to the aims of the International Dark Sky Association (IDA) with regards to the avoidance of light pollution. The IDA's goals are to be effective in stopping the adverse environmental impact on dark skies by building awareness of the problem of light pollution and of the solutions.

2B.2.26 IDA describes light pollution as any adverse effect of artificial light including sky glow, glare, light trespass, light clutter, decreased visibility at night, and energy waste. The IDA has a number of policy initiatives and collates technical information identifying best practice for avoiding light pollution.

2B.2.27 Lighting can have a significant impact on the landscape character and visual receptors. The legislation, policy and guidance relevant to the landscape and visual issues in relation to the HPC proposed development are examined in **Chapter 22**, **Volume 2** of the Environmental Statement.

f) Lighting Baseline Condition

2B.2.28 The HPC development site lies within an area with dark skies at night and the only significant source of lighting in the vicinity of the HPC development site is the existing Hinkley Point Power Station Complex. **Figure 2B.2** illustrates the existing Hinkley Point B power station at night[1].

Figure 2B.2: Photo of Existing Hinkley Point Power Station Complex at Night

2B.2.29 The site was visited in October 2010 and four initial views were recorded to illustrate the level of existing lighting at night. Viewpoint locations are shown on **Figure 2B.3**. **Figures 2B.4** to **2B.7** illustrate the views of the existing Hinkley Point Power Station Complex from receptors located around the site, including the West Somerset Coast Path, landscape to the south-east of the site and two views from the Quantock Hills Area of Outstanding Natural Beauty (AONB).

2B.2.30 Additionally, 13 locations were selected for dusk views and agreed with statutory consultees during informal consultation in April 2011. Site visits to record the views were carried out in June and July 2011. Baseline photographs of all 13 dusk views

[1] Source: Water.Technologies.net a product of Net Resources International

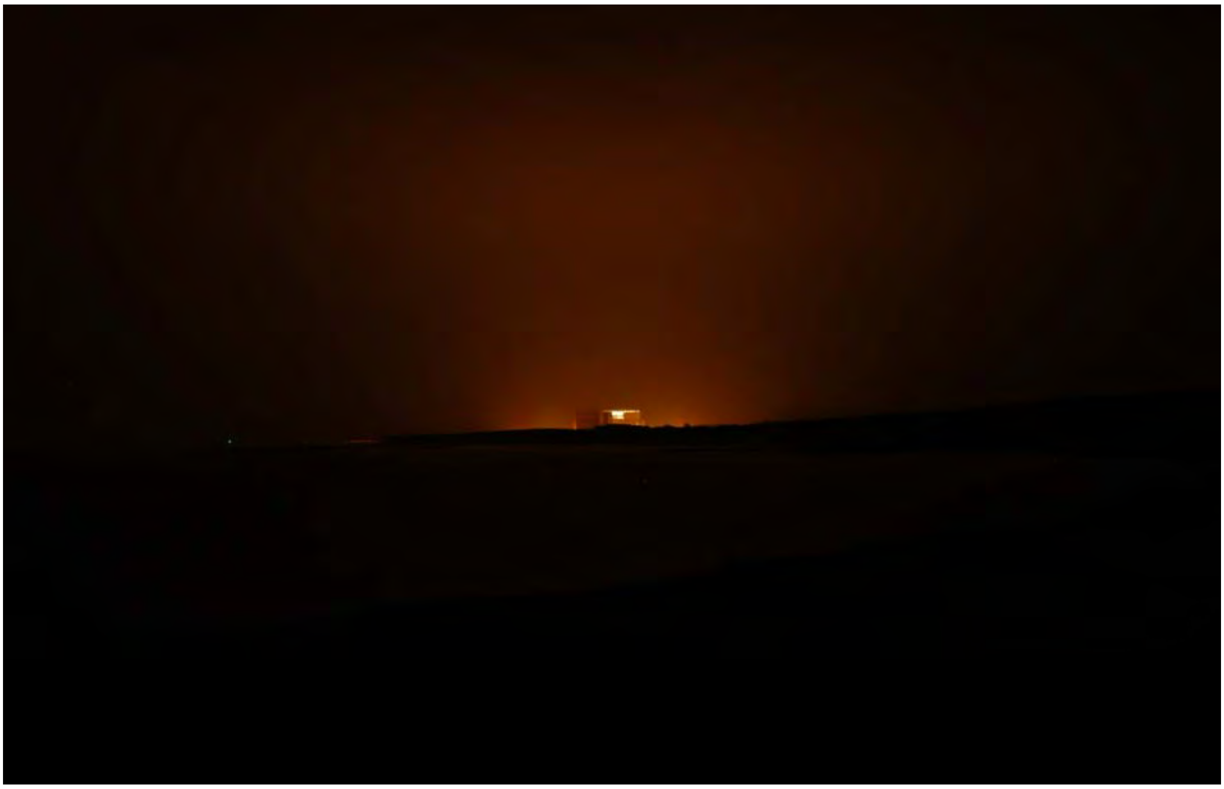
are included in the Technical Appendix. Full resolution baseline dusk photographs are presented in **Volume 2, Chapter 22** of the ES**.**

2B.2.31 The locations were selected from Principal Viewpoints for the LVIA (refer to **Volume 2, Chapter 22**) agreed with statutory consultees. The locations of all viewpoints are shown on **Figures 22.9** and **22.9a** in **Volume 2**, **Chapter 22** of the ES.

Figure 2B.3: Viewpoint Locations – Night Views

2B.2.32 **Figure 2B.4** illustrates a night view from the West Somerset Coast Path north of Lilstock (Public Right of Way (Prow) No. WL24/10). This viewpoint is located approximately 2.4km from the HPC development site boundary and is included in **Volume 2, Chapter 22** of the ES as Principal Viewpoint 3.

Figure 2B.4: Lighting Baseline: Night View 1 – Lilstock, Coastal Footpath



2B.2.33 **Figure 2B.5** illustrates a night view from Hilltop Lane located within the north-eastern fringes of the Quantock Hills AONB. This viewpoint is located approximately 4km from the HPC development site and is representative of views from the north-eastern part of the Quantock Hills AONB.

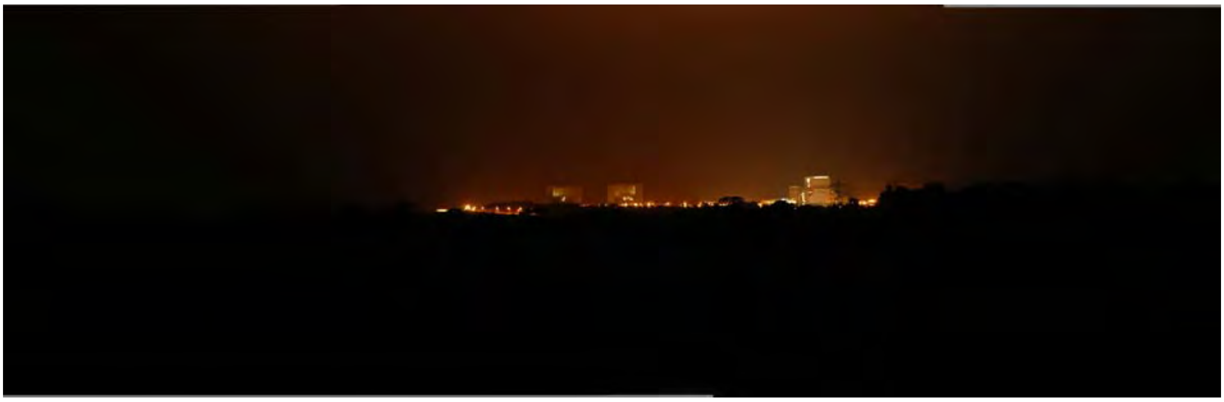
Figure 2B.5: Lighting Baseline: Night View 2 – Hilltop Lane, Quantock Hills AONB

2B.2.34 **Figure 2B.6** illustrates a night view from the A39 layby within the Quantock Hills AONB. This viewpoint is located approximately 5.5km from the HPC development site and is representative of views from the eastern edge of the Quantock Hills AONB and the A39.

Figure 2B.6: Lighting Baseline: Night View 3 – A39, Holford Layby, Quantock Hills AONB

2B.2.35 **Figure 2B.7** illustrates a night view from a local road approximately 0.6km south of the existing Hinkley Point Power Station Complex. The viewpoint is included in **Volume 2, Chapter 22** of the ES as Principal Viewpoint 12.

Figure 2B.7: Lighting Baseline: Night View 4 – Local Road to the South of the Site



2B.2.36 All recorded night views show the existing Hinkley Point Power Station Complex as a source of significant light pollution due to poor control of light distribution and poor colour rendering of the existing lights (orange low pressure sodium lights). **Figure 2B.7** illustrates direct glare from the lights and that there is minimal control of horizontal light distribution, which causes problems with light spill and direct upward light. These problems enhance the glow effect from the development.

g) Environmental Considerations

2B.2.37 Protection of the environment is a key consideration in developing a lighting strategy for the operation of Hinkley Point C. It is recognised that the development site is located within an area with several environmental constraints. They include:

- area of dark skies and landscape character sensitive to light sources;
- the Quantock Hills AONB which overlooks the site from the south-west and Mendip Hills AONB is located to the north-east of the site;
- Exmoor National Park is located approximately 14km to the west of the site;
- the site is located adjacent to an area of outstanding scenic interest; and
- designated sites of ecological importance including SSSI, RAMSAR and SPA providing habitat for important bird species (see **Volume 2, Chapter 20** of the ES).

2B.2.38 A minimum of 10 bat species have been recorded as using the HPC development site, including lesser and greater horseshoe and barbastelle bats for commuting and foraging. The Green Lane through the centre of the site, Benhole Lane along the western boundary and the Bum Brook along the southern boundary have been identified as 'key' bat corridors (see **Volume 2, Chapter 20** of the ES).

2B.2.39 There are no local landscape designations that cover any part of the landward element of the HPC permanent development site. However, there are a number of local planning designations covering landscapes of particular interests that are present in the LVIA study area. A full list of landscape designations is provided in **Volume 2, Chapter 22** of the ES.

2B.2.40 There are a number of PRoW crossing the HPC development site and in its immediate vicinity, including a coastal path which runs along the top of the low cliff line. For more details please refer to **Volume 2, Chapter 25** of the ES.

2B.2.41 There are no known sites of international importance for cultural heritage within the HPC development site, however a Scheduled Monument (Wick Barrow, also known as Pixies Mound) is located to the east of the proposed HPC development. There are also no listed buildings within the HPC development site. An important Grade II* listed building, Fairfield House, is located approximately 3km south-west. For more details on Scheduled Monuments and listed buildings please refer to **Volume 2, Chapter 23** of the ES.

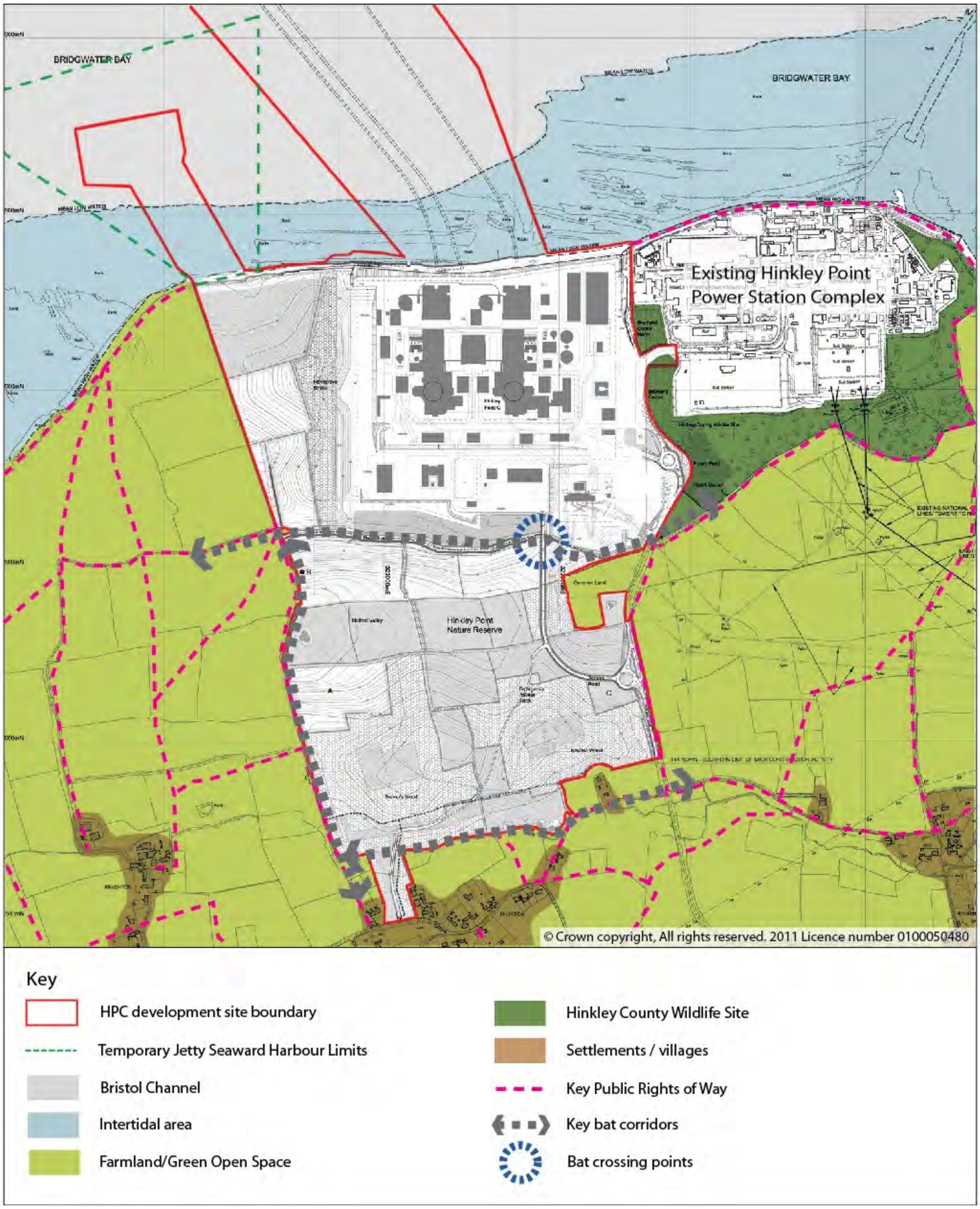
h) Key Local Lighting Receptors

2B.2.42 The analysis of the site context, landscape character and environmental constraints led to the identification of several key local receptors which have the potential to be affected by the proposed lighting. Key local lighting receptors are selected based on the professional judgement of the environmental assessors and include landscape, visual, historic, ecological or amenity receptors which are located either in close proximity to the HPC development site or are of high sensitivity and have the highest potential to be impacted by the HPC operational lighting. Lighting impacts on all relevant receptors is assessed in the relevant ES chapters.

2B.2.43 Key local lighting receptors identified, include (see **Figure 2B.8**):

- settlements/hamlets of Wick, Shurton, Burton and Knighton and Doggetts farm;
- users of PRoW in the vicinity of the site;
- Bridgwater Bay;
- intertidal area (encompassing the Severn Estuary SPA/Ramsar and Bridgwater Bay SSSI);
- Hinkley County Wildlife Site lying partly within the HPC development site and around the existing Hinkley Point Power Station Complex;
- areas of farmland around the site; and
- key bat corridors (in particular corridors running through the HPC development site).

Figure 2B.8: Key Local Lighting Receptors



i) Key Lighting Receptors in the Wider Context

2B.2.44 Other receptors located within the LVIA study area and considered in the lighting strategy include (see **Figure 2B.9**):

- Quantock Hills AONB;
- Mendip Hills AONB;
- Exmoor National Park;
- Areas of outstanding scenic interest; and
- Elevated areas of farmland within the study area represented by Principal and Secondary Viewpoints (see **Volume 2, Chapter 22** of the ES).

Figure 2B.9: Key Lighting Receptors (Wide Site Context)

2B.2.45 The Quantock Hills AONB is located at its closest approximately 3.7km to the south-west of the HPC development site. The AONB covers an area of about 125km² and reaches a height of 384m overlooking the development site. The Mendip Hills AONB lies approximately 19.5km north-east of the HPC development site.

2B.2.46 Exmoor National Park is situated within the counties of Somerset (71% of the park) and Devon. The boundary of the National Park is located approximately 14km, and beyond, to the west of the HPC development site.

2B.2.47 The HPC development site is bounded by an area of outstanding scenic interest, which extends further to the south-west.

j) Consultation

2B.2.48 The need for assessment of HPC operational lighting was confirmed during consultation. The selection of representative night and dusk viewpoint locations was agreed with the consultees in April 2011.

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2B.3 Objectives and Mitigation

a) The Need for Lighting

2B.3.2 The primary aim of the operational lighting proposal for the HPC proposed development is to ensure that, in the absence of natural light, a safe working environment is maintained.

2B.3.3 Due to the proximity of nationally protected landscapes, the Quantock Hills AONB and an area of outstanding scenic interest, the HPC development site has been categorised as lying within an Environmental Zone E1 which requires the maximum control and limitation of intrusive light sources on the surrounding landscape in accordance with the legislation, planning and guidance.

2B.3.4 As defined in the BSEN 12464, Designated Environmental Zone E1 is an “intrinsically dark area such as national parks or protected sites”. Zone E2 is defined as “low district brightness areas, such as industrial or residential rural areas”. The HPC Operational Lighting Strategy should comply with the Environmental Zone E1 standard.

2B.3.5 A lighting system would be required for the following external areas of the HPC permanent development:

- roads and pedestrian footpaths (internal to site boundary);
- car parks;
- perimeter and High Security Area (HSA) fences;
- vehicle inspection areas;
- off-site vehicle search area;
- road lighting designed for traffic routes ME3a lighting class and conflict areas CE2 lighting class; and
- the National Grid 400kV Substation.

2B.3.6 The HPC development would be a source of internal lighting from several HPC buildings. Details of the internal lighting proposals are included in the **Hinkley Point C Design and Access Statement**.

2B.3.7 The primary objectives of the lighting strategy shall be to achieve the following:

- comply with planning requirements;
- meet key standards and statutory requirements;
- provide a safe working environment;
- allow 24 hour working;
- target lighting at where it is required;
- avoid over illumination;
- avoid upwards lighting;
- avoid light spill to neighbouring areas;

- minimise energy consumption; and
- minimise disruption to bat corridors.

b) Approach

2B.3.8 The lighting strategy recognises the requirements of health and safety and protection of the environment and aims to minimise the impact of light on important receptors in the following ways:

- the lighting scheme must allow for safe operation of HPC and ensure the scheme's compliance with all relevant health and safety standards;
- the lighting scheme should attempt to minimise the amount of light spill to areas outside the working or access areas. Wherever possible, this requirement would be met by considering the number of fittings and their mounting height; an overall lighting requirement can be met by a smaller number of high output fittings mounted at a higher elevation or a higher number of smaller output fittings mounted at lower level. The use of downward facing lighting fittings (directional lighting) would also reduce the amount of light spill;
- HPC development would require 24 hour working during operations;
- the only permanent lighting outside the HPC permanent development area would be installed at the southern roundabout on Wick Moor Drove.

c) Mitigation

2B.3.9 A range of mitigation measures are available to address the potential lighting impacts.

2B.3.10 As part of the mitigation measures to minimise light spill, the following should be considered:

- design to correct illumination levels. Do not over-light an area thus avoiding adding to sky glow;
- move luminaires away from boundaries;
- use of shields and baffles to reduce light spill to a minimum;
- introduce controls to avoid unnecessary night time lighting; and
- ensure luminaires are orientated correctly following installation.

2B.3.11 As part of the mitigation measures to minimise upwards light and distant visual impact, the following should be considered:

- use of full cut-off exterior luminaires to avoid light above the horizontal;
- direct light downwards wherever possible to avoid sky glow; and
- ensure appropriate luminaires are chosen.

2B.3.12 As part of the mitigation measures to minimise the impact of lighting on bats, the following should be considered:

- type of lamp to minimise UV content;

- light spill control to avoid obtrusive light;
- height of lighting columns to be considered to reduce risk of light spill; and
- lighting levels to be kept to the minimum required to achieve a safe working environment.

2B.3.13 In addition to lighting mitigation measures, several retained and proposed landscape features within and around the HPC development site would contribute to lighting mitigation. These features are illustrated on **Figure 2B.10** and include:

- Existing and proposed landform which reduce the potential impact of lighting on surrounding farmland, local settlements and PRoW in the vicinity of the HPC development site. Existing topography includes the Green Lane ridge (majority to be retained) and local rolling landform around the HPC development site which would reduce impact of lighting from the nearby villages, hamlets and farms to the south and south-west of the HPC development site.
- Strong hedgerow field pattern and woodland blocks and scrub, including advance screen planting implemented in the spring of 2011 and early restoration proposals within the southern part of the HPC development site, would contribute to reducing the impact of lighting due to a degree of enclosure they provide.
- Retained Hinkley County Wildlife Site, which contains mature woodland areas and partially screens the flat and open Wick Moor.
- Large areas of woodland and hedgerow planting to the south of the Green Lane ridge.

2B.3.14 Details of the final landscape design outside the HPC permanent development are described in **Volume 2, Chapter 22** of the ES.

Figure 2B.10: Local Lighting Mitigation

Key

- HPC development site boundary
- Temporary Jetty Seaward Harbour Limits
- Green Lane ridge, existing rolling landform and proposed screening bunds reduce impact of lighting on surrounding farmland, PRoW and local settlements
- Retained Hinkley County Wildlife Site helps screen the flat and open Wick Moor
- Strong hedgerow field patterns & woodland blocks/scrub, including screen planting: define and enclose land, reduce impacts inland

2B.4 HPC Operational Lighting Strategy

a) Operational Lighting Proposals (External)

2B.4.1 For the purpose of this lighting strategy, the HPC proposed development has been divided into six external lighting zones. These are illustrated on **Figure 2B.11** and are as follows:

- roads and pedestrian footpaths (internal to site boundary);
- car parks;
- perimeter and HSA fences;
- vehicle inspection areas;
- off-site vehicle search area;
- road lighting designed for traffic routes ME3a lighting class and conflict areas CE2 lighting class; and
- the National Grid Substation.

2B.4.2 Additionally, permanent road lighting would be installed at the southern roundabout at Wick Moor Drove.

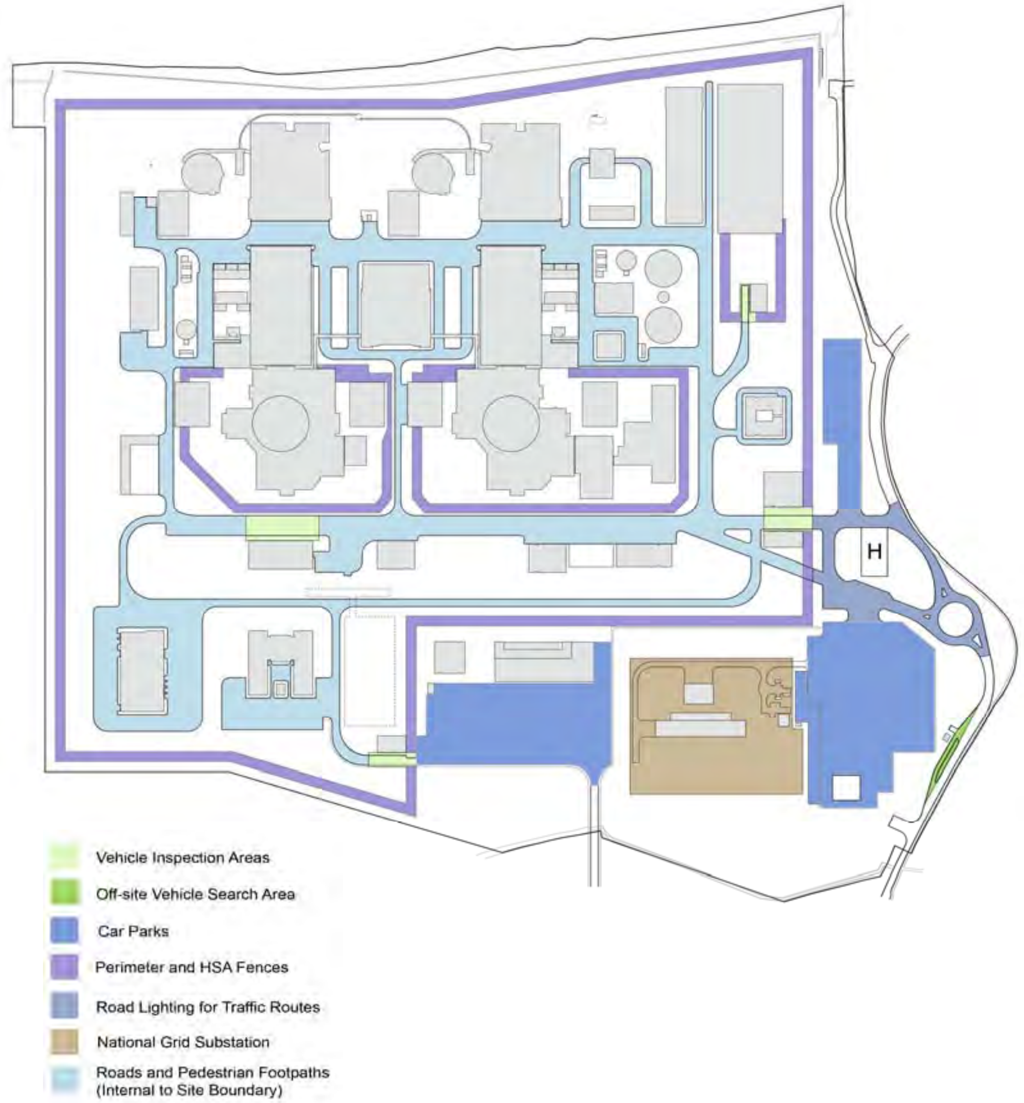
2B.4.3 Details of the indicative proposed lighting are provided on the following drawings (see Technical Appendix):

- HINK-A1-OLS-00-GA-001, Rev 01 – showing external lighting details within the HPC permanent development, including lighting at the southern roundabout but excluding the National Grid Substation.
- 23-SWA-0547750 Rev P1, 23-SWA-0547751 Rev P1 and 23-SWA-0547753 Rev P0 – showing lighting proposals for the National Grid Substation.

2B.4.4 All luminaires specified above would be provided with flat lens with the operating surface parallel to the ground level.

2B.4.5 Wherever applicable, the light fittings should be mounted suitably on the building wall instead of lighting poles.

Figure 2B.11: Operational Lighting (External) within HPC Permanent Development (Indicative)



b) Indicative Description of HPC External Lighting Zones

i. Roads and Pedestrian Footpaths (Internal to Site Boundary)

2B.4.6 Lighting of internal roads and footpaths would be provided with a luminaire type Kingfisher – LED-in Range, 101 Watt, mounted on 8m columns. The proposed layout of the lighting columns is provided in the Technical Appendix.

ii. Car Parks

2B.4.7 Lighting of the car parks would be provided with a luminaire type Kingfisher – LED-in Range, 129 Watt, single or double-mounted on 8m columns. The proposed layout of the lighting columns is provided in the Technical Appendix.

iii. Perimeter and HSA fences

2B.4.8 Lighting of the perimeter fence would be provided with a luminaire type Kingfisher – LED-in Range, 101 Watt, mounted on 8m columns. Lighting of the HSA fences internal to site boundary would be provided with a luminaire type Kingfisher – LED-in

Range, 101 Watt, mounted on 10m columns. The proposed layout of the lighting columns is provided in the Technical Appendix.

iv. Vehicle Inspection Areas

2B.4.9 Lighting of the vehicle inspection areas would be provided with a luminaire type Urbis - ZX3, 250 and 400 Watt, mounted on 8m columns. The proposed layout of the lighting columns is provided in the Technical Appendix.

v. Road Lighting

2B.4.10 Road lighting designed for traffic routes ME3a class lighting would be provided with a luminaire type Urbis – ZX3, 150 Watt and 400 Watt, mounted on 10m columns. Lighting of roundabouts (lighting designed for conflict areas CE2) would be provided with a luminaire type Urbis – ZX3, 250 Watt, mounted on 10m columns. The lamp type would match the existing road lighting.

2B.4.11 Road lighting at the southern roundabout at Wick Moor Drove would be provided with Urbis Sapphire 2 Sealsafe Lanterns, 140 Watt, mounted on 10m columns.

2B.4.12 The proposed layout of the lighting columns is provided in the Technical Appendix.

vi. National Grid Substation

2B.4.13 The proposed luminaires in the National Grid Substation compound are High Pressure Sodium Lamps (SON) which emit light over a moderate band of long wavelengths including a small UV component. Luminaires will be mounted on 6m lighting masts to provide minimum lighting levels of 4lux. For details on external lighting layout, lighting column specifications and lighting levels and contours refer to drawings 23-SWA-0547750 Rev P1, 23-SWA-0547751 Rev P1 and 23-SWA-0547753 Rev P0 in the Technical Appendix.

2B.4.14 Subject to final luminaire selection, National Grid's proposed external luminaires (floodlights and road lighting lanterns) should emit 0% of light above horizontal. To ensure this, it is therefore recommended that the luminaires are installed as per the manufacturer's instructions maintaining an angle of zero degrees to the horizontal plane.

2B.4.15 Lighting levels at 50m from the fence line are as shown on the attached lighting drawing no 23-SWA-0547753 Rev P0 (see Technical Appendix).

2B.4.16 Lighting within the substation will only be activated when:

- the security system is triggered; or when
- emergency work is taking place during the hours of darkness. Predominately repair work and routine maintenance works are planned for daylight hours.

2B.4.17 Due to the proximity of a key bat corridor along the Green Lane, lighting levels at the southern edge of the National Grid Substation area should be zero based on calculated levels as shown on the attached drawing no 23-SWA-0547753 Rev P0 (see Technical Appendix).

2B.5 Summary

2B.5.1 The lighting strategy has been designed to meet objectives outlined for the operational phase of the HPC proposed development and minimise potential lighting impacts on key lighting receptors identified following the analysis of the environmental context for the proposed development.

2B.5.2 The operational HPC development would require lighting within the HPC permanent development area to ensure a safe working environment for all activities, compliance with planning requirements and meeting key standards and statutory requirements.

2B.5.3 The proposed HPC operational lighting strategy:

- complies with planning requirements, meets key standards and statutory requirements and provides a safe working environment;
- is designed to light levels appropriate for the operational site;
- locates the significant sources of lighting away from sensitive receptors, such as residents of nearby settlements or key bat corridors and minimises lighting impact on these key receptors;
- includes luminaires with shields and baffles to limit light spill onto sensitive areas;
- includes lighting columns of a minimum height required for safe operation;
- includes controls to avoid unnecessary illumination;
- includes full cut-off luminaires to prevent upward light and minimise light pollution;
- considers the choice of energy-efficient luminaires which provide enough illumination to safely undertake operational activities while limiting their impact on lighting receptors; and
- contains light sources appropriate for use and the identified environmental considerations.

2B.5.4 The HPC operational lighting strategy has been designed to mitigate lighting impact on the receptors identified in section 2B.2 in line with the relevant legislation, British Standards, policy and guidance. **Table 2B.1** summarises how the strategy aims to mitigate the impact of operational lighting on key lighting receptors.

2B.5.5 The relevant technical chapters of the ES assess the significance of environmental impacts based on the information provided in this strategy.

Table 2B.1: Lighting Mitigation

Receptor	Mitigation measure
Residents of Wick, Shurton, Burton and Knighton and Doggetts farm	Existing and proposed landform including planting, Green Lane ridge and rolling landform, strong hedgerow field pattern, and off-site mitigation providing screening. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas.
Users of PRoW in the vicinity of the site	Existing and proposed landform including planting, Green Lane ridge and rolling landform, strong hedgerow field pattern, and off-site mitigation providing screening. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas.
Bristol Channel	Using controls to avoid unnecessary illumination beyond work areas.
Intertidal area	Using controls to avoid unnecessary illumination beyond work areas.
Hinkley Point County Wildlife Site	Existing and proposed landform and screen planting. Green Lane ridge and rolling landform, strong hedgerow field pattern, and off-site mitigation contribute to screening. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas.
Areas of farmland around the site	Existing and proposed landform and screen planting. Green Lane ridge and rolling landform, strong hedgerow field pattern, and off-site mitigation contribute to screening. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas.
Key bat corridors	Minimising UV light content. Maintaining buffers between sensitive bat corridors and luminaires. Minimising light spill onto key bat corridors. Existing and proposed landform including planting, Green Lane ridge and rolling landform, strong hedgerow field pattern, and off-site mitigation providing screening. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas.
Quantock Hills AONB and Mendip Hills AONB	Directing lights downwards. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas. Compliance with Dark Sky policy and relevant British Standards. Lighting designed to Environmental Zone E1 standard.
Exmoor National Park	Directing lights downwards. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas. Compliance with Dark Sky policy and relevant British Standards. Lighting designed to Environmental Zone E1 standard.
Area of outstanding scenic interest	Screening bund along the north-western boundary of the HPC development site. Green Lane ridge and rolling landform, strong hedgerow field pattern, and off-site mitigation contribute to screening. Reducing upward light and using controls to avoid unnecessary illumination beyond work areas.

References

Ref. 1 CLG (1997) Lighting in the Countryside: Toward Good Practice London: HMSO.

TECHNICAL APPENDIX

Schedule of Lighting Design Criteria

The lighting design criteria for each functional area of the permanent development site are scheduled together with the particular constraints for each area.

The areas are defined as follows:

- Power Station Operational Areas – Permanent facility comprising of all areas necessary to operate the power station.
- Roads and Car Parks – Roads and car parks within the development area together with interfaces to the public roads. The categories of the roads interfaces will be dependent on the assessment of the average daily traffic (ADT).

Definitions

The following symbols are used in the design criteria schedules:

- E_m – maintained Illuminance (lux) on reference surface taken as ground level
- U_0 – Minimum Illuminance Uniformity
- GR_L – Glare Rating limits
- R_a – Minimum Colour Rendering Index

Power Station Operational Area

Area	**Power Station Operational Area**
Applicable Standard	BS EN 12464-2:2007 Lighting of Workplaces Part 2 Outdoor Work Places

Lighting Requirements for areas, tasks and activities in accordance with:

Table: Power Plants

Area, task or activity	Em	U0	GRL	Ra
Pedestrian movements within electrically safe areas	5	0.25	50	20
Inspection Areas	50	0.4	50	20
Servicing Areas	100	0.4	45	40

Lamp options	Metal Halide, LED
Specific Constraints	Light spill to foreshore area to comply with Environment Zone E1.

Roads and Car Parks

Area	**Roads and Car Parks in the Development Area**
Applicable Standard	Applicable Standard BS EN 12464-2:2007 Lighting of Workplaces Part 2 Outdoor Work Places

Lighting Requirements for areas, tasks and activities in accordance with:

Table: General Circulation Areas at Outdoor Workplaces

Area, task or activity	Em	U0	GRL	Ra
Pedestrian movements within electrically safe areas	5	0.25	50	20
Regular Vehicle Traffic	20	0.4	45	20
Pedestrian passages, vehicle turning	50	0.4	50	20
Medium Traffic Parking Areas	10	0.25	50	20

Lamp options	Metal Halide (low UV), LED, High Pressure Sodium
Specific Constraints	Light spill to foreshore area to comply with Environment Zone E1.
	Light spill to bat corridors to comply with Environmental Zone E1.
	Lamps to have low UV emissions adjacent to bat corridors.

Area	**Roads Interfaces to Public Roads**
Applicable Standard	BS 5489 -1:2008 CoP for Design of Road Lighting Part 1 Amenity Areas

Table: Lighting criteria defined in BSEN 13201-2:2003 Road Lighting Part 2 – Performance Requirements

Area, task or activity	Lighting Class	U0
Traffic routes	ME4a, ME3b, ME3a	subject to average daily traffic
Conflict areas	CE2, CE3	subject to average daily traffic

Lamp options	Metal Halide (low UV), LED, High Pressure Sodium
Specific Constraints	Environment Zone E1.

Glossary of Terms

Light Trespass (E_v)	Light emitted by a lighting installation that falls outside the boundaries of the area for which the lighting installation is designed.
Source Intensity (I)	Intensity of the light source in the potentially obtrusive direction measured in candelas (cd).
Luminance (L_b)	Maximum average luminance of the vertical plane of a neighbouring area from direct illumination, measured in cd/m².
Luminance (L_s)	Maximum average luminance of the vertical plane of signs from direct illumination, measured in cd/m².
Upward Light (ULR)	Proportion of the flux of the luminaire that is emitted above the horizontal, when the luminaire is mounted in its installed position and attitude.
Maintained Illuminance (E_m)	Value below which the average luminance on the specified surface is not allowed to fall. Note, it is the average luminance at the time maintenance should be carried out.
Minimum Illuminance Uniformity (U_o)	Ratio of minimum luminance to average luminance on a surface.
Glare Rating Limits (GR_l)	Upper limit of glare by the CIE Glare Rating system.
Minimum Colour Rendering Index (R_a)	Quantitative measure of the ability of a light source to reproduce the colours of various objects faithfully in comparison with an ideal or natural light source.
Curfew	Time during which stricter requirements (for the control of obtrusive light) will apply.

Dusk View 1 – Principal Viewpoint 3 (see ES Volume 2, Chapter 22)

Dusk View 2 – Principal Viewpoint 7 (see ES Volume 2, Chapter 22)

Dusk View 3 – Principal Viewpoint 9 (see ES Volume 2, Chapter 22)

Dusk View 4 – Principal Viewpoint 10 (see ES Volume 2, Chapter 22)

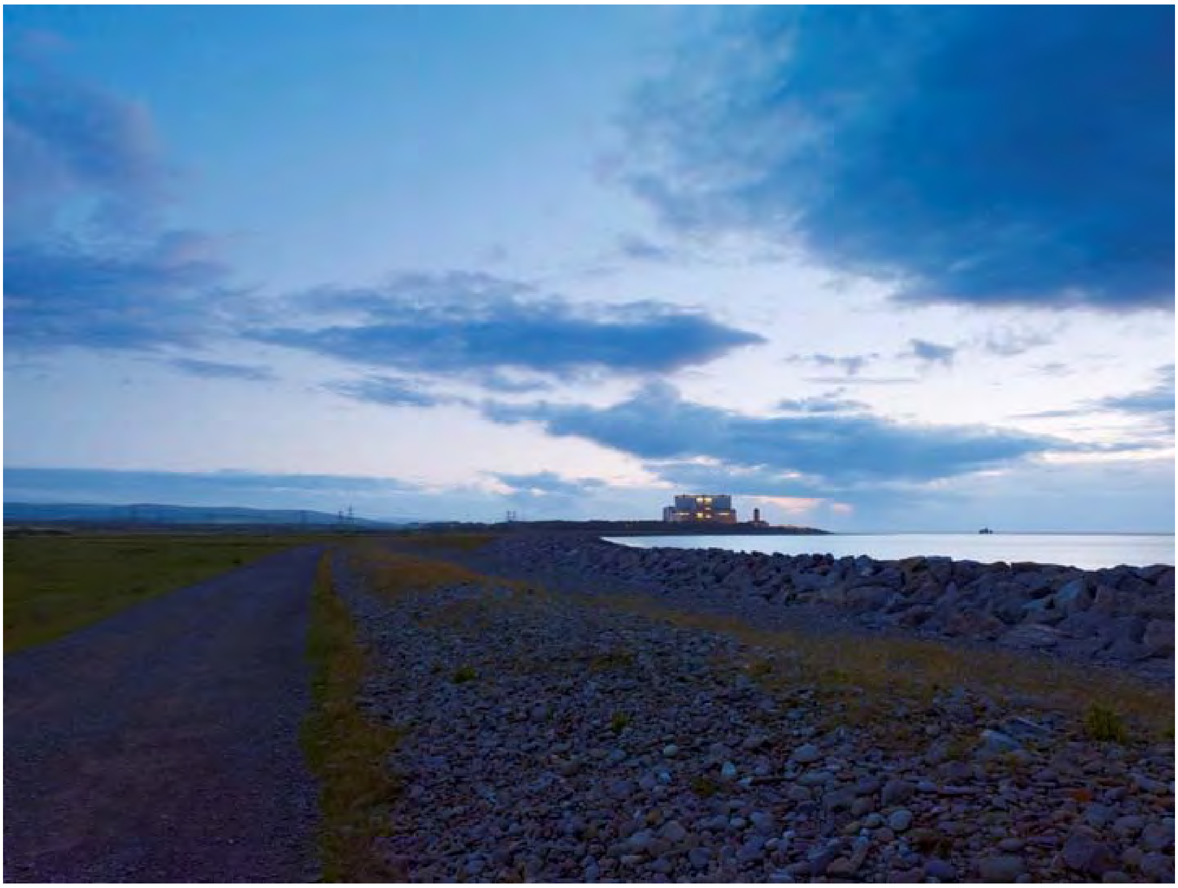
Dusk View 5 – Principal Viewpoint 11 (see ES Volume 2, Chapter 22)

Dusk View 6 – Principal Viewpoint 12 (see ES Chapter Volume 2, Chapter 22)

Dusk View 7 – Principal Viewpoint 16 (see ES Volume 2, Chapter 22)

Dusk View 8 – Principal Viewpoint 18 (see ES Volume 2, Chapter 22)

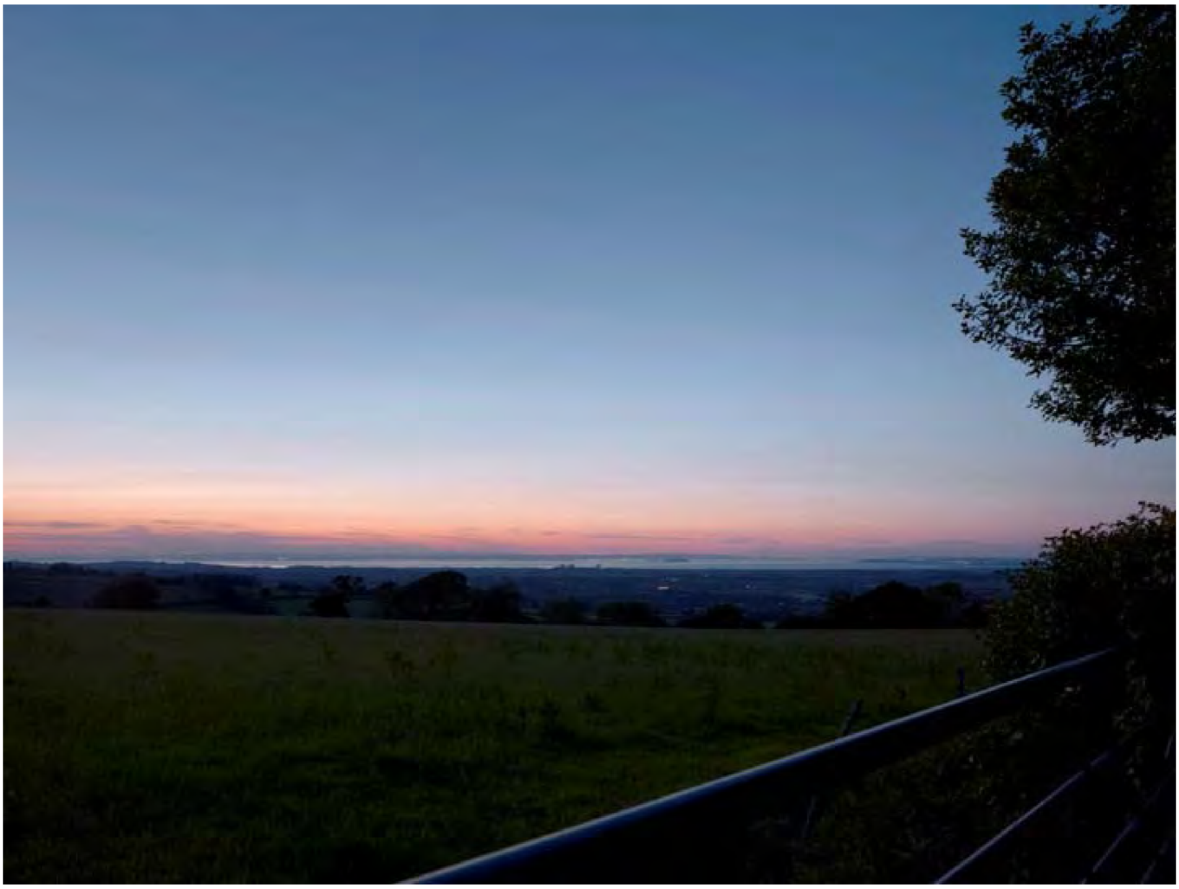
Dusk View 9 – Principal Viewpoint 19 (see ES Volume 2, Chapter 22)



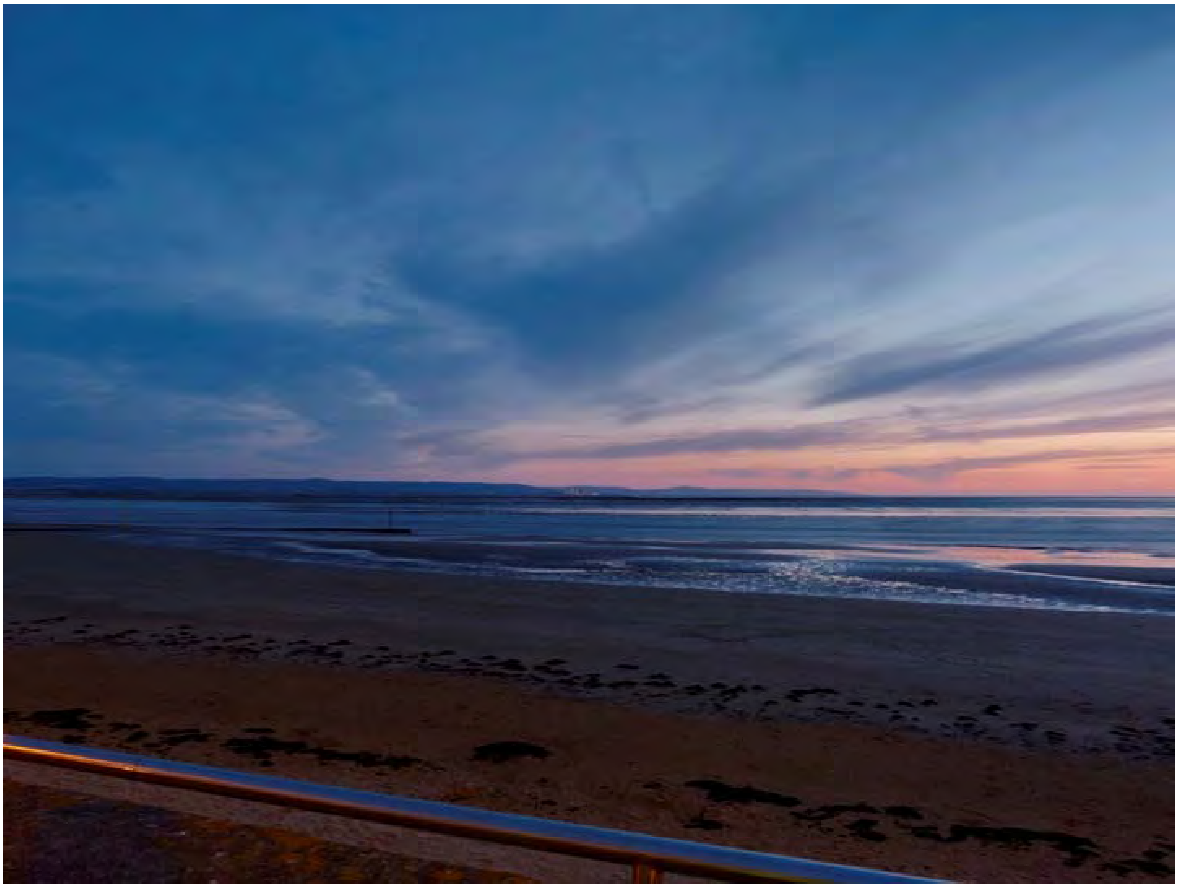
Dusk View 10 – Principal Viewpoint 27 (see ES Volume 2, Chapter 22)

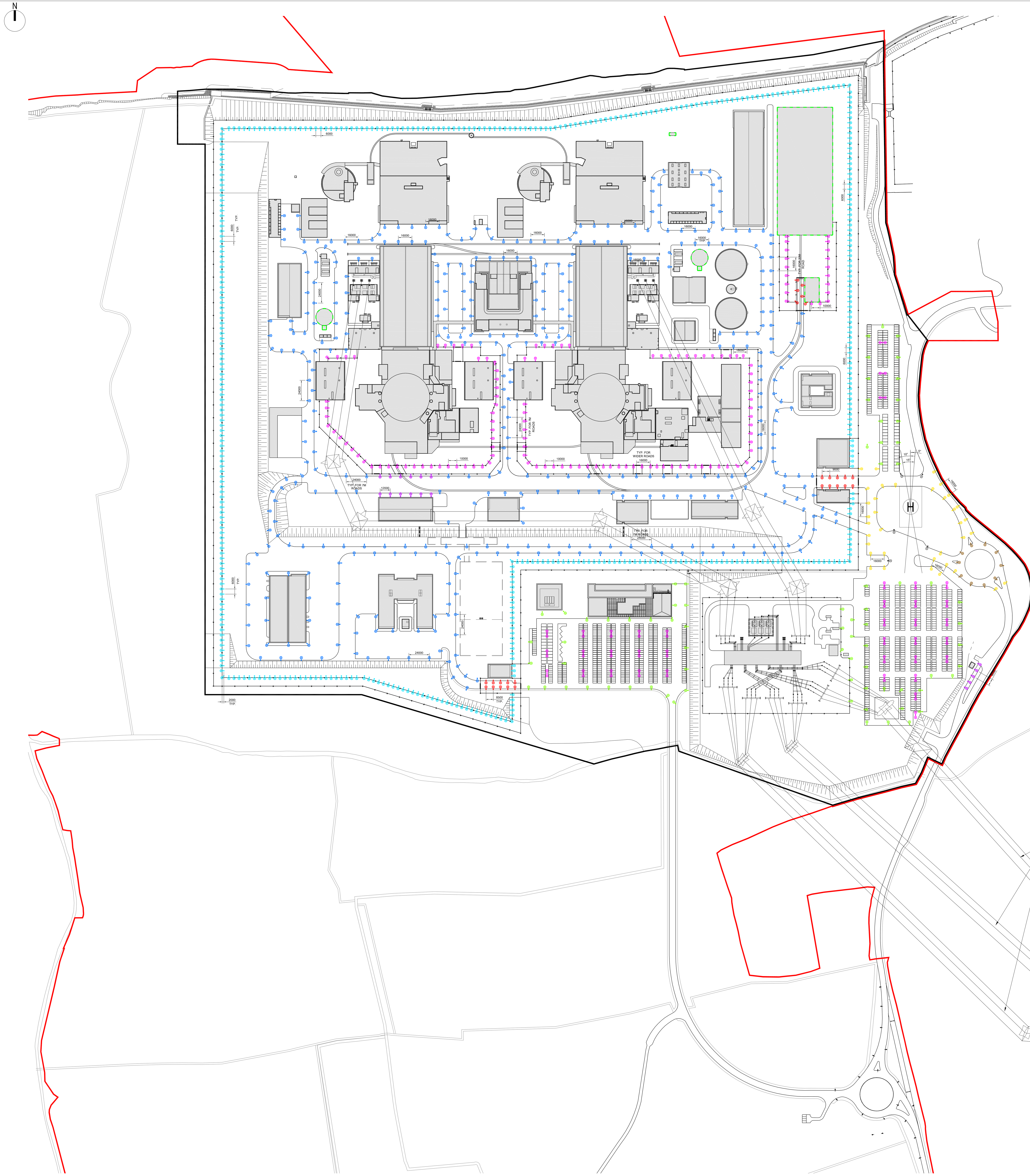
Dusk View 11 – Principal Viewpoint 29 (see ES Volume 2, Chapter 22)

Dusk View 12 – Principal Viewpoint 34 (see ES Volume 2, Chapter 22)



Dusk View 13 – Principal Viewpoint 37 (see ES Volume 2, Chapter 22)





1 OPERATIONAL LIGHTING STRATEGY

SCALE 1:2500

THE OVERHEAD LINES AND TOWER (PYLON) POSITIONS ILLUSTRATED ARE INDICATIVE ONLY AND ARE ONE OF TWO OPTIONS PRESENTLY BEING DEVELOPED BY NATIONAL GRID. THESE OVERHEAD LINES AND PYLONS WILL BE SUBJECT TO A SEPARATE DCO APPLICATION BY NATIONAL GRID AND WILL BE REFINED FOLLOWING PUBLIC CONSULTATION, FURTHER ENVIRONMENTAL STUDIES AND DETAILED OVERHEAD LINE DESIGN.

LIGHTING KEY

Area	Symbol	Luminaire Ref.	Pole height / No. of Luminaires	Luminaire Manufacturer	Product Code	Lamp type	Wattage of luminaire	Lamp Lumen Output
Security Fence		A1	8m / 1 No.	Kingfisher - LED-in Range	AEC LIN-1B-ST-006	LED - 63 Nos.	101 W	8450 lm
Fence internal to site boundary		A2	10m / 1 No.	Kingfisher - LED-in Range	AEC LIN-1B-ST-006	LED - 63 Nos.	101 W	8450 lm
Vehicle Inspection Areas		B1	8m / 1 No.	Urbis - ZX3	Urbis 942314 ZX3 /FG/1399/110/-53/942314	SON-T	250 W	33200 lm
		B2	8m / 1 No.	Urbis - ZX3	Urbis 263874 ZX3 /FG/1399/145/-45/263874	SON-T	400 W	56500 lm
Car Parks		C1	8m / 1 No.	Kingfisher - LED-in Range	AEC LIN-1B-ST-008	LED - 81 Nos.	129 W	10650 lm
		C2	8m / 2 Nos.	Kingfisher - LED-in Range	AEC LIN-1B-ST-008	LED - 81 Nos.	129 W	10650 lm
Roadways (Internal to site)		D1	8m / 1 No.	Kingfisher - LED-in Range	AEC LIN-1B-ST-006	LED - 63 Nos.	101 W	8450 lm
Road lighting for Traffic Routes ME3a lighting class		D2	10m / 1 No.	Urbis - ZX3	Urbis 273364 ZX3 /FG/1399/115/-47x/273364	SON-T	150 W	17500 lm
		D3	10m / 1 No.	Urbis - ZX3	Urbis 263874 ZX3 /FG/1399/145/-45/263874	SON-T	400W	56500 lm
Roundabout (Designed to Conflict area CE2)		D4	10m / 1 No.	Urbis - ZX3	Urbis 942314 ZX3 /FG/1399/110/-53/942314	SON-T	250 W	33200 lm

Note: 1. All luminaires specified above are provided with flat lens with the operating surface parallel to the ground level.
2. Wherever applicable, the light fittings shall be mounted suitably on the building wall instead of lighting poles.

SOUTHERN ROUNDABOUT LIGHTING

Lantern Specification

Lantern Detail

Lantern Type : Urbis Sapphire 2 Sealsafe Lantern
Urbis Reference : SAPH2IB/140/CPOT/1963/FG/NEMA/R7035/
: ALC/GR-HV/HZ-VT/105/-30/263561
Complete With: : 140 Watt CPO -TW Lamp
: Nema Photocell
: Harvard Control Gear
: Colour: RAL 7035
: Optical Unit sealed to IP66, comprising:
: Type 1963 Reflector
: Flat Glass Projector
: Matrix Number 263561 (105/-30)

Mounting Details

Height : 10.0 metres
Bracket Length : 1.0 metre
Inclination : ••••
Column Position : As shown

Lamp Details

Lamp Output : 16,500 lumens
Maintenance Factor : 0.76
Optic Tightness Rating : IP66 Sealsafe
Pollution Category : Medium
Cleaning Cycle : 36 months
Relamping Period : 3 years (12,000 hours)
Number of Units : 18
Scheme Number : SP040_1

Lanterns from Hinkley Point Campus Design

DRAWING SYMBOLS & LEGEND

HINKLEY POINT C DEVELOPMENT SITE BOUNDARY (DCO)
HINKLEY POINT C PERMANENT DEVELOPMENT SITE BOUNDARY
TEMPORARY JETTY SEAWARD HARBOUR LIMITS
BUILDINGS / STRUCTURES
NATIONAL GRID 400KV PYLONS & LINES (SEE CAVEAT BELOW)
PYLONS & LINES - EDF ENERGY STANDARD
RAILWAY TRACKS
FENCES
PARAMETER BUILDINGS

THE OVERHEAD LINES AND TOWER (PYLON) POSITIONS ILLUSTRATED ARE INDICATIVE ONLY AND ARE ONE OF TWO OPTIONS PRESENTLY BEING DEVELOPED BY NATIONAL GRID. THESE OVERHEAD LINES AND PYLONS WILL BE SUBJECT TO A SEPARATE DCO APPLICATION BY NATIONAL GRID AND WILL BE REFINED FOLLOWING PUBLIC CONSULTATION, FURTHER ENVIRONMENTAL STUDIES AND DETAILED OVERHEAD LINE DESIGN.

REVISION	DATE	DRAWN	CHECKED	REASONS FOR REVISION/ COMMENTS	APPROVED
01	SEPT 2011	YRM	YRM	FOR IPC SUBMISSION	NNB

edf ENERGY

HINKLEY POINT C

DRAWING TITLE
Hinkley Point C Development Site
Operational Lighting Strategy

Indicative Lighting Design

PROJECT DRAWING REFERENCE NO.	REVISION	SCALE	DATE
HINK-A1-OLS-00-GA-001	01	1:2500 @ A1	SEPT 2011

DOCUMENT
Operational Lighting Strategy

SCALE BAR
0 20 40 60 80 100 200
metres

DRAWING SECURITY CLASSIFICATION

☐ PROTECTIVE MARKING REQUIRED
☒ NOT PROTECTIVELY MARKED

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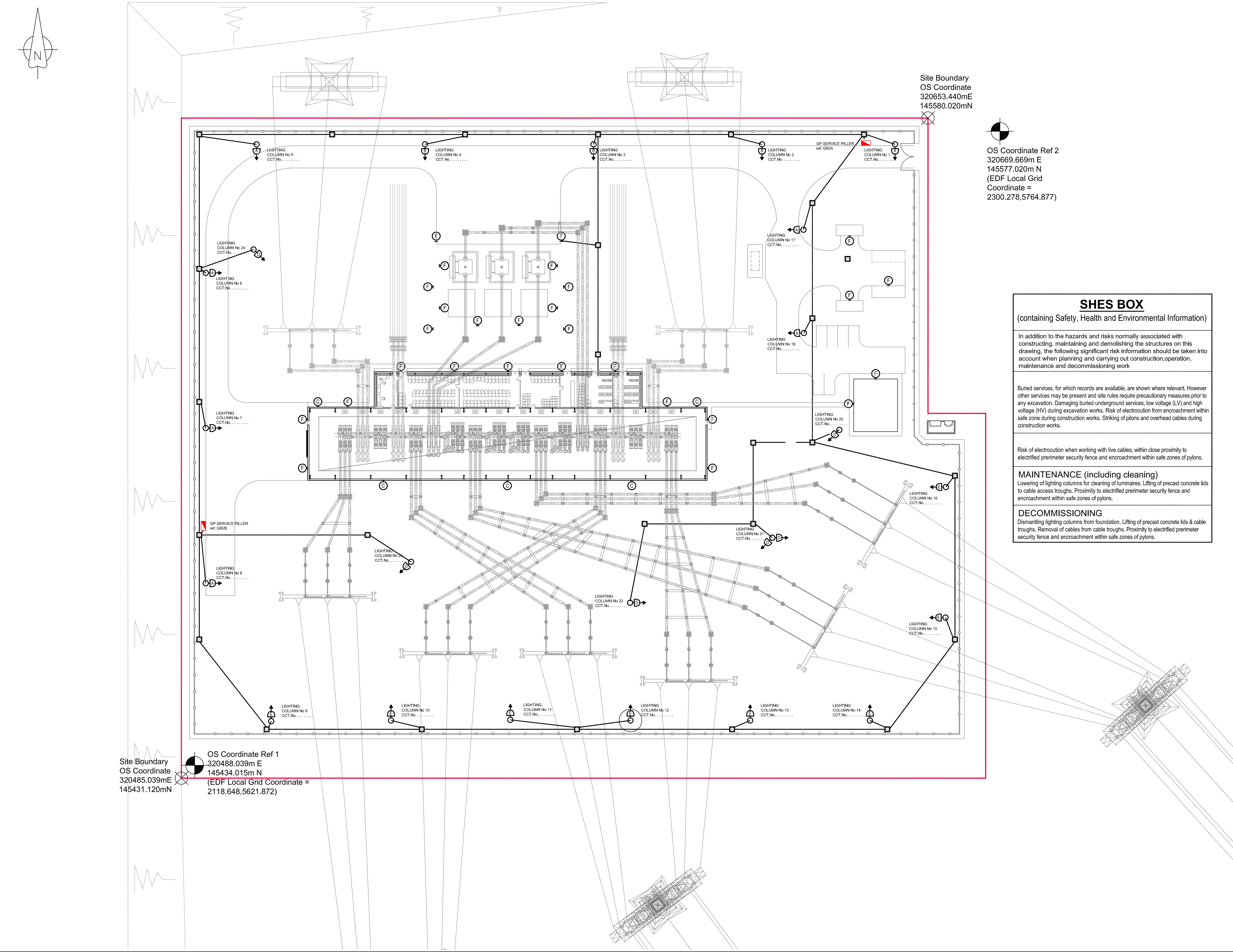

SHES BOX

(containing Safety, Health and Environmental Information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction,operation, maintenance and decommissioning work

Buried services, for which records are available, are shown where relevant. However other services may be present and site rules require precautionary measures prior to any excavation. Damaging buried underground services, low voltage (LV) and high voltage (HV) during excavation works. Risk of electrocution from encroachment within safe zone during construction works. Striking of pilons and overhead cables during construction works.

Risk of electrocution when working with live cables, within close proximity to electrified prerimeter security fence and encroachment within safe zones of pylons.

MAINTENANCE (including cleaning)
Lowering of lighting columns for cleaning of luminaires. Lifting of precast concrete lids to cable access troughs. Proximity to electrified prerimeter security fence and encroachment within safe zones of pylons.

DECOMMISSIONING
Dismantling lighting columns from foundation. Lifting of precast concrete lids & cable troughs. Removal of cables from cable troughs. Proximity to electrified prerimeter security fence and encroachment within safe zones of pylons.

NOTES

1. All dimensions are in millimetres unless noted otherwise.
2. Co-ordinates are in metres and relate to site grid.
3. Direction of luminaires to be confirmed

LEGEND

○ LUMINAIRE CONNECTED TO COLUMN

Luminaire Schedule:

TYPE A	150W SON-T Road Lantern mounted on a 6m mast
TYPE B	150W Asymmetric Road Lantern mounted on a 6m mast
TYPE C	250W Asymmetric floodlight wall mounted at 10m
TYPE D	250W Asymmetric floodlight mounted on a 6m mast
TYPE E	100W Asymmetric Road Lantern mounted on a 6m mast
TYPE F	70W SON-T Amenity Wall mounted luminaire mounted at 2.2m

SHURTON 400kV SUBSTATION FORMS PART OF HINKLEY POINT C POWER STATION

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P1	06-04-2011	Issued for Planning	RG	RS	CB	SB
P0	14-02-2011	Issued for Planning	RG	RS	CB	SB

PRELIMINARY

Electricity Alliance
South West Alliance, Ashville Industrial Estate, Short Way, Thornbury, South Gloucestershire, BS35 3UU

nationalgrid
Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA

Drawing Title
BUILDING SERVICES
EXTERNAL LIGHTING
LAYOUT WITH CABLE DUCT ROUTES

Site
SHURTON 400kV SUBSTATION

Scale	Sheet size	Sheet No.	Total Sheets.
1:400	A1	1	1

Originator Job No. B2902130 | Revision
Drg No. 23/SWA/0547750 | P1
N.G. Project No. 20832S

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Issue		Purpose of Revision	Issue		Purpose of Revision
Drawn		NG Issue Description to go in here when required	Drawn		
Checked			Checked		
Approved / Date			Approved / Date		

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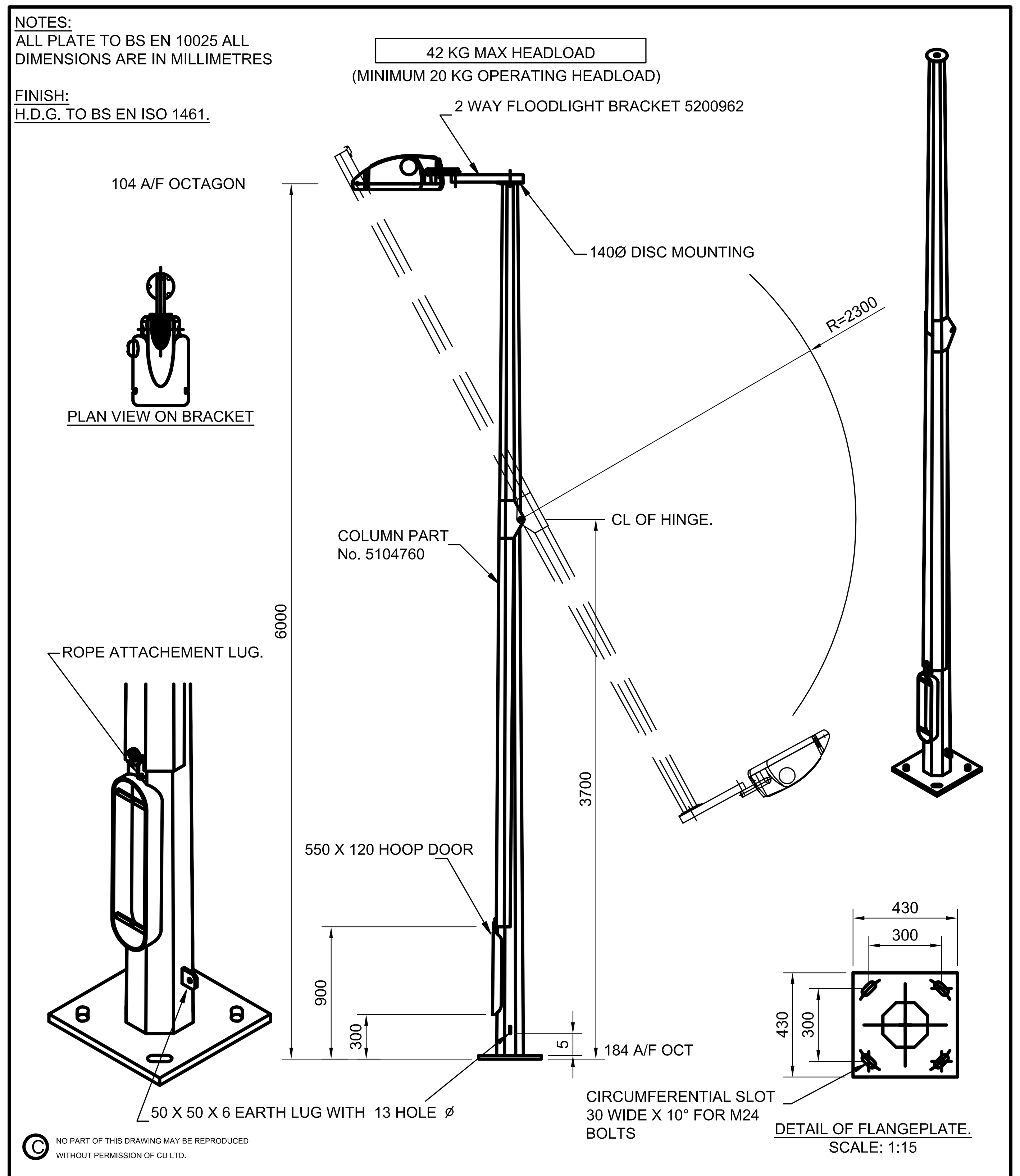
1. All dimensions are in millimetres unless noted otherwise.
2. Co-ordinates are in metres and relate to site grid.
3. Direction of luminaires to be confirmed

LEGEND

REFERENCE DRAWINGS



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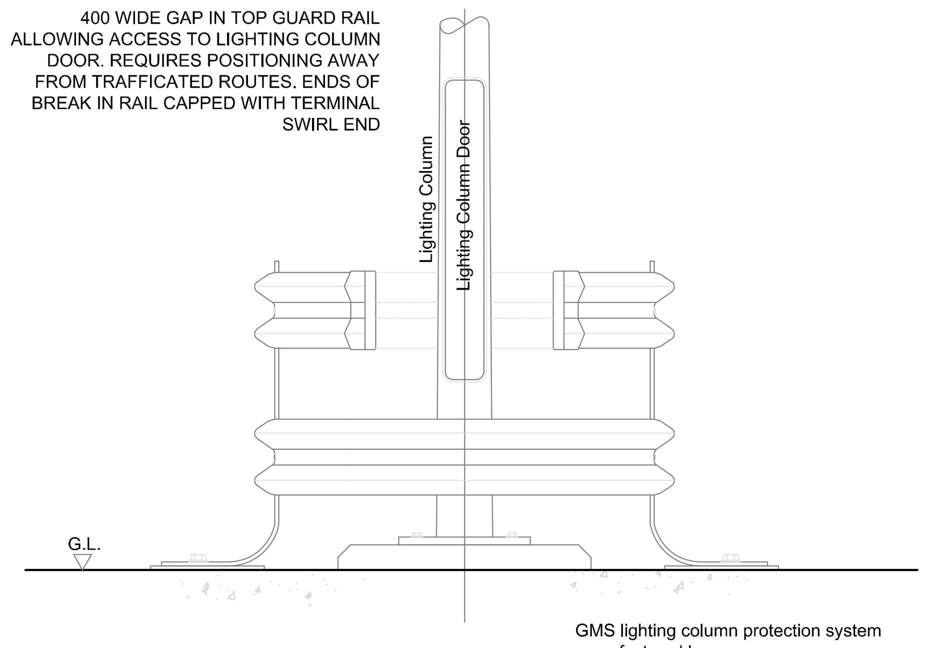
ISS.	REVISION	DATE	SIGN.
02	EARTHLUG MOVED & RESIZED.	18/05/05	RJG
03	COLUMN PART No.ADDED.	23/10/07	S.B

TITLE:
GENERAL ARRANGEMENT
6M EXTRA HEAVY MID-HINGE
WITH 2 No FL500 250W
FLANGED
NATIONAL GRID
SUBSTATIONS PC 2065

CU
WARE HERTS

DRAWN	CHECKED	DATE	SCALE	DRAWING No.
S.B	S.B	18/04/07	1:25	S-5000276-03

400 WIDE GAP IN TOP GUARD RAIL ALLOWING ACCESS TO LIGHTING COLUMN DOOR. REQUIRES POSITIONING AWAY FROM TRAFFICATED ROUTES. ENDS OF BREAK IN RAIL CAPPED WITH TERMINAL SWIRL END



Column Foundation

GMS lighting column protection system manufactured by;
ASSET International Structured Solutions
Stephenson Street
Newport, South Wales. NP19 4XH
with 750Ø 'Armco' horizontal rail protection.

SHES BOX

(containing Safety, Health and Environmental Information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction,operation, maintenance and decommissioning work

CONSTRUCTION

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OPERATION

Risk of electrocution when working with live cables, within close proximity to electrified perimeter security fence and encroachment within safe zones of pylons.

MAINTENANCE (including cleaning)

Lowering of lighting columns for cleaning of luminaires. Lifting of precast concrete lids to cable access troughs. Proximity to electrified perimeter security fence and encroachment within safe zones of pylons.

DECOMMISSIONING

Dismantling lighting columns from foundation. Lifting of precast concrete lids & cable troughs. Removal of cables from cable troughs. Proximity to electrified perimeter security fence and encroachment within safe zones of pylons.

SHURTON 400kV SUBSTATION
FORMS PART OF HINKLEY
POINT C POWER STATION

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P1	06-04-2011	Issued for Planning	RG	RS	CB	SB
P0	14-02-2011	Issued for Planning	RG	RS	CB	SB

PRELIMINARY

Electricity Alliance
South West Alliance, Ashville Industrial Estate, Short Way, Thornbury, South Gloucestershire, BS35 3UU

nationalgrid
Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA

Drawing Title
BUILDING SERVICES
EXTERNAL LIGHTING
MISCELLANEOUS DETAILS

Site
SHURTON 400kV SUBSTATION

Scale	Sheet size	Sheet No.	Total Sheets.
NTS	A1	1	1

Originator Job No. B2902130 | Revision

Drg No. 23/SWA/0547751 | P1

N.G. Project No. 20832S

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Issue		Purpose of Revision	Issue		Purpose of Revision
Drawn		NG Issue Description to go in here when required	Drawn		
Checked			Checked		
Approved / Date			Approved / Date		

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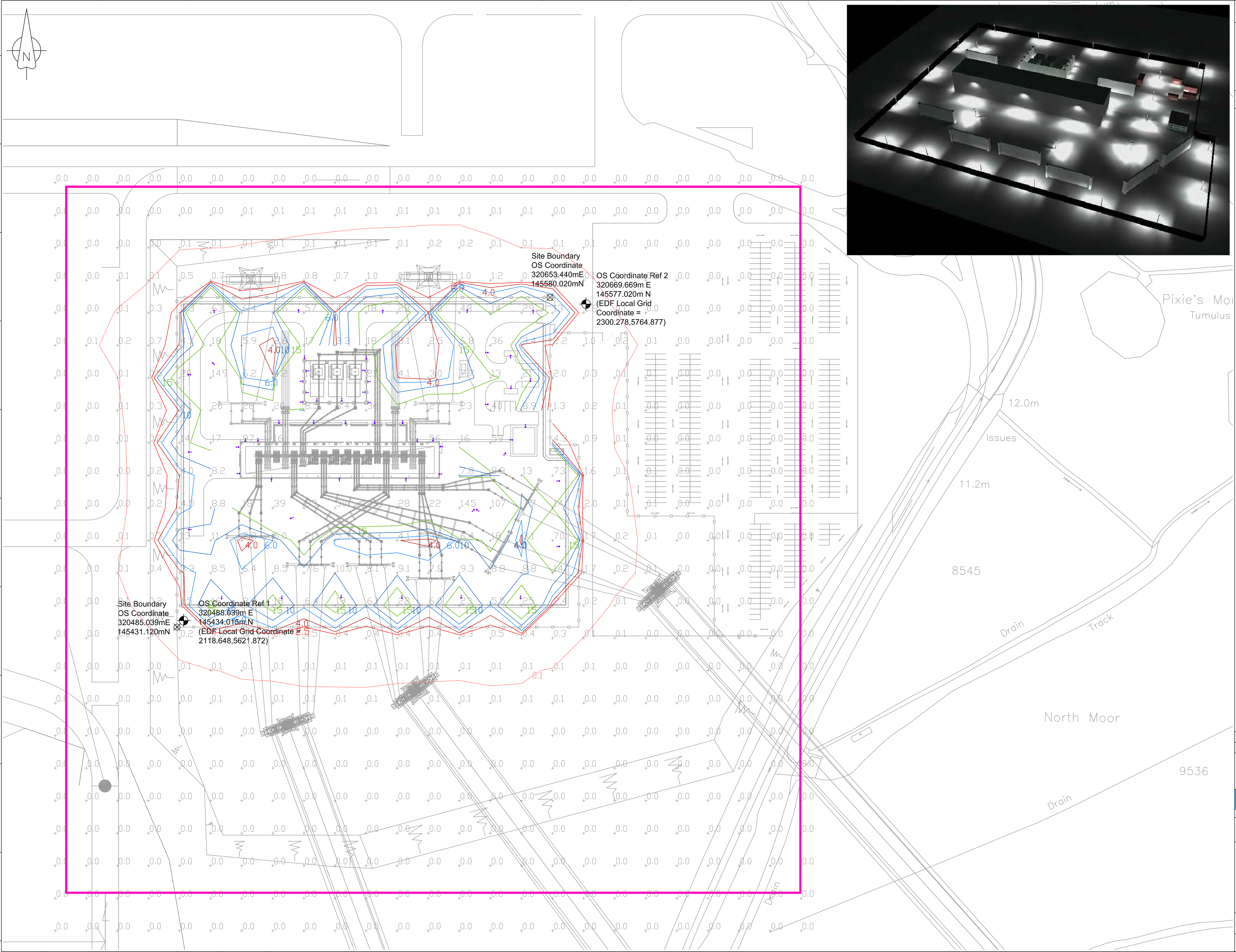

NOTES

1. All dimensions are in millimetres unless noted otherwise.
2. Co-ordinates are in metres and relate to site grid.
3. Direction of luminaires to be confirmed
4. Lighting levels as emitted from sub-station external lighting installation only.

LIGHTING CONTOURS (LUX LEVELS):

- 0.1 LUX
- 2.5 LUX
- 4 LUX
- 6 LUX
- 10 LUX
- 15 LUX
- 25 LUX

SHES BOX

(containing Safety, Health and Environmental Information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction,operation, maintenance and decommissioning work

CONSTRUCTION
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OPERATION
Risk of electrocution when working with live cables, within close proximity to electrified premimeter security fence and encroachment within safe zones of pylons.

MAINTENANCE (including cleaning)
Lowering of lighting columns for cleaning of luminaires. Lifting of precast concrete lids to cable access troughs. Proximity to electrified perimeter security fence and encroachment within safe zones of pylons.

DECOMMISSIONING
Dismantling lighting columns from foundation. Lifting of precast concrete lids & cable troughs. Removal of cables from cable troughs. Proximity to electrified perimeter security fence and encroachment within safe zones of pylons.

SHURTON 400kV SUBSTATION FORMS PART OF HINKLEY POINT C POWER STATION

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P0	06.04.11	Issued for planning	RG	RS	CB	SB

PRELIMINARY

Electricity Alliance

South West Alliance, Ashville Industrial Estate, Short Way, Thornbury, South Gloucestershire, BS35 3UU

nationalgrid

Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA

Drawing Title

BUILDING SERVICES
EXTERNAL LIGHTING
EXTENDED AREA LEVELS
AND CONTOUR DETAILS

Site

SHURTON 400kV SUBSTATION

Scale	Sheet size	Sheet No.	Total Sheets.
1:800	A1	1	1

Originator Job No. B2902130

Drg No. 23/SWA/0547753 — Revision P0

N.G. Project No. 20832S

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Checked			Checked		
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APPENDIX 4A: OPERATIONAL LIQUID DISCHARGES

APPENDIX 4A: OPERATIONAL LIQUID DISCHARGES

Table 4A.1: Operational Liquid Discharges

Substance	Circuit conditioning (kg/yr)	Sanitary waste discharge (kg/yr)	Producing demineralised water (kg/yr)[4]	Maximum 24-hour loading (kg/d)	Maximum annual loading (kg/yr)
Boric Acid	14000	--	--	5630	14000
Acetic Acid	--	--	14	0.1	14
Acrylic acid	--	--	165	1	165
Aluminium	4.9	--	--	1.1	4.9
ATMP	--	--	9100	45	9100
BOD	--	1278	--	3.5	1278
Boron[1]	2448	--	--	984	2448
Chloride	--	--	87100	450	87100
Chromium	7.8	--	--	1.7	7.8
COD	5050	--	--	330	5050
Copper	0.39	--	--	0.08	0.39
Detergents	3200	--	624	270	3824
Ethanolamine	920	--	--	25	920
HEDP	--	--	890	4.5	890
Hydrazine[2]	28	--	--	4	28
Iron	33	--	46000	257	46033
Lead	0.28	--	--	0.06	0.28
Lithium hydroxide	8.8	--	--	--	8.8
Manganese	3.1	--	--	0.67	3.1
Morpholine	1680	--	--	95	1680
Nickel	0.41	--	--	0.09	0.41
Nitrogen as N	10120	1278	--	324	11398
Phosphates	800	--	--	200	800
Phosphoric Acid	--	--	12	0.1	12
Sodium	--	--	52400	855	52400
Sodium polyacrylate	--	--	8030	40	8030
Sulphates	--	--	98400	2000	98400
Suspended solids	2800	1916	88000	875	92716

Substance	Circuit conditioning (kg/yr)	Sanitary waste discharge (kg/yr)	Producing demineralised water (kg/yr)[4]	Maximum 24-hour loading (kg/d)	Maximum annual loading (kg/yr)
Unionised Ammonium (NH_3)[3]	1184	150	--	74	1334
Zinc	5.6	--	--	1.2	5.6

Table Notes:

[1] Boron is calculated by dividing the loading for boric acid (H_3BO_3) by 5.72 to obtain loading of B alone.

[2] 24 hour flow of hydrazine is based on input data from Flamanville EPR.

[3] Unionised ammonia was calculated as 11.7% (annual loading) or 22.9% (24 hour loading) of the total nitrogen flow (assuming all nitrogen was in the form of ammonia, NH_4^+), based on pH =8.11, salinity = 23.3 psu and temperatures of 35.5^oC (annual loading) and 48^oC (24 hour loadings). For the purpose of worst-case assessment of 24 hour loadings it is assumed that only two of the four cooling water pumps are in operation. (see Ref. 18.65 for further detail).

[4] Loadings include discharges associated with desalination and demineralisation units. Desalination plant loading values have been retained to provide bounding conditions in terms of a worst-case discharge scenario.

APPENDIX 4B: OPERATIONAL GASEOUS EMISSIONS

APPENDIX 4B: OPERATIONAL GASEOUS EMISSIONS

Table 4B.1: Operational Gaseous Emissions

Parameter	Value [a]	Units
EDG emissions		
Stack internal diameter	1.0	m
Stack height	30.0	m
Exit velocity	35	m/s
Ambient temperature of discharge gases	375	˚C
SO_2 emission rate	2.93	g/s
NO_x emission rate	30.66	g/s
PM_{10} emission rate	0.80	g/s
CO emission rate	2.41	g/s
SBO emissions		
Stack internal diameter	0.82	m
Stack height	30.0	m
Exit velocity	15.0	m/s
Ambient temperature of discharge gases	515	˚C
SO_2 emission rate	0.40	g/s
NO_x emission rate	6.80	g/s
PM_{10} emission rate	0.19	g/s
CO emission rate	0.57	g/s
Main stack emissions		
Stack internal diameter	3.0	m
Stack height	70.0	m
Exit velocity	0.982	m/s
Ambient temperature of discharge gases	15	˚C
H_2CO emission rate (commissioning)	0.0342	g/s
CO emission rate (commissioning)	0.0320	g/s
H_2CO emission rate (operation)	0.0243	g/s
CO emission rate (operation)	0.0229	g/s
NH_3 emissions		
Ambient temperature of discharge gases	100	˚C
NH_3 emission rate	3.12	g/s

APPENDIX 7A: LEGISLATION, POLICY AND GUIDANCE

APPENDIX 7A: LEGISLATION, POLICY AND GUIDANCE

7A.1 UK Radioactive Waste Policy

7A.1.1 The development of UK policy on radioactive waste management has been an ongoing process since the start of the nuclear industry in the 1940s. Overarching Government policy is set out in the Government White Paper, Review of Radioactive Waste Management Policy Cm2919, as amended (Ref. 7.1). The fundamentals of the policy are that Government would maintain and continue to develop a policy and regulatory framework which would ensure that:

- radioactive wastes are not unnecessarily created;
- such wastes that are created are safely and appropriately managed and treated; and
- they are then safely disposed of at appropriate times and in appropriate ways to safeguard the interests of existing and future generations and the wider environment, and in a manner that commands public confidence and takes due account of costs.

7A.1.2 The White Paper 'Managing Radioactive Waste Safety: a Framework for Implementing Geological Disposal' (Ref. 7.1) sets out the Government's framework for managing higher activity radioactive waste in the long-term through geological disposal, coupled with safe and secure interim storage and ongoing research and development to support its optimised implementation. It also invites communities to express an interest in opening up, without commitment, discussions with Government on the possibility of hosting a Geological Disposal Facility (GDF) at some point in the future.

7A.1.3 The Government updated its policy on the decommissioning of nuclear facilities in 2004 (Ref. 7.2) which stated that new facilities covered by the policy should be designed and built so as to minimise decommissioning and associated waste management operations and costs.

7A.2 UK Disposal Strategy for LLW

7A.2.1 LLW has been disposed of in near-surface facilities at the LLWR in Cumbria for many years. However, the existing capacity of the LLWR is less than the forecast volume of LLW that must be dealt with in the future.

7A.2.2 The UK Government and the devolved administrations of Northern Ireland, Scotland and Wales carried out a review of solid LLW policy in 2007 (Ref. 7.3) and a new policy was announced that sets out a more flexible approach for managing solid LLW in the long-term. The key aim of the policy statement was to provide a high level framework within which individual LLW management decisions could be taken flexibly to ensure safe, environmentally acceptable and cost-effective management solutions that appropriately reflect the nature of the LLW concerned.

7A.2.3 Under the Energy Act 2004, the Nuclear Decommissioning Authority (NDA) is responsible for developing and implementing a strategy and plans for LLW management and disposal. In 2010 the NDA published the UK Strategy for the Management of Solid Low Level Waste from the UK Nuclear Industry (Ref. 7.4). This sets out a strategy which would provide continued capability and capacity for the management and disposal of LLW in the UK, for both the nuclear and non-nuclear industries through:

- application of the waste management hierarchy;
- best use of existing facilities, working more efficiently and potentially extending the life of the existing national repository; and
- development and use of new fit-for-purpose management and disposal routes, so waste producers have more choice in determining and implementing waste management routes.

7A.2.4 The UK LLW strategy is supported by a number of strategic best practicable environmental option (BPEO) studies covering potential alternatives to the LLWR for metallic wastes, combustible wastes and VLLW. These provide a baseline against which any site can undertake an analysis. A key aspect of achieving the strategy is the improved segregation of wastes to enable alternative disposal routes to the LLWR to be used effectively.

7A.3 UK Long-term Waste Management Solution for ILW and Spent Fuel

a) The Committee on Radioactive Waste Management

7A.3.2 Studies into the best disposal options for legacy[1] higher activity wastes (ILW, HLW) and spent fuel have been ongoing for more than 25yrs. In July 2003, the Committee on Radioactive Waste Management (CoRWM) was established by Ministers of the UK Government and devolved administrations to oversee a review of options for managing legacy solid radioactive waste in the UK and to recommend the option, or combination of options, that can provide a long term solution, providing protection for people and the environment.

7A.3.3 CoRWM reported its findings in July 2006 and recommended ‘geological disposal’ as the solution for the long-term storage of the most hazardous legacy radioactive wastes. CoRWM made a total of 15 recommendations to Government (Ref. 7.5). These covered, amongst other topics:

- geological disposal;
- interim storage;
- flexible decision-making;
- research; and
- inviting communities to host a GDF.

[1] The term legacy refers to waste and spent fuel from past and current civil and military nuclear programmes.

7A.3.4 Recommendations 1 and 2, presented below, provided advice to Government with regard to geological disposal of waste and requirements for interim storage prior to the availability of a GDF.

"Recommendation 1: Within the present state of knowledge, CoRWM considers geological disposal to be the best available approach for the long-term management of all the material categorised as waste in the CoRWM inventory when compared with the risks associated with other methods of management. The aim should be to progress to disposal as soon as practicable, consistent with developing and maintaining public and stakeholder confidence.

Recommendation 2: A robust programme of interim storage must play an integral part in the long-term management strategy. The uncertainties surrounding the implementation of geological disposal, including social and ethical concerns, lead CoRWM to recommend a continued commitment to the safe and secure management of wastes that is robust against the risk of delay or failure in the repository programme. Due regard should be paid to:

I. reviewing and ensuring security, particularly against terrorist attacks;

II. ensuring the longevity of the stores themselves;

III. prompt immobilisation of waste leading to passively safe waste forms;

IV. minimising the need for re-packaging of the waste; and

V. the implications for transport of wastes."

7A.3.5 CoRWM's recommendations have been accepted by UK Government for the long term management and disposal of the UK's legacy wastes and have been taken forward in the Managing Radioactive Waste Safely White Paper described previously.

b) CoRWM Position on New Build Wastes

7A.3.6 In its 2006 Recommendations to Government (Ref. 7.5), CoRWM made it clear that it takes no position on the desirability or otherwise of nuclear new build and stated that future decisions on new build should be subject to their own assessment process, including consideration of waste. CoRWM emphasised that its recommendations are directed to existing and committed waste arisings and should not be seen as either a red or green light for nuclear new build.

7A.3.7 On 25 October 2007 Government re-appointed CoRWM with revised Terms of Reference and a predominantly new membership. These state that:

"...The role of the reconstituted Committee on Radioactive Waste Management (CoRWM) would be to provide independent scrutiny and advice to UK Government and devolved administration Ministers on the long-term management, including storage and disposal, of radioactive waste. CoRWM's primary task is to provide independent scrutiny on the Government's and Nuclear Decommissioning Authority's proposals, plans and programmes to deliver geological disposal, together with robust interim storage, as the long-term management option for the UK's higher activity wastes."

7A.3.8 CoRWM has further clarified its position with regard to nuclear new build (Ref. 7.6); a position statement issued by CoRWM in 2010 reiterated that its position on the desirability or otherwise of building new nuclear power stations remains neutral. In March 2010, CoRWM, in its response to Government consultation on the draft National Policy Statements for Energy Infrastructure (Ref. 7.7), also made a number of observations to Government on matters that, in its opinion, should be addressed when considering approval of new nuclear power stations. The observations are wide ranging and include consideration of whether effective arrangements would exist to manage and dispose of waste that would be produced by new nuclear power stations in the UK.

7A.4 UK Disposal Strategy for New Build ILW and Spent Fuel

7A.4.1 The UK Government has stated that, based on scientific consensus and international experience, waste and spent fuel from new nuclear build would not raise such different technical issues compared with nuclear waste from legacy programmes as to require a different technical solution. Government concluded that it would be technically possible, and desirable, to dispose of higher activity waste from new nuclear power stations in a GDF and that such waste should be stored in safe and secure interim storage until a GDF becomes available.

7A.4.2 The National Policy Statement for Nuclear Power Generation (EN-6), Volume II (Ref. 7.8) states:

> *"The Government is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations. As a result, the IPC should not consider this question. However there may be planning issues relating to the on-site management of radioactive waste which it is appropriate for the IPC to consider as part of the development consent application."*

7A.4.3 EDF Energy have developed its waste and spent fuel management strategy for HPC in accordance with Government policy and guidance and specifically the "waste base case" that Government has set out in their guidance on the Funded Decommissioning Programme to prospective new nuclear operators (Ref. 7.9).

7A.4.4 A key element of this guidance is that the operator should assume that all higher activity wastes should be stored on the site of its generation until a GDF is available.

7A.4.5 The principle of geological disposal is to isolate the waste deep inside a suitable rock formation to ensure that no significant quantities of radioactivity ever reach the surface environment. It is the main option on which the NDA is conducting research for the long-term management of radioactive waste. It is the UK Government's and many other nations' preferred long-term approach.

7A.4.6 Geological disposal is a multi-barrier, multi-phased approach, based on placing wastes deep underground, beyond disruption by man-made or natural events. The UK Government is currently undertaking a process to identify potential sites for a GDF. The approach is based on voluntarism and partnership with local communities, coupled with the use of appropriate site screening and assessment criteria. Overseas experience, particularly from Sweden and Finland, suggests that such an approach is likely to be an effective way of selecting an appropriate and acceptable site.

7A.4.7 The UK Government has invited communities, through the Managing Radioactive Waste Safely (MRWS) White Paper (Ref. 7.5), to express an interest in our taking part in the process that would ultimately provide a site for a GDF. The NDA is the implementing organisation, responsible for planning and delivering the GDF and, as part of this process, would engage with communities and other stakeholders.

7A.4.8 Three local authorities have expressed an interest in entering discussions about the siting process. These discussions are without commitment and are initially about finding out more about what hosting a GDF would mean for a community in the long-term. Partnership working is developing in these communities to help them make a more formal decision about whether to participate further in the process. This process is separate from and is unrelated to the application to build HPC.

7A.4.9 The MRWS White Paper notes that *“Through agreed mechanisms for updating the Baseline Inventory, inclusion of new waste would be taken forward in discussion with host communities as the programme proceeds. Geological disposal facility design activities would consider the necessary features to safely accommodate particular waste types if that proves necessary”*. It is anticipated that the inclusion of waste from new nuclear power stations would follow this process.

a) Radioactive Waste Management Regulation in the UK

7A.4.10 The UK Government's radioactive waste management policy is supported by a regulatory framework that aims to ensure that all radioactive wastes are safely and appropriately managed in ways that pose no unacceptable risks to people or the environment.

References

7.1 Review of Radioactive Waste Management Policy, Final Conclusions. Cm 2919. HMSO, 1995.

7.2 The Decommissioning of the UK Nuclear Industry's Facilities. HMSO, 2004.

7.3 Defra, DTI and the Devolved Administrations. Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom. Defra, London, 2007.

7.4 NDA. UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry, 2010.

7.5 CoRWM. Managing our Radioactive Waste Safely, CoRWM's recommendations to Government, CoRWM Doc 700, 2006.

7.6 CoRWM. Statement of its position on New Build Wastes, CoRWM doc. 2749, Final, 2010.

7.7 CoRWM. Response from the Committee on Radioactive Waste Management to the Government consultation on the draft National Policy Statements for Energy Infrastructure, CoRWM doc.2748 Final, 2010.

7.8 DECC. National Policy Statement for Nuclear Power Generation (EN-6), Volume II of II – Annexes. 2011, Section B.5.1.

7.9 BERR. Consultation on Funded Decommissioning Programme Guidance for New Nuclear Power Stations. (Online) Available at: http://www.berr.gov.uk/files/file44486.pdf, 2008.

APPENDIX 9A: SOCIO-ECONOMIC TECHNICAL NOTE 1: WORKFORCE PROFILE

FOREWORD

EDF Energy is planning to build a new nuclear power station at Hinkley Point near Bridgwater, Somerset, comprising two UK EPR reactor units with an expected output of approximately 1,630MW per unit. The new site, Hinkley Point C (HPC), is to the west of the existing Hinkley Point Power Station Complex. The new power station is based on replicating as much as possible the design for the Flamanville 3 unit in Normandy, France, currently under construction.

EDF Energy undertook a review of the likely workforce required to construct the Hinkley Point C (HPC) Project and associated developments (AD) which was shared with the local authorities in January 2011 and published in draft as part of the "Stage 2 Update" consultation in February 2011. EDF Energy is now producing its final proposals for the site and associated developments and this note updates the previous figures to reflect the minor changes in proposals and phasing since that time.

The aim of this paper is to provide:

- A revised profile which shows the development of the workforce at HPC during the construction period, and a more detailed understanding of the likely job types and skills mix for the earlier contracts to inform the construction skills workforce strategy that is currently being developed by EDF Energy with the local authorities
- An assessment of the current local labour supply; and
- Predicted mix of home-based and non-home-based recruitment to inform the Accommodation and Transport strategies.

The findings of this note have been used to assess the supply of accommodation, the likely demand arising from the non-home-based workers, the resultant accommodation mix, and the subsequent effects on other services (health, education, policing, leisure etc.). These are incorporated into the technical assessment of the scheme and inform the detailed implementation strategies as well as transport and accommodation.

APPENDIX 9A: SOCIO-ECONOMIC TECHNICAL NOTE 1: WORKFORCE PROFILE

9A.1 Introduction

9A.1.1 NNB Generation Company Limited (company number 06937084), part of EDF Energy, is the company that will ultimately make the Development Consent Order application. For the purpose of this document, NNB Generation Company Limited is referred to as EDF Energy.

9A.1.2 EDF Energy is planning to build a new nuclear power station at Hinkley Point near Bridgwater, Somerset, comprising two UK EPR reactor units with an expected output of approximately 1,630MW per unit.

9A.1.3 The new site, Hinkley Point C (HPC), is to the west of the existing Hinkley Point Power Station Complex. The new power station is based on replicating as much as possible the design for the Flamanville 3 unit in Normandy, France, currently under construction.

9A.1.4 EDF Energy undertook a review of the likely workforce required to construct the Hinkley Point C Project and associated developments (AD) which was shared with the local authorities in January 2011 and published in draft as part of the "Stage 2 Update" consultation in February 2011.

9A.1.5 EDF Energy is now producing its final proposals for the site and Associated developments and this note updates the previous figures to reflect the minor changes in proposals and phasing since that time.

9A.1.6 This has involved the updating the workforce histogram, which was based on data from current and previous power station construction projects, more detailed information on likely skills requirements, and a review of the assumptions about the proportion of workers that will be home-based and non-home-based.

9A.1.7 This paper brings together this information, produced by EDF Energy's internal construction team with HDS, the Impact Assessment Unit (IAU) at Oxford Brookes University, and the EDF Energy Construction Workforce Development Team (using MACE's database of construction skills).

9A.1.8 The aim of this paper is to provide:

- A revised profile which shows the development of the workforce at HPC during the construction period, and a more detailed understanding of the likely job types and skills mix for the earlier contracts to inform the construction skills workforce strategy that is currently being developed by EDF Energy with the local authorities.
- An assessment of the current local labour supply.

- Predicted mix of home-based and non-home-based recruitment to inform the Accommodation and Transport strategies.

9A.1.9 The findings of this note have been used to assess the supply of accommodation, the likely demand arising from the non-home-based workers, the resultant accommodation mix, and the subsequent effects on other services (health, education, policing, leisure etc.). These are incorporated into the technical assessment of the scheme and inform the detailed implementation strategies as well as transport and accommodation.

9A.1.10 The focus is on the overall peak construction employment scenario, but the civils peak is also estimated. The estimates for the construction of the main HPC Project are set out in the wider context of all the other cumulative internal elements for the HPC programme i.e. associated development (AD). These are included in **Plate** A9A.1 in Section 2 of this note. In the context of the whole construction project, the AD workforce numbers are low, and peaks occur before the civils work peak and total peak.

9A.1.11 Socio-economic prediction is an inexact exercise, and the predictions and associated mitigation and enhancement measures should be the subject of regular monitoring. An adaptive assessment approach is required, building from the Environmental Statement, through more detailed forecasts for early phases of the scheme and regular monitoring and effective management of impacts over the duration of the project. This note begins the first two parts of that approach by bringing together the best available data for assessment and planning purposes.

9A.2 Labour Demand

9A.2.1 The proposed Power Station at HPC will be a two unit EPR reactor. The EPR is a new design and two single unit reactors are currently under construction in Europe, in France (Flamanville 3) and Finland (Okiluoto). Neither is yet complete.

9A.2.2 The EDF Energy construction team has used two main sources of information to produce workforce assumptions for HPC.

9A.2.3 Firstly, it has reviewed the workforce profiles from EDF Energy's database of previous projects for (non-EPR) two unit reactors, with an 18 month gap between construction of each, to examine the build-up of overall workforce and the relationship between workforce (operatives) build up for each of the two main contract packages – Civils and Mechanical and Electrical (M+E) - to identify an indicative histogram. The overall histogram and the Civils and M+E components (and their timings) are reflected in **Plate A9A.1**.

9A.2.4 Secondly, it has used EDF Energy monitoring data from Flamanville 3 to identify the quantity of workforce (number of hours worked) and make up (between operatives and staff) for the Civils contracts to date, and forecasts to the end of the construction period. The project began in 2007 and the monitoring data therefore covers the years 2007 to 2010. This includes both Civil and (some) M+E contracts. The total number of hours required to build the power station is assumed to be double that for Flamanville and this has been applied to the histogram for the two unit reactors, with the assumption that the M+E contracts will have the same relationships to Civils as on non-EPR reactors. The conversion of hours worked to workforce numbers is based on an assumption of a typical shift pattern of average 8 hour shifts and 21 days per month per worker. This is consistent with the proposed shift patterns set out in EDF Energy's Stage 2 a consultation.

9A.2.5 It is further assumed that staff and management (contractors and EDF Energy combined) are equivalent to just over 25% of total operatives, and that on-site services, security and clerical roles, just over 5%. These assumptions are based on previous experience at Sizewell, Flamanville and other EDF Energy operations.

9A.2.6 We have also assumed that permanent operational employment begins to build up from month 35 (with month 0 being the beginning of the preliminary works) to prepare for the completion of the first unit, to a peak of 900 (700 directly employed plus 200 contracted) at completion of both units. These are early workforce assumptions and may change over time although, as can be seen from the histograms, any changes will not have an effect on overall peaks as the main operational workforce build up is later in the project.

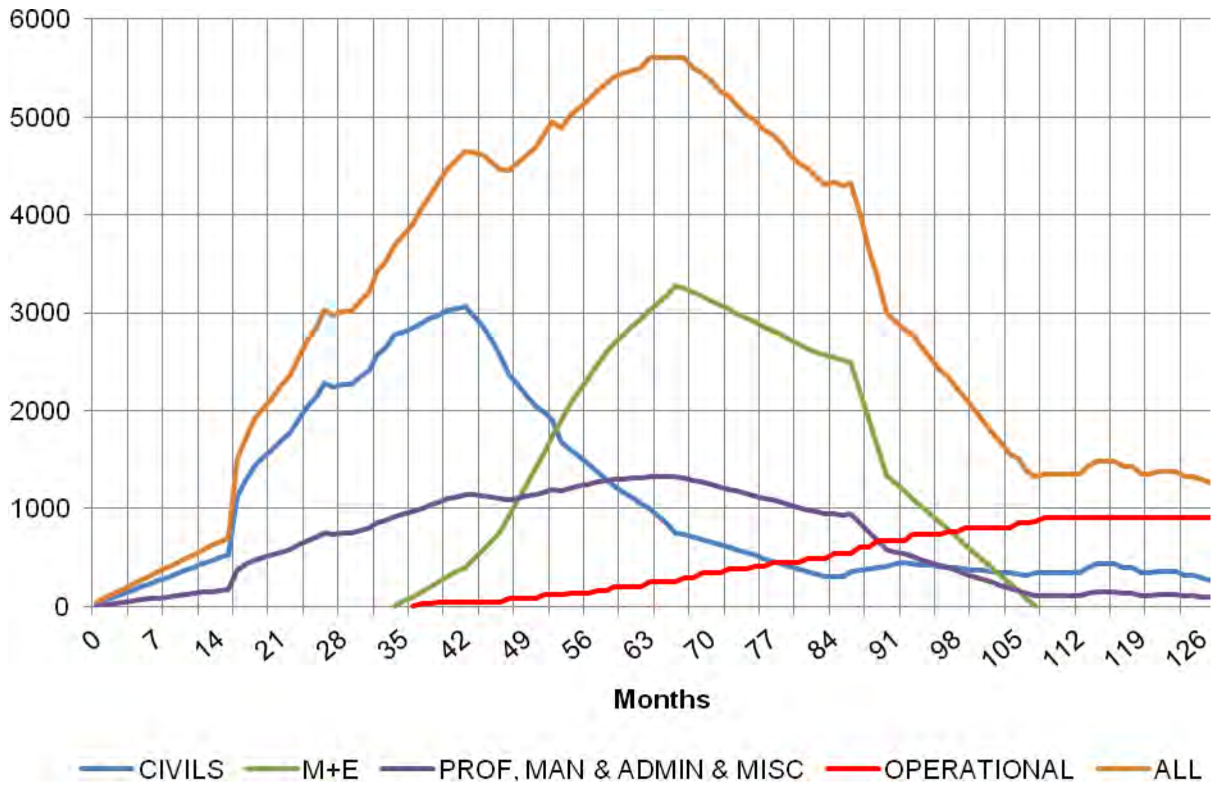
9A.2.7 The data for early works include enabling, remediation, preliminary works and jetty which will be largely completed prior to IPC consent for the main project. They are consistent with the data and assumptions used in the Socio-Economic Chapter of the Environmental Statement for the Preliminary Works application, although they show a "smoothed" build up and also include professional staff as well as site operatives.

9A.2.8 A number of responses to EDF Energy's Stage 2 proposals suggested that it would be useful to take a single overview of total workforce profiles, including those for the proposed Associated developments – namely the Accommodation Campuses, Park and Rides, Wharf, and Cannington Bypass. These have been incorporated into the histogram on the basis of assumptions and proposals that were consulted on in the Stage 2 update consultation. These sites will be completed well before the peak in the Civils and M+E workforces, and any further minor revision will not have a significant impact on the conclusions drawn below.

9A.2.9 Two other particular issues of uncertainty were raised in response to EDF Energy's Stage 2 assumptions – relating to the relative productivity of the British and French construction industries, and the extent to which actual workforce outcomes will depend on the operational approach of chosen lead contractors. In order to test this we have compared the indicative workforce profile from the assumptions above with (commercially confidential) workforce histograms submitted by the five companies bidding for the Civils contracts. This analysis has confirmed that both the peak workforce number and the phasing of the workforce is in line with proposals submitted by the contractors.

9A.2.10 **Plate A9A.1** below, shows the combined histogram which brings together the implications of these assumptions. It identifies a combined "Civils" peak of 4,650, and a combined M+E and overall peak of 5,600. The numerical breakdowns are set out in **Table A9A.1** as key points for identifying peak workforce impacts on labour supply and consequently on accommodation. These assumptions give labour force numbers at key points in the project to ensure impacts can be assessed. Overall numbers of people working on the site over the lifetime of the project are likely to be significantly higher, with a likely range of 20,000 to 25,000 people.

Plate A9A.1: HPC Construction Labour Demand Curve — Estimated Workforce Numbers



Source: from EDF Energy estimates (Jun 2011)

Table A9A.1: HPC: Peak Disaggregated Labour Demand Requirements

	Civils Peak (Month 43, Jan '15)		Overall Peak (Month 64 to 68, Oct '16 to Feb '17)	
	%	Number	%	Number
Civil Operatives	66%	3,070	18%	990
M+E Operatives	9%	400	54%	3,030
Operational Staff	1%	50	4%	250
Staff and Management	19%	900	19%	1,050
Site Services, Security & Clerical	5%	240	5%	280
All	100%	4,660	100%	5,600

Source: from EDF Energy Energy estimates (Jan 11)

9A.3 More Detailed Skill Categories

9A.3.1 **Table A9A.2** sets out broad skill categories based on information from potential civils stage contractors, Cogent (the sector skills Council) (Ref. 9A.1) and on data from the Sizewell B (SZB) construction monitoring study for both civils and M+E stages. (Ref. 9A.2).

Table A9A.2: Main skill categories for construction operatives – drawing on information from construction of Sizewell B/COGENT

Civils Work Stage (operatives)
Timber/formwork
Concrete/cement/masons
Drivers/crane operators/labourers
Reinforced steelwork/erectors
Scaffolders
Welders
Civil works labourers/semi skilled
Others
Mechanical and electrical works stage (operatives)
M+E labourers/semi-skilled
Welders – special metals
Welders – steel
Boiler makers; pipe-fitters
Fitters
Electricians; electro-mechanical fitters
Instrumentation
Cable pullers

9A.3.2 The skills mix will have consequent impacts on the assumptions about home-based and non-home-based splits (and therefore total demand for accommodation) and accommodation demand by type.

9A.4 Skills Model

9A.4.1 In order to plan effectively for the early stages of the construction programme the EDF Energy Construction Workforce Development (CWfD) team has been working on a “bottom up” model, which takes a more detailed view of the early contract packages so that work can be undertaken with partners to plan for effective skills and recruitment measures. This makes the essential link between the assessment model described above, which has been used for planning purposes, and the specific actions required to maximise employment for residents of the local districts and Somerset, which EDF Energy and partners have a shared interest in and commitment to achieving.

9A.4.2 The CWfD team model uses existing project information combined with evidence taken from previous projects and models to build up an indicative picture of labour inputs for each project within the programme. The methodology has information provided by potential main contractors project and planning experience and expert consultation to validate the results and ensure that they are as representative as possible at this early stage of the planning process. It is consistent with the overall workforce assumptions on AD, Civils and M+E contracts as described above.

9A.4.3 There is an element of estimation and assumption in the model which may be improved upon significantly as the finer details of the project are reviewed and agreed. Each project within the model has its own time scale, works phasing, cost and labour profile. Different labour coefficients have been used that reflect the differing nature of the work under construction across all associated developments and the main site. Each project is overlaid onto master programme timeline, which aggregates the labour requirement on individual projects and provides an overview of the overall programme as a forecast of total employment.

9A.5 Outputs: Early Years

9A.5.1 The outputs from the model provide a useful indication of the employment profiles across various occupation groups and the workforce as a whole. It has been used here to provide an indication of the proportions, occupations and skills sets that will be required on the programme during the first two years of the build phase. This includes Associated Development works and the start of the main Civil works at HPC. Forecasts exclude detailed breakdowns of the labour required for the site preparation works (Months 1 to 16).

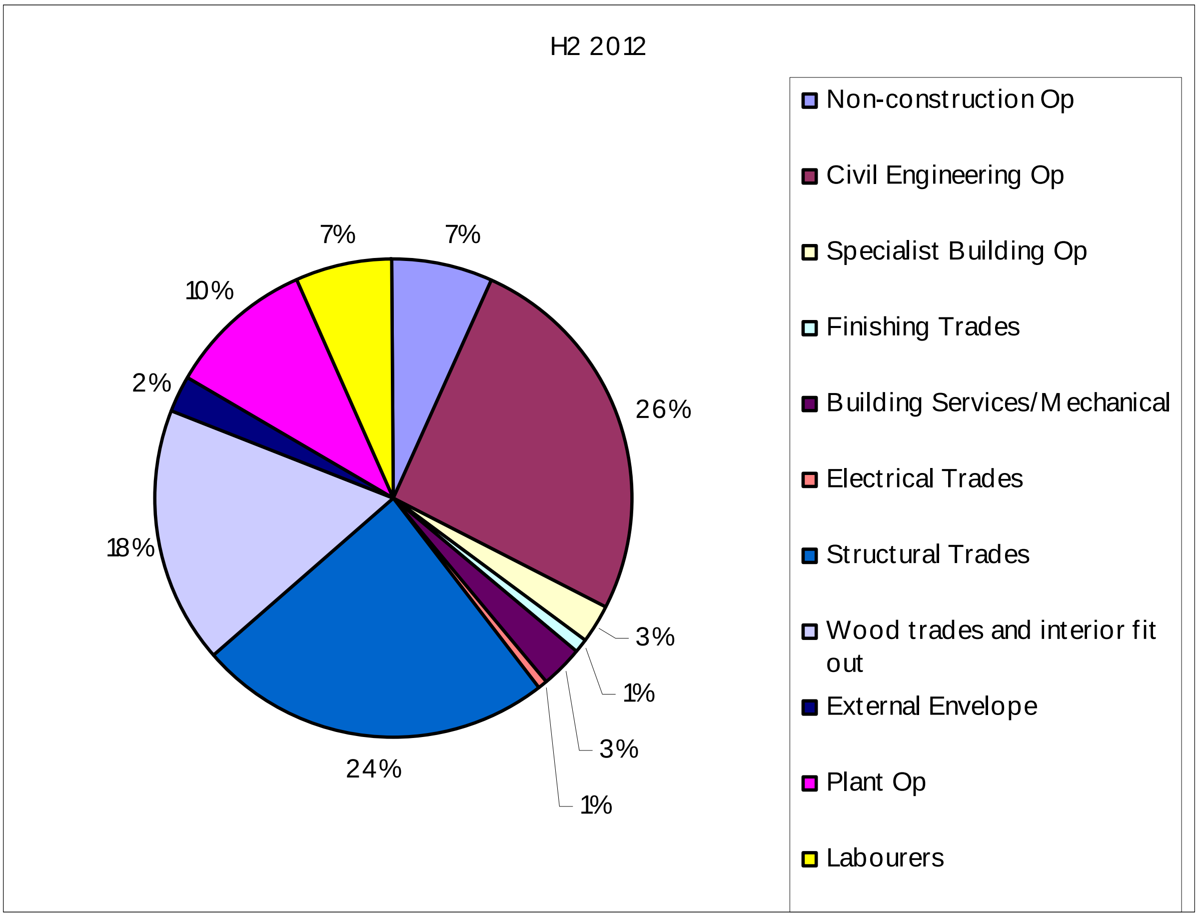
9A.5.2 The forecasts provide indicative volumes and proportions of occupations that will be expected across the programme in 11 broad occupation and skills groups. These are represented using illustrative 6 month breakdowns of the workforce. This allows the model to show the changing proportions of different occupations within the workforce at different points in time as the overall programme progresses.

9A.5.3 The detailed occupational groups shown in **Plate A9A.2:** Months 17 to 22, **Plate** A9A.3 and **Plate** A9A.4, are described in Annex 2.

9A.6 Months 17 to 22 – Main Civils Contract Plus Associated Development

9A.6.1 In the initial six month period of the main programme, it is anticipated that up to half of all construction workers are likely to drawn from civil engineering and structural trades. At this time, the workforce is expected to expand rapidly. There is also a large cohort of wood trades and plant operatives, which will be associated with formwork carpentry and civil engineering preliminary work.

Plate A9A.2: Months 17 to 22



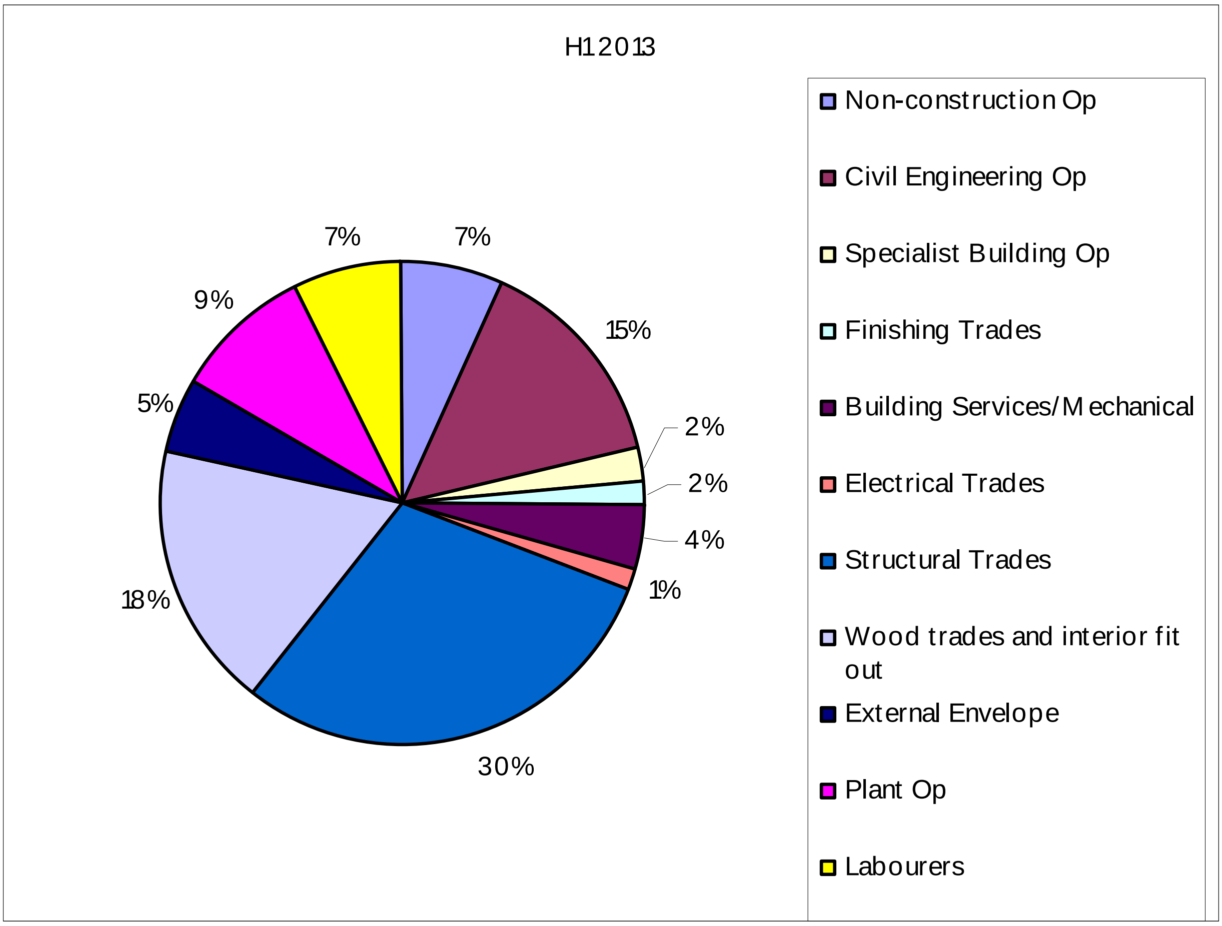
Source: EDF Energy CWfD Model

9A.7 Months 23 to 34

9A.7.1 As the project starts to mature, the numbers in the workforce grow steeply. Within the overall workforce, the numbers of civil engineering operatives will increase but their relative proportion within the overall workforce is predicted to decrease, as structural trades, such as reinforcing bar fixers, increase in prominence.

9A.7.2 Wood trades and plant operatives increase in number but remain at a similar percentage of the workforce as in Period 1. These workforce patterns are to continue to the end of the period.

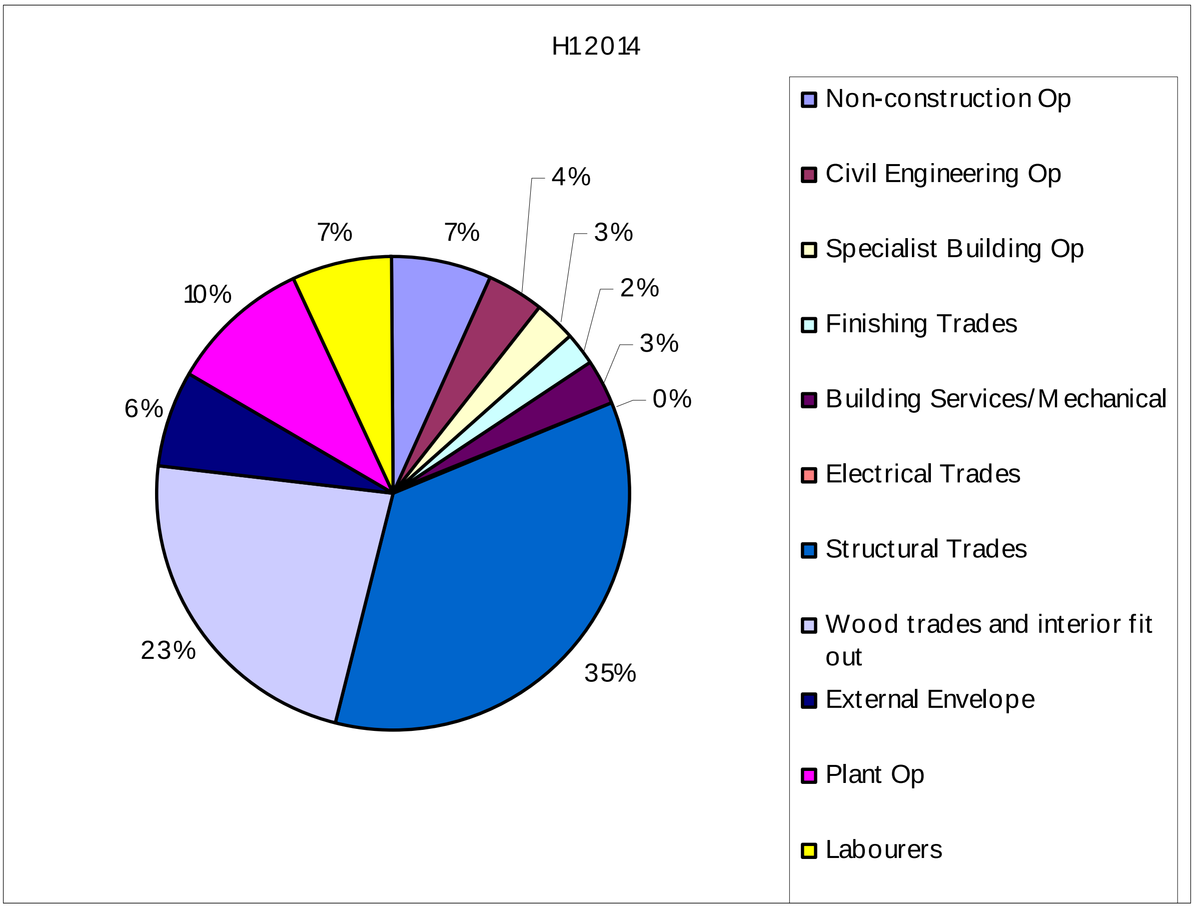
Plate A9A.3: Months 23 to 34



Source: EDF Energy CWfD Model

9A.7.3 By May 2015, it is anticipated that the main AD and preliminary works will be complete and the major civil engineering works will be the dominant project at HPC. The model reflects this, indicating a high proportion and correspondingly large numbers of structural and wood trades within the workforce.

Plate A9A.4: Months 35 to 40



Source: EDF Energy CWfD Model

9A.8 Future Use of Skills Information and Forecasting

9A.8.1 It is a core operating philosophy of EDF Energy that all skills and employment interventions that are put in place to support the construction of HPC will be demand-led, dynamic and flexible. This is to ensure that at all times the offer will align with the needs of EDF Energy, HPC contractors and the wider local economy during the build.

9A.8.2 In order to achieve optimal impact from its employment, skills and training interventions it will be essential for the programme to be intelligence-led and evidence-based, through the effective utilisation of labour forecasts, work package analysis, contractor engagement and broader labour market intelligence.

9A.8.3 These will continue to be developed and supplied by the EDF Energy Workforce Development Team. Skills gaps and requirements will be identified with sufficient time for specific provision and appropriate funding mechanisms to be designed and programmed in advance.

9A.9 Labour supply

a) 90 Minute Construction Daily Commuting Zone (CDCZ)

9A.9.1 In order to assess whether the assumptions about the sources of labour are reasonable, we need to assess the supply of labour from within the home-based and non-home-based workforce. The first step is to confirm the definition of the home-based area/CDCZ and then the split between the home-based and non-home-based workforce.

9A.9.2 The determination of the CDCZ impact area involves consideration of a number of factors which affect workers willingness to commute daily to the site. These include travel allowances for construction workers, general studies of construction workforce mobility and monitoring of previous projects.

9A.9.3 The Construction Industry Joint Council (CJIC) agreement (Ref. 9A.3) sets out national standards for pay and conditions for workers on major building and infrastructure sites in the UK. The current agreement, which took effect in June 2008, sets out rates for daily travel and fare allowances. These are currently payable on a sliding scale based on the distance travelled, up to a maximum of 75 kilometres (c.47 miles).

9A.9.4 A study for the UK DTI and ECITB (IFF and University of Warwick, 2005) (**Table** A9A.1) shows that a proportion of UK and SW region construction workers will travel to work for distances over 50 miles on a daily basis. Indeed it is estimated that 11% of SW construction workers travel more than 50 miles to work daily. (Ref. 9A.4).

9A.9.5 Monitoring studies of the construction of Sizewell B also show actual local recruitment extending to a 50 miles/90 minutes commute (Glasson and Chadwick, 1995). A 90-minute commute zone was also agreed for the assessment in the late 1980s of the previous proposal for Hinkley Point C. (Ref. 9A.5).

9A.9.6 Discussions with local stakeholders at the Socio-Economic Workshops in 2009 and 2010 reinforced these determinants with local knowledge and experience and it was concluded that the 90 minute area remained a reasonable assumption.

9A.10 Labour Supply: Districts, Somerset and CDCZ

9A.10.1 **Table A9A.3, Table** A9A.1 and **Table** A9A.5**,** show local (CDCZ, and Somerset) labour supplies in the construction sector in roughly similar proportions to national and regional supplies. It is important to distinguish between data which includes self-employed and that which does not. Self-employment is very important in the construction sector. **Table A9A.3** shows approximately 48,000 workers (employed) in construction trades in the CDCZ in 2008, of whom about 9,000 were in Somerset. **Table A9A.4** suggests these figures could be even higher.

9A.10.2 In addition, there were about 39,000 people unemployed in the CDCZ in July 2011, with about 7,000 in total in Skilled Trades and in Process, Plant & Machine Operations. A further 10,500 are in the elementary occupations category. **Table** A9A.4 shows that 4,200 people are seeking jobs in construction trades, with about two–thirds seeking skilled jobs and one-third seeking unskilled/ semi-skilled jobs. About 20% of those seeking construction jobs are based in Somerset.

9A.10.3 The detailed occupational breakdowns set out in Section 3.2 are compatible with those set out in Annex 2 and used in the skills model described in Section 2.3 above. This suggests that, for the Civils stage there is a reasonable “fit” with the local labour market with the HPC labour demand representing only a small proportion of the available labour force. The next iterations of the workforce modelling will identify any pinch points and also training requirements which might be necessary to convert generic skills e.g. in carpentry, to the specific requirements of a major infrastructure project e.g. formwork carpentry. This will inform the Construction Workforce Development Strategy. Overall, the general conclusion is that there is a significant and relevant supply of labour in the CDCZ and in Somerset on which HPC can draw.

Table A9A.3: Employment in Construction and Related Activities 2008 (Ref. 9A.6)

Area	Construction Sector (SIC45)	Of which: civil engineering (SIC45.2)	Related Technical Services (SIC74.2)
Sedgemoor	1,870	947	479
Taunton Deane	2,279	1,366	1,546
West Somerset	405	207	54
Sub-Total	*4,554*	*2,520*	*2,079*
Somerset	9,366	4,967	3,435
CDCZ	47,996	24,406	20,510
South West	98,835	49,627	36,473

Source: Office for National Statistics, Annual Business Inquiry (NOMIS). Employment figures exclude self-employed workers

Table A9A.4: Employment in Construction and Related Activities 2008

Occupation	CDCZ 2008 Actual	Somerset 2008 Actual	CDCZ 2014 Estimate	Somerset 2014 Estimate
Senior Executives	4,299	770	4,060	730
Construction managers	9,987	1,780	8,936	1,590
Non-construction professionals	11,237	2,000	10,468	1,850
Wood trades	13,116	2,300	11,177	1,950
Brick-layers	4,152	730	3,547	620
Building Envelope Specialists	6,275	1,110	4,772	840
Painters and decorators	6,826	1,210	6,160	1,090
Plasterers and dry-liners	1,985	340	1,671	290
Roofers	2,166	390	1,588	280
Floorers	1,639	290	1,536	270
Glaziers	2,529	450	2,023	350
Specialist Building Operatives	2,751	480	2,106	360
Scaffolders	839	140	1,152	200
Plant operatives	1,625	270	1,885	320
Plant mechanics/ fitters	1,358	240	1,423	250
Steel erectors/structural	1,252	210	1,191	210
Labourers nec	5,505	960	7,091	1,250
Electrical trades and installation	5,871	1,030	5,863	1,020
Plumbing and HVAC trades	7,994	1,420	6,993	1,240
Logistics	827	140	948	160
Civil engineering operatives nec	2,533	440	3,117	540
Non-construction operatives	1,209	210	1,311	220
Civil engineers	2,950	520	2,091	360
Other construction professionals	7,070	1,260	5,575	990
Architects	1,696	310	1,254	220
Surveyors	2,750	480	2,453	430
TOTAL SIC 45 and 74.2	110,443	19,480	100,395	17,630
SIC 45	95,975	16,910	89,018	15,630
SIC 74.2	14,466	2,570	11,373	2,000

Source: Experian/IAU

Table A9A.5: Occupations Sought by Unemployed Claimants: Construction Related Occupations, July 2011 (Ref. 9A.7)

Occupation sought (selected occupations)	Sedgemoor, Taunton Deane and West Somerset	Somerset	90 Minutes CDCZ
Engineering professionals: science & engineering technicians	35	85	520
Skilled mechanical & electrical trades	55	110	570
Skilled construction & building trades	165	300	1,555
Construction Operatives (semi-skilled)	15	35	200
Elementary construction occupations (un-skilled)	125	245	1,380
TOTAL	405	770	4,225

Source: Office for National Statistics, monthly claimant count data. Figures are based on the following SOC 2000 occupational categories which are regarded as relevant to the construction phase of Hinkley Point development: 21.2 – engineering professionals;31.1 – science and engineering technicians; 52.1 – metal forming, welding and related trades; 52.2 – metal machining, fitting and instrument making; 52.4 – electrical trades; 53.1 – construction trades; 53.2 – building trades; 81.4 – construction operatives; 91.2 – elementary construction occupations.

9A.11 Home-based and non-home-based recruitment

9A.11.1 Previous research has shown that the potential for home-based recruitment is very much influenced by the skill level involved, with the percentage local recruitment being higher the less skilled the job. **Table A9A.6** sets out predictions for levels of local recruitment, informed by:

- Power station workforce category requirements.
- Recent information (on civil works) from potential contractors.
- The availability of local supply.
- Comparative information from other UK power station projects and also from Flamanville 3.

9A.11.2 Flamanville 3 has achieved about 45-50% home-based recruitment from La Manche department in the Civils phase. This area has a population of about 500,000, which is similar to the population of Somerset, but which is only about 20% of the population of the HPC CDCZ. It should be noted that such comparative figures at both Sizewell B and at Flamanville 3 do include an element of mitigation/'policy on', with the objective to support recruitment. (NB - Annex 1 provides a comparative analysis of the potential for home-based recruitment between Sizewell B and the proposed HPC, which shows that the demands on home-based supplies of construction workers are well within the margins that were achieved at Sizewell B).

9A.11.3 Analysis shows that, for example, with relatively small levels of demand for Site Services and Clerical jobs (e.g. 240 at civils peak; 280 at total peak), low skill requirements, relatively high wages, and large availability of labour supply (both employed and unemployed), there should be few problems in meeting the high proportions of home-based recruitment which have been the norm for this category of employment on other power station construction sites. In contrast, the much higher levels of demand for professional and managerial staff (900 at civils peak and 1,050 at total peak), the high skill requirements, the tendency for the developer and main contractors to second staff from 'head office', and the relative shortage of such skills in the CDCZ (including in Somerset in particular) indicate likely low proportions of home-based recruitment, although possibly at the upper end of recent such project experience.

Table A9A.6: Ranges for Total Local Recruitment at Peak Construction from Other UK Nuclear Power Station Studies

Employee Category	Range from previous studies	Specific case of Sizewell B peak construction from monitoring data
Site services and security operatives	90-100%	96
Clerical staff	90-100%	33*
Professional staff	2-20%	33*
Civil Operatives	45-75%	61
Mechanical and electrical operatives	35-50%	38

Source: Power Station Studies, Impact Assessment Unit

** - Combined monitoring category at Sizewell B*

9A.12 Estimates of Potential Home-Based Recruitment

9A.12.1 **Table A9A.7** provides broad estimates of potential home-based recruitment from within the 90-minutes CDCZ at civils peak and at total peak. All the percentages are mid-points of a range of up to +/- 10%. The commentary in the table provides a summary of the analysis from the previous sections of this note.

9A.12.2 These estimates are then applied to the disaggregated labour demand requirements for HPC construction main project, as set out in **Table A9A.1**. **Table A9A.8** and **Table** A9A.9 provide estimates of the mid-points of the home-based (CDCZ) and non-home-based splits for the civils peak and the total peak respectively.

9A.12.3 The higher home-based percentage for the civils peak reflects in particular the greater propensity for home-based recruitment for the civil operatives' category. Conversely, the lower percentage for the total peak reflects in particular the lower propensity for home-based recruitment for the more skilled and larger number of M+E operatives.

9A.12.4 For both peaks it is estimated that there will be little or no difference in recruitment to the other categories, with the exception that the peak civil operatives' stage may be lower than for the total peak by virtue of the civils' peak demand on certain skill groups. The application of the +/- 10% ranges would give home-based recruitment figures of 1,770 (38%) to 2,140 (46%) for the civil works peak and 1,740 (31%) to 2,120 (38%) for the total peak.

Table A9A.7: Estimates of Potential Home-Based Recruitment Percentages from CDCZ: Civils Peak And Total Peak Construction (All % Are Mid-Points Of Range Of Up To +/- 10%)

Construction Workforce Category	Predicted HB recruitment (civils peak)	Predicted HB recruitment (total peak)	Commentary
Site services, security and clerical	90	90	Recruited from service sector, less skilled jobs, relatively low numbers needed, and considerable potential from unemployed
Professional staff (EDF Energy and contractors)	15-20	15-20	Other extreme of skill requirement. May be case for a higher HB rate than previously used (10%), informed by contractors' data and unemployment figures in relevant categories. NB: contractors' and EDF Energy clerical staff are included in site services, security and clerical category. Estimated CDCZ recruitment is less than 1% of CDCZ employment in relevant categories
Civil works operatives	45-50	50	Guidance from SZB indicates a 40:60 skilled: semi/unskilled split. There is likely to be reasonable availability from employed and unemployed in CDCZ—enhanced by training. Location Quotients for civil works trades are around national norms, except for scaffolders and plant operatives Which are slightly lower.
M&E work operatives	35	30	Guidance from SZB indicates a 75:25 skilled: semi/unskilled split. Home-based availability from employed and unemployed in CDCZ will be much tighter than for Civils —especially for specialist skilled jobs. Also M&E numbers peak is the overall peak. But Location Quotients for M&E trades are around national norms, except for electricians. Still some HB potential—for some skilled jobs and especially for less skilled jobs.
Operational staff (permanent occupations)	50	50	Draws much on previous operational recruitment patterns at Hinkley and Sizewell

Table A9A.8: Home-based and Non-Home-based Labour at the Proposed Hinkley Point C: Civil Peak Construction (rounded numbers) (all % are mid-points of range of up to +/- 10%)

	Total	Home-based		Non-Home-Based	
		%	Number	%	Number
Civil Operatives	3,070	46%	1,420	54%	1,650
M&E Operatives	400	34%	140	66%	260
Operational staff	50	50%	30	50%	30
Staff and management	900	15%	140	85%	770
Site services, security and clerical	240	90%	220	10%	20
All (including AD & Prelims)	4,660	42%	1,950	58%	2,730

Note: Numbers may not add due to rounding

Table A9A.9: Home-Based and Non-Home-based Labour at the Proposed Hinkley Point C: Overall Peak Construction (rounded numbers) (all % are mid-points of range of up to +/- 10%)

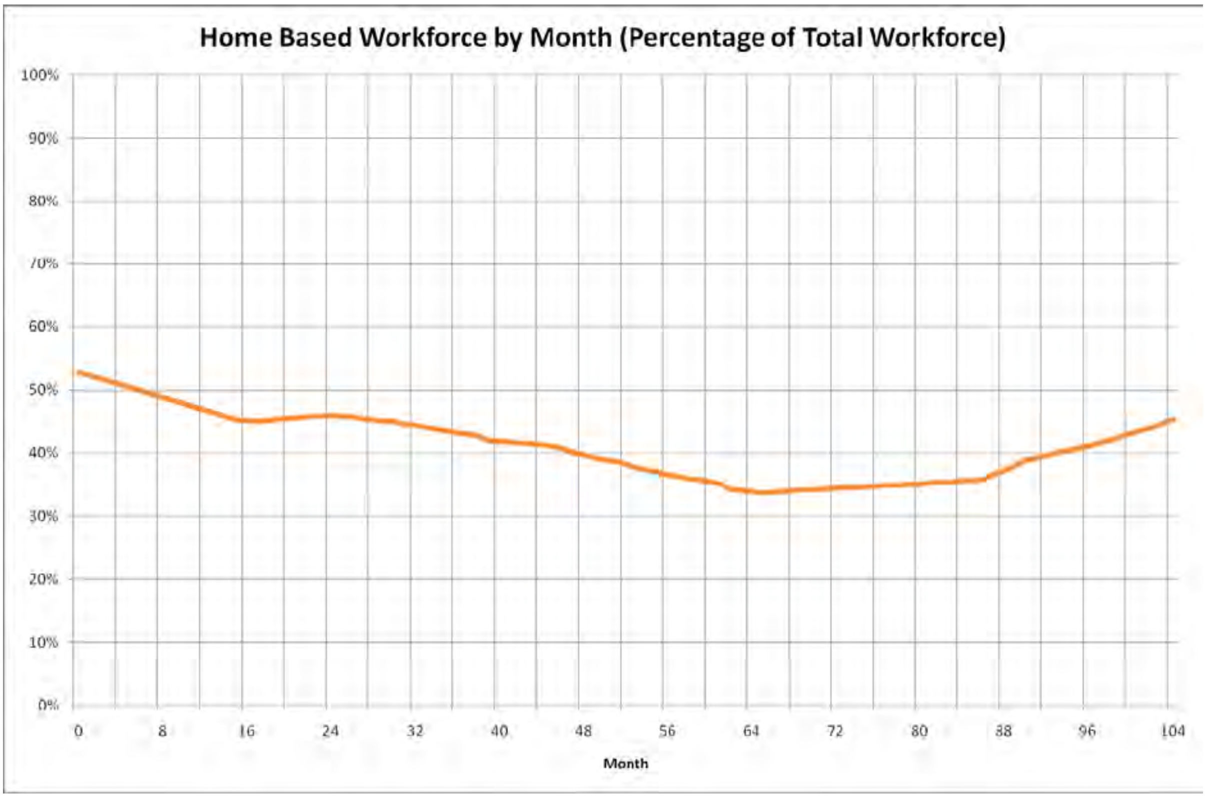
	Total	Home-based		Non-Home-Based	
		%	Number	%	Number
Civil Operatives	990	50%	500	50%	500
M&E Operatives	3,030	30%	910	70%	2,120
Operational staff	250	50%	130	50%	130
Staff and Management	1,050	15%	160	85%	890
Site services, security and clerical	280	90%	250	10%	30
All (including AD & Prelims)	5,600	34%	1,900	66%	3,700

9A.12.5 As implied by **Table A9A.8** and **Table A9A.9,** the proportion of the total workforce which will be home-based (i.e. already resident in the 90 minute area) will vary over the period of the development, with a higher proportion at the outset, which then reduces as the project moves towards its peak, and increases again towards completion as the permanent workforce grows – all of whom will ultimately live in the area. The overall number of local opportunities will however continue to increase as the project moves towards peak (representing a slightly lower proportion of an increasing number of jobs). This is illustrated in **Plate A9A.5** and **Plate A9A.6**.

9A.12.6 This phasing of jobs provides partners with the opportunity to increase local workforce proportions in the later stages by recruiting local people in the earlier stages for lower skilled jobs and helping them to develop their skills and move between contractors and different types of contract throughout the construction period. This approach has been a successful feature of large scale construction projects and depends on a concerted effort at the early stages to produce high quality skills information, and tailored programmes to address local needs.

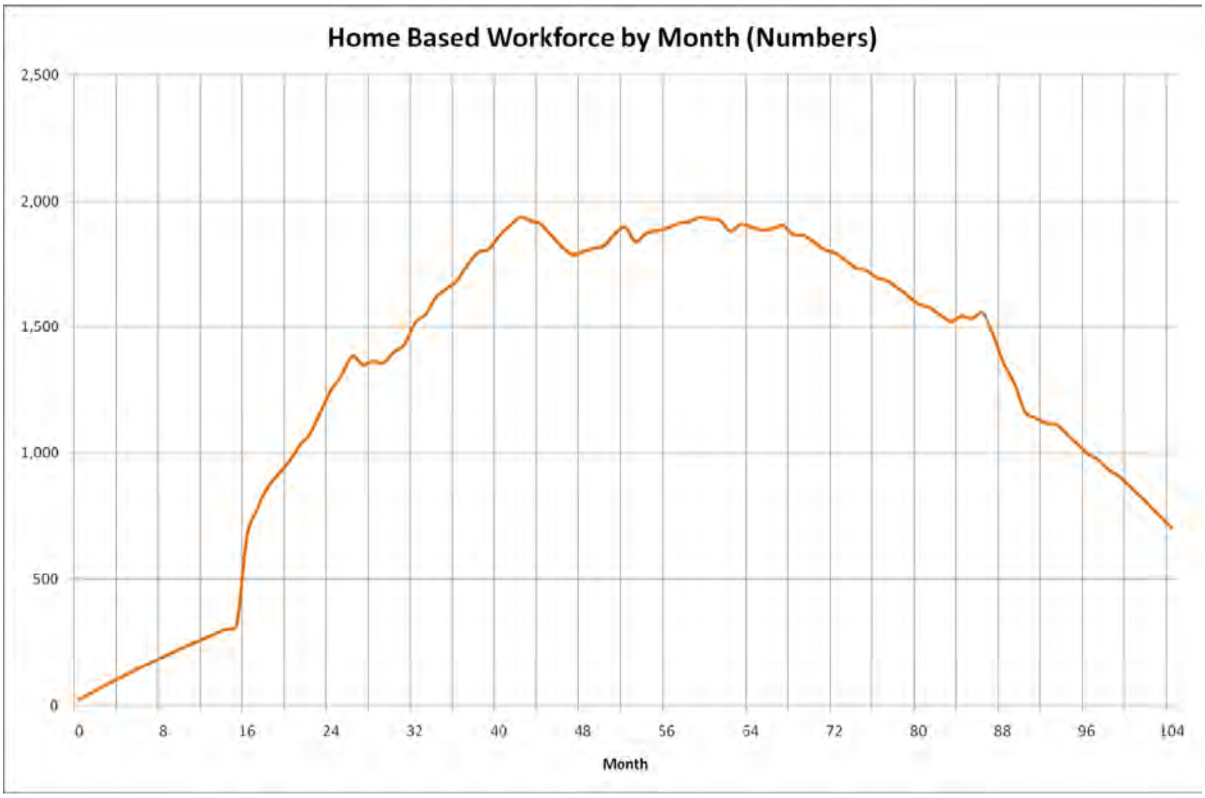
9A.12.7 On the basis that such programmes are implemented it is estimated that of this home-based workforce, over two-thirds will be Somerset residents. At the civils peak it is anticipated that Somerset residents will make up 31 per cent of the total workforce, falling to 23 per cent at overall peak. On average over the lifetime of the project Somerset workers are likely to make up at least 25 per cent of the workforce. When applied to the total number of workers over the lifetime of the project set out in para 2.1.10, this suggests at least 5,000 Somerset residents will work at Hinkley in the construction phase.

Plate A9A.5: Hinkley C - Indicative Home-Based Workforce (Proportion of Total)



Source: IAU Assumptions/EDF Energy/HDS

Plate A9A.6: Hinkley C - Indicative Home-Based Workforce (Number)



Source: IAU Assumptions/EDF Energy/HDS

Use of Workforce profile

9A.12.8 The workforce profile described above has been used to underpin the assessment of the socio-economic impacts of the construction phase of the HPC development. It has been brought together with EDF Energy's strategy for accommodating construction workers, and the transport ("Gravity" model) which identifies the likely locations, within the CDCZ, where the workforce will be resident. This information has been used to inform the assessment of the likely overall population impacts and impacts on public services and local communities.

9A.12.9 The information has also been used to help plan for EDF Energy's Construction Workforce Development Programme, which will begin operation with the implementation of the early works contracts, to maximise the opportunities for residents of the immediate districts and Somerset more generally. The skills forecasts will be updated throughout the project, and informed by an on-going system of monitoring.

ANNEX 1: SZB/HPC COMPARISON

The CDCZ for the Sizewell B development was based on the 1984 definition of Travel-to-Work Areas (TTWAs), covering an area within 90mins of the power station site. Using 1991 Census data, it is possible to determine the proportion and total number of residents employed in the construction industry (Standard Industrial Classification; SIC) – this is a scaled-up number derived from a 10% sample of all residents of these TTWAs. (Ref. 9A.8).

Table A9A.10: Construction Workforce Population Distribution at Sizewell B

Census 2001				
1984-based TTWA	**Total Population (10% Sample)**	**People employed in Construction (10% Sample)**	**Total Population**	**Construction Employees (scaled-up)**
Clacton	7,647	235	65,580	2,015
Colchester	20,069	841	160,302	6,718
Harwich	2,182	33	17,594	266
Beccles and Halesworth	4,741	181	38,323	1,463
Bury St. Edmonds	7,086	246	58,622	2,035
Diss	3,745	139	31,268	1,161
Great Yarmouth	10,158	348	82,616	2,830
Haverhill	3,248	129	25,859	1,027
Ipswich	23,291	813	187,919	6,560
Lowestoft	7,898	281	65,394	2,327
Newmarket	8,060	307	64,782	2,468
Norwich	29,957	1,118	247,146	9,224
Sudbury	5,190	221	41,736	1,777
Thetford	6,250	208	50,186	1,670
Woodbridge and Leiston	6,085	264	48,788	2,117
TOTAL	145,607	5,364	1,186,115	43,656

Source: Census 1991

This indicates an overall proportion of 3.68% of all people in the Sizewell CDCZ that were employed in the construction industry, equating to around 43,656 people. This compares to the current (2001) assessment for the HPC 90-minute CDCZ of 3.14% of all residents employed in construction. The HPC CDCZ is based on Local Authorities, and **Table A9A.11** outlines the total number of people, and those residents employed in the construction industry in 2009. (Ref. 9A.9).

Table A9A.11: Total Population and Residents Employed in Construction Sector

Census MYE (2009) / Annual Population Survey (2009)		
Local Authorities	**Total Population**	**Residents employed in Construction**
Bath and North East Somerset	177,700	6,900
Bristol, City of	433,100	11,800
East Devon	132,700	6,500
Exeter	118,800	6,100
Mendip	108,700	3,400
Mid Devon	76,000	2,600
North Devon	91,500	2,900
North Somerset	209,100	8,300
Sedgemoor	112,100	2,900
South Gloucestershire	262,200	11,200
South Somerset	158,600	4,700
Taunton Deane	108,700	2,400
Teignbridge	126,900	5,800
West Dorset	96,500	4,000
West Somerset	35,400	1,600
Newport	140,400	4,700
TOTAL	2,388,400	85,900

Source: ONS Mid-Year Population Estimates 2008; ONS Annual Population Survey 2009

Table A9A.12 summarises and compares the labour pools for the Sizewell and Hinkley C CDCZs, indicating that a similar proportion of a larger pool for Hinkley were employed in construction industries in 2001 compared to the Sizewell CDCZ in 1991, both in terms of total population and working-age economically active population. Being a larger population, therefore, the Hinkley CDCZ has a significantly larger number of construction-employed residents:

Table A9A.12: Comparison of Sizewell B and Hinkley Point C CDCZ Characteristics

	Hinkley Point C CDCZ	Sizewell CDCZ
Total Population	2,388,400	1,186,115
Total Population (16+, Economically Active)	1,163,200	651,350
Residents Employed in Construction	85,900	43,656
% of all Residents Employed in Construction	3.60%	3.68%

As **Table A9A.12** shows, the potential workforce within 90 minutes of HPC is 100% bigger than the equivalent for Sizewell B. This suggests that higher levels of local labour should be easier to achieve at HP C than they were at Sizewell B. Local employment was in fact higher at Sizewell B than has been assumed in the assessments for HPC. At Sizewell B, the proportion of labour drawn from within the CDCZ fluctuated over the course of the construction phase. In the first quarter of construction it was 55%, it then rose to 65% in Q2 before declining to around 50% in Q6 and remaining there until Q16 at which point it declined over a further five quarters to 40%. It remained around 40% until the final year of construction when it was between 35% and 38%.Residents of the CDCZ made up at least 40% of the construction workforce for the entire construction period except the final year, when they made up no less than 35%.

ANNEX 2: EMPLOYMENT GROUPS AND SECTORS

Table A9A.13: Employment Groups and Sectors

GROUP	TRADE
	Lifts
	Mechanical
Building Services/Mechanical	Plumbing inc Sanitary Ware
	Rail Workers
	Utilities - Comms
	Utilities - Electrics
	Utilities - Gas
	Utilities - Water & Drainage
	Groundworkers (Civils) incl piling
	Tunnellers
	Asphalters/Road Layers
Civil Engineering Op	Landscapers/Pitch/Track Contractors
Electrical Trades	Electricians (inc. FAs & Comms)
	Brick/Block layers
	External Walls
	Scaffolders
	Glaziers
External Envelope	Roofers
	Screeders
	Carpet Layers
	Decorators
	Fittings, Seats Signage
Finishing Trades	Tilers (Floor & Wall)
Labourers	General Operatives
	Prelims - Site Admin
	Prelims - Caterers
	Prelims - Cleaners
	Prelims - Security
	Prelims - Transport
	Logistics - Waste Operatives
	Logistics - Technicians
	Logistics - Facilities Management
Non-construction Op	Security Specialist
Plant Op	Plant Operatives
	Demolition
	Metalworkers (Arch & General)
	Ceiling Fixers
Specialist Building Op	Maintenance operatives
	Concretors (Frame)
	Rebar Fixers (Frame)
	Precast Erectors
Structural Trades	Steel Erectors (inc Decking)
	Carpenters (Frame)
	Joiners
	Dry Liners
	Plasterers
Wood trades and interior fit out	Raised Floor Fixers

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APPENDIX 9B: SOCIO-ECONOMIC TECHNICAL NOTE 2: DEMOGRAPHIC BENCHMARKS

FOREWORD

EDF Energy is reviewing the potential impacts of the development of Hinkley Point C (HPC). As part of this process it has produced a revised assessment of the likely workforce profile, set out in an accompanying technical note (HPC Socio-Economic Technical Note 1: Workforce Profile) which has been agreed with the local authorities.

This note builds on that assessment, to consider the possible demographic make-up of that workforce, and illustrative examples of where the workforce might live

The note uses:

1. Benchmark data on the profile of the UK construction workforce, which gives an illustration of the potential profile at Hinkley;

2. More detailed data from the socio-economic technical assessment, and the experience of previous major construction projects to address specific concerns such as family profiles and disabilities; and,

3. Illustrative data from the “gravity model” which shows where the non-home based workforce might live based on assessments of accommodation availability and EDF’s accommodation proposals.

Socio-economic prediction is an inexact exercise, and the predictions and associated mitigation and enhancement measures should be the subject of regular monitoring. An adaptive assessment approach is required, building from the Environmental Statement, through regular monitoring and effective management of impacts over the duration of the project.

APPENDIX 9B: SOCIO-ECONOMIC TECHNICAL NOTE 2: DEMOGRAPHIC BENCHMARKS

9B.1 Demographic Breakdowns of the Construction Workforce

a) Approach

9B.1.1 Technical Note 1 sets out estimates of the numbers, likely phasing, and types of workers required to construct HPC. It also, through an assessment of the labour market and drawing on experience of other major construction projects, estimates the likely proportions of the workforce who already live within 90 minutes of the site and will commute daily (the home-based workforce), and those who will move into the area (defined as a 60 minute radius), mostly on a temporary basis, to work on the construction project (the non-home based workers).

9B.1.2 These overall numbers are the starting point for assessing the likely impacts of the construction workforce. In order to be able to have a more detailed understanding of likely impacts it is necessary to have a more refined picture of the people who will comprise this workforce, particularly the non-home-based workers.

9B.1.3 This paper considers a range of source data on the construction labour force in the UK to identify potential demographic breakdowns of this workforce, particularly for those groups covered by the Equalities Act 2010 (Ref. 9B.1) for which data is available, and which will form part of the Equalities Impact section of the Socio-Economic Assessment for the HPC scheme. These are:

- age;
- sex;
- disability; and
- race.

9B.1.4 Data is not available for other Equalities groups identified in the Act but they will be considered in a qualitative way, if appropriate, in subsequent assessments.

9B.1.5 In addition to these demographic breakdowns, this report also considers the extent to which workers are likely to bring families to the area, as this could have some very specific impacts on public services.

9B.2 Source Information

9B.2.1 We have sought to identify the most up to date, comprehensive and relevant datasets to undertake our analysis, and have particularly sought to find information that is broken down to at least regional level, to be able to explore local dimensions. The key data-sources used include.

9B.2.2 Census Data from the 2001 Census (Ref. 9B.2) – although this is now nearly ten years old it remains the most comprehensive single dataset on age and gender characteristics, although where we have used this information we have sought to validate using more up to date information.

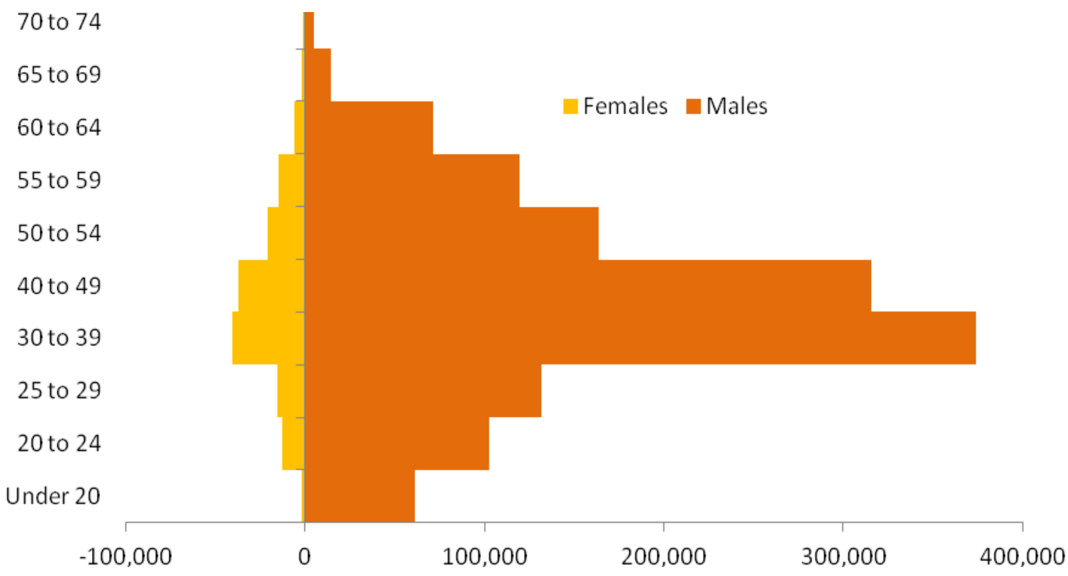
9B.2.3 Annual Population Survey/Labour Force Survey – which provides the most comprehensive recent data (June 2010). Because this is a sample survey it becomes less reliable at the local level, and for the purposes of this report we have therefore used data for the south-west region. We have used both directly available data from the National Online Manpower Information Services Database (NOMIS), and also from secondary sources; (Ref. 9B.3).

9B.2.4 Reports bringing together primary data from elsewhere such as those produced by the Skills and Intelligence Learning Module (SLIM) at the Southwest Observatory, (Ref. 9B.4) the Construction Skills Network (CSN) (Ref. 9B.5), monitoring of major construction projects including Sizewell B, and academic research.

a) Age and Gender

9B.2.5 The 2001 Census gives a comprehensive overview of the age and gender structure of the UK construction industry. **Plate A9B.1** below shows the split between age ranges and males and females. It demonstrates that the construction workforce is overwhelmingly male and in the 20 to 49 age range.

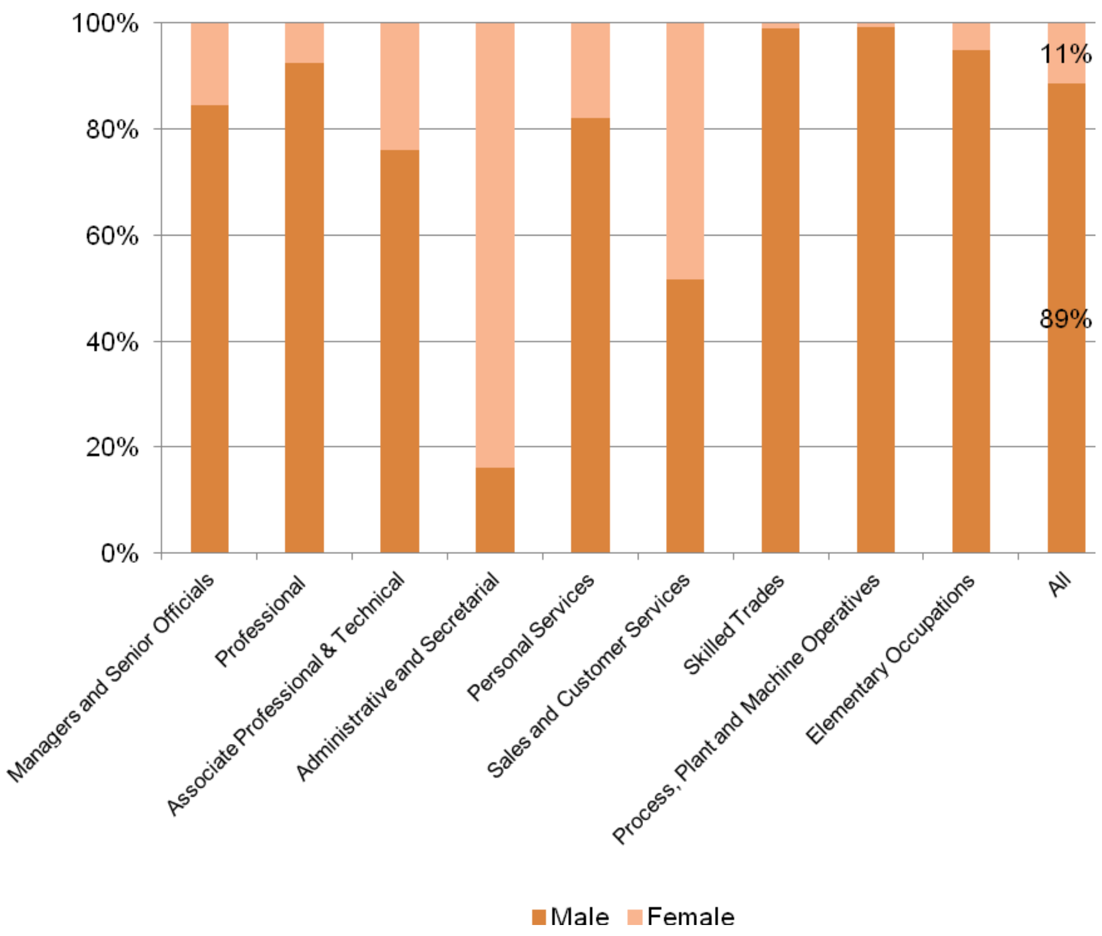
Plate A9B.1: Age and Gender Breakdown: Construction Sector (2001)



Source: Census 2001, Quod

9B.2.6 More recent data from the Annual Population Survey (2009/10) confirms that these proportions have not changed in the intervening decade. **Plate A9B.2** shows the gender breakdown by job type within the construction sector as well as the proportions overall. This shows that while women make up the majority of the workforce in Administrative and Secretarial Occupations (of which there will be a number at HPC (see Technical Note 1), and between 10 and 20% of professional and managerial positions, the on-site operative occupations (skilled trades, elementary and operatives) are male dominated. As these dominate the sector as a whole, just fewer than 9 out of 10 workers in the construction sector are men.

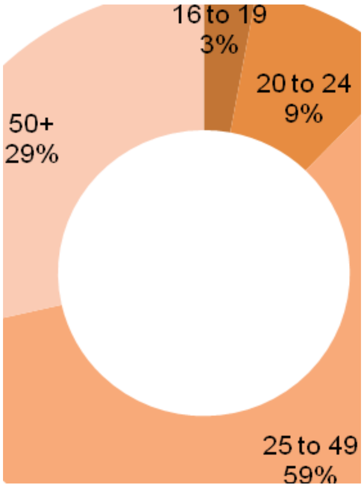
Plate A9B.2: UK Construction Workforce by Gender 2009/10



Source: Annual Population Survey 2009/10

9B.2.7 **Plate A9B.3** shows the age breakdown of the workforce from the same survey which confirms the broad age split from the Census. The recent Gibson Report, reviewing productivity and skills in the UK Engineering Construction Industry (Ref. 9B.6) notes the predominantly male workforce, and the ageing of the UK engineering construction workforce - with about 65% of the current workforce over the age of 40. This covers the more skilled roles involved in designing, engineering, constructing and maintaining the process plant.

Plate A9B.3: UK Construction Workforce by Age 2009/10



Source: Annual Population Survey 2009/10

9B.2.8 These gender and age breakdowns are fairly consistent across all of the datasets that we have reviewed and have changed little, if at all, over time (Briscoe (1995) shows no change in proportion of women working in the sector between 1990 and 2003). We have therefore applied them to the peak non-home-based workforce of 3,700, taking into account job types and skill levels, from Technical Note 1. The rounded benchmark age and gender numbers are set out in **Table A9B.1** below. We believe that these provide a reasonable basis for an assessment of public services impacts relevant to these dimensions.

Table A9B.1: HPC: Age and Gender Benchmarks

Age Group	Male	%	Female	%
Under 35	1,180		130	
35-49	1,220		140	
50+	920		110	
TOTAL	3,320	90%	380	10%

Source: Quod

b) Disability

9B.2.9 There are a number of definitions of disability, which means that there is no single source of data for identifying benchmarks in the construction industry.

9B.2.10 The Labour Force Survey (now the Annual Population Survey) used the definition from the Disability Discrimination Act (Ref. 9B.7) and asked whether people have a health problem or disability that limited their day to day activities or the paid work they could do. The most recent (2004) data identifies 13.7% of the construction workforce having a disability, and 16.5% in the South West.

9B.2.11 Other sources have identified lower proportions. These include:

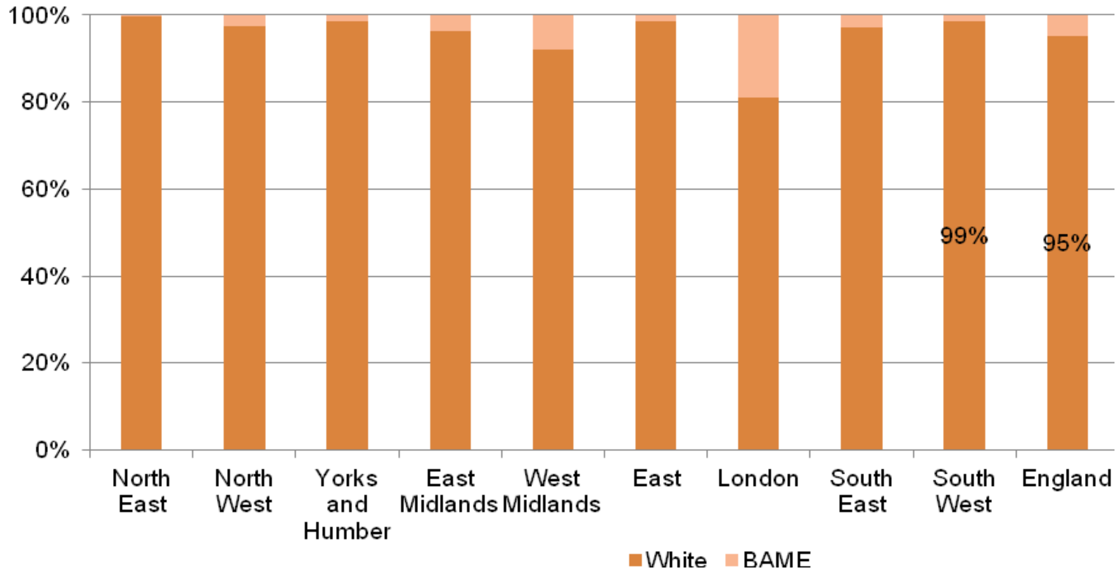
- London Development Agency/Mayor of London (2007), t*he Construction Industry in London and Diversity of Performance*. From the 2001 Census, this report identified 6.6% of employees in manual construction trades in London as people with LLTI (limiting long term illnesses). (Ref. 9B.8).
- *Construction Industry Council (2009)*, *Gathering and reviewing data on diversity within the construction professions*. This report identified a range of from 8 to 15% of the construction workforce, across UK regions, with some form of disability. (Ref. 9B.9).
- Olympics Delivery Authority (ODA) (2010), Employment and Skills Update. This bulletin identified a project target benchmark of 3% of workforce from people with disabilities, but in the published figures for September 2010 the project only achieved 1.2% despite considerable efforts to achieve the benchmark. (Ref. 9B.10).

9B.2.12 Given the diversity of definitions it would not be appropriate, on this basis, to identify a benchmark of construction workers with disabilities for HPC. EDF Energy and its contractors and sub-contractors will ensure that they meet the requirements of the Disability Discrimination Act (2004 and other dates) and the Equalities Act to ensure that disabled people are treated equally.

c) Race, Nationality and Ethnicity

9B.2.13 **Plate A9B.4**, below, shows the ethnic breakdown of the construction workforce in the UK. This shows that the workforce is 95% white in the UK as a whole, rising to 99% in the south-west. London is the only significant outlier with just under a fifth of its construction workforce being from black and minority ethnic communities.

Plate A9B.4: Ethnicity of Employed Construction Workforce 2009/10

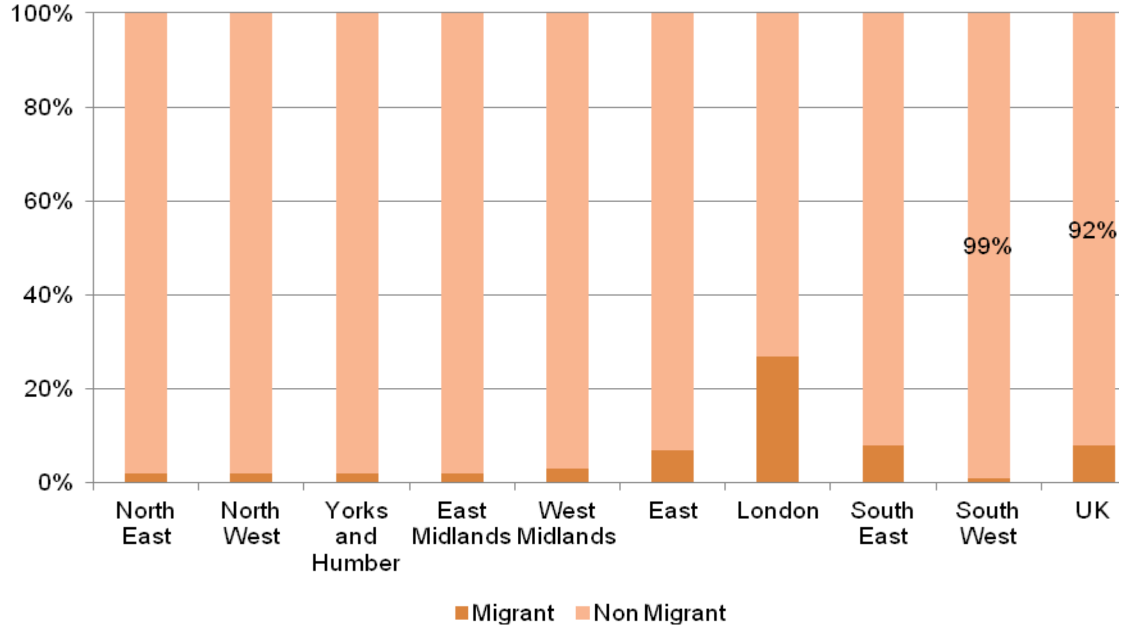


Source: Annual Population Survey 2009/10

9B.2.14 This pre-dominantly white workforce contains within it a range of nationalities. **Plate** A9B.5, below, shows the proportion of the construction workforce that was non-migrant (i.e. UK nationals) and migrant (foreign nationals) in 2008. This shows that the workforce was predominantly British nationals, standing at 92% of the overall workforce, rising to 99% in the south-west. Again, London is the main outlier with over a quarter of the construction workforce being foreign nationals. Of the “migrant” workers around two-thirds are from what is described as the A8 Accession countries, the central and eastern European countries that joined the EU in 2004.

9B.2.15 It would not be appropriate to set a benchmark for ethnicity or nationality of the HPC workforce. All workers at HPC will have a legal right to work in the UK, and all workers will be covered by UK employment law. It should be noted that construction is a “naturally itinerant industry” with workers moving to where the work is available. (Ref. 9B.11) EDF Energy is working with the Local Authorities and other agencies both to maximise jobs for Somerset residents and to ensure that arrangements are put in place to manage the impacts of the entire non-home-based workforce.

Plate A9B.5: UK Construction Workforce: Migrant/Non-Migrant (2008) (Ref. 9B.12)



Source: CSN/BRMB

d) Families

9B.2.16 It is assumed that each non-home-based construction worker taking owner occupied accommodation will be doing so because they are bringing family members to the area with them. It is estimated from previous studies of the construction of Sizewell B Power Station in the 1990s that for each construction worker with a family there will be 1.2 non-construction worker adults, and 0.85 children per family.

9B.2.17 Applying these proportions to the breakdowns in Technical Note 1, suggests there might be a total of up to 500 family-type households at HPC at peak. Further to this, it is estimated that these households would have around 300 school age children in total, around 60% (174) of primary age and 40% (124) of secondary age. In addition there would be likely to be a further 85 children of pre-school age.

9B.2.18 Given the age of this data we have sought to find appropriate comparators to test their current applicability. First, we have sought to identify the extent to which migrant workers have dependent children of school age. Data on this is available from the Worker Registration Scheme, from 2004 to 2007. This covers people from the A8 accession countries described above but, in the absence of other data, we have used this as a proxy for all non-home-based operatives including UK nationals. This shows an average for the South-West of 4.2% of workers having dependent children and 5.7% for the UK as a whole. This is in line with the operatives proportions set out in paragraph 2.18 above.

9B.2.19 We have also sought to validate the assumptions about family size and make up. To do this we have used data from the 2001 Census on “Moving Groups” i.e. those households who have moved into their home in the last year, both within the County and outside. The data allows us to isolate households by age of head of household, so we have calibrated these with the age range set out in **Table A9B.1**. This serves to exclude pensioner households, which might artificially depress the numbers of children is included in the assessment. Using this data we identify an average of 63 children per 100 households, compared to the 85 described in para 1.2.18. They were also broadly split along the same age ranges. This would again seem to suggest that the assumptions are broadly reasonable.

9B.2.20 Discussions are underway with Somerset County Council on the implications of these numbers for education provision and EDF Energy is currently awaiting updated information on schools capacity projections. The section below deals with the potential distribution of the non-home-based workforce, which will be of importance in managing impacts on education and other services.

9B.3 Spatial Distribution of the Workforce

9B.3.1 The spatial distribution of the workforce will be significant for managing the impacts of the incoming population on local areas and services.

9B.3.2 The distribution of the non-home-based workforce will be driven by a number of factors including the scale and location of purpose-built "campus" accommodation by EDF Energy, and the cost and availability of other types of accommodation including "latent", owner occupied, private rented and tourist accommodation. Detailed assumptions about this are contained in EDF Energy's draft Accommodation Strategy and its accompanying technical note. These assumptions have been fed into a Transport "Gravity Model" which then distributes the workforce across the 60 minute zone.

9B.3.3 **Table A9B.2**, below, shows how this workforce is distributed within the 60 minute commuting zone from HPC. This assumes approximately 1,000 campus places in Bridgwater and 500 on site. On this basis just under 2,000 non-home-based workers would be located in Sedgemoor and about 800 in West Somerset.

Table A9B.2: Indicative Distribution of Non-Home-Based Workforce

Area	All Accommodation Sectors
Sedgemoor	1,970
West Somerset	780
Taunton Deane	430
Mendip	75
North Somerset	455
TOTAL	3,700

Source: SBA/EDF

9B.3.4 **Figure 1.1** shows a more "fine grained" distribution of the overall workforce, home-based and non-home based. It shows, perhaps unsurprisingly, that the workforce is likely to be clustered in the main settlements of Bridgwater, Taunton, Burnham, Weston Super-Mare and Minehead.

9B.3.5 **Figure 1.2** shows only the non-home-based workforce in Owner Occupied accommodation – those most likely to have children of school age. This shows a broader distribution which, given the relatively small numbers concerned, doesn't show any major clusters in any single location. This again reflects the findings at Sizewell that families were reasonably spread across the area with noticeable impacts in only one or two locations.

9B.4 Input to Wider Work Streams

9B.4.1 The demographic assessment and benchmarks above are intended to enable EDF Energy and partners to assess potential impacts of the workforce on the local area. It should be noted that the benchmarks are for the "peak" workforce and will not reflect conditions for the full nine years of the construction project. Most of the impacts can be scaled to reflect the non-home based workforce over the construction period as shown in Technical Note 1.

9B.4.2 The information contained in this report has already been presented to the Socio-Economic Task-group, Somerset County Council Education Officers (17 February), the Emergency Services Group (23 February), the Skills Operations Group, (25 February) and Health Task Group, (3 March). It will be also be used for further assessments of impacts on relevant services including the Socio-Economic assessment for EDF's application to the Infrastructure Planning Commission.

References

9B.1 Equality Act. HMSO, 2010.

9B.2 ONS. Census 2001. (Online) Available at: www.nomisweb.co.uk (Accessed 23 August 2011).

9B.3 ONS. Annual Population Survey /Labour Force Survey. (Online) Available at: www.nomisweb.co.uk (Accessed 23 August 2011).

9B.4 Skills and Intelligence Learning Module (SLIM) at the Southwest Observatory. (Online) Available at: http://www.swslim.org.uk (Accessed 23 August 2011).

9B.5 Construction Skills Network (CSN). (Online) Available from http://www.cskills.org (Accessed 23 August 2011).

9B.6 Construction Industry Joint Council (CIJC). CIJC resolution and promulgation working rule agreement: IR.2011.20. June 2011.

9B.7 Disability Discrimination Act. HMSO, 2005.

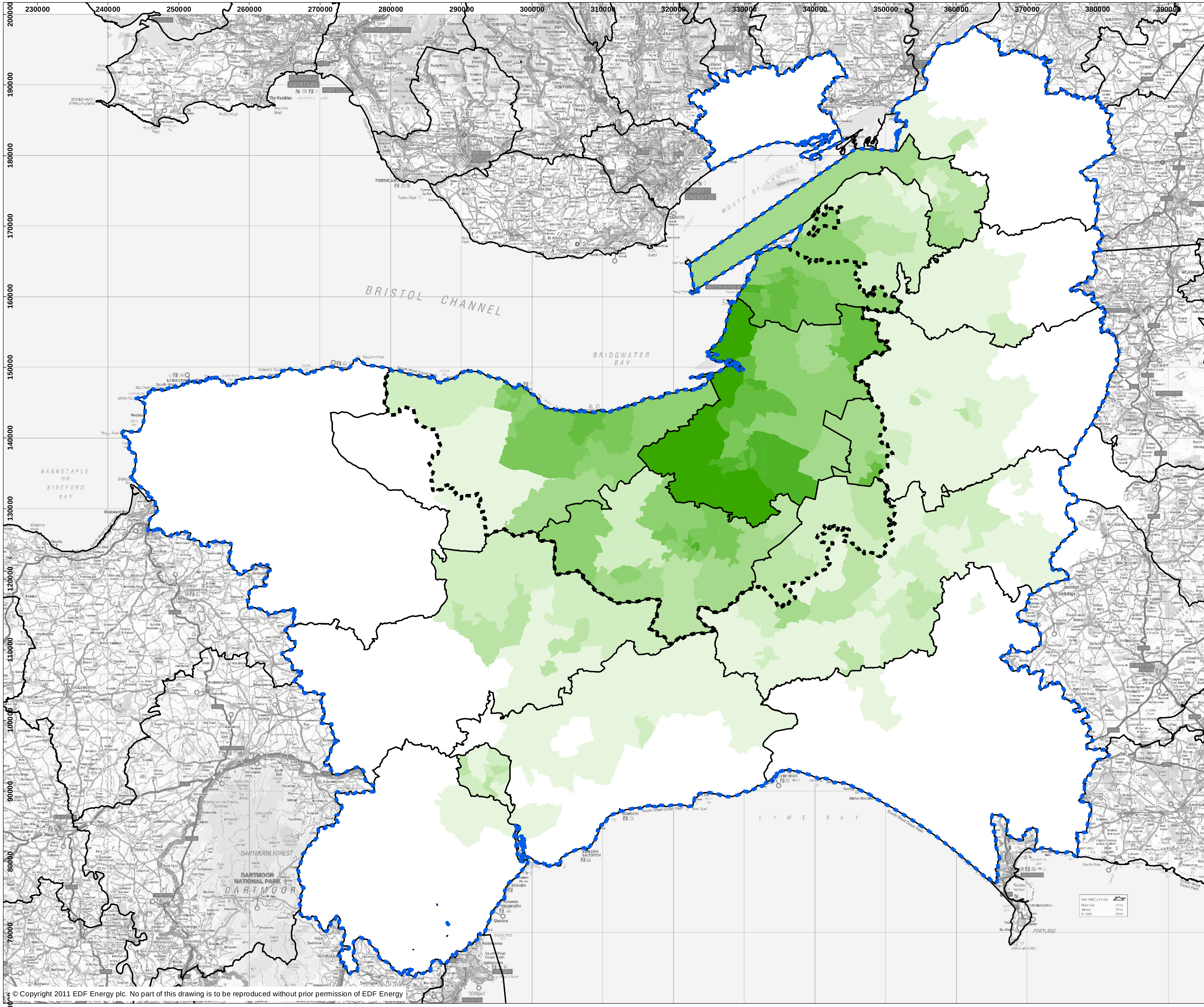
9B.8 London Development Agency/Mayor of London. The construction industry in London and diversity of performance. London: LDA, 2007.

9B.9 Construction Industry Council (CIC). Gathering and reviewing data on diversity within the construction professions. Bristol: CIC, 2009.

9B.10 Olympic Delivery Authority. Jobs, skills futures: working to deliver the Olympic park – employment and skills update. London: ODA, October 2010.

9B.11 IPPR. Building a new home, migration in the UK construction sector. IPPR: London, 2008. (Online) Available at: http://www.ippr.org/publications/55/1669/building-a-new-homemigration-in-the-uk-construction-sector?siteid=ipprnorth (Accessed 23 August 2011).

9B.12 Construction Skills Research. Sector skills assessment for the construction sector 2009: Construction skills UK report. Norfolk: CSN, 2009.



KEY

CDCZ

60-MINUTE TRAVEL ZONE

LOCAL AUTHORITIES

HB AND NHB WORKER DISTRIBUTION

TOTAL WORKERS

0 - 1
2 - 3
4 - 5
6 - 8
9 - 13
14 - 27
28 - 44
45 - 73
74 - 117
118 - 194

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9B

FIGURE TITLE:

DISTRIBUTION OF ALL HOME-BASED AND NON-HOME-BASED CONSTRUCTION WORKERS AT PEAK

FIGURE NO:		REVISION:
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SEPT 2011	M.H	1:415,946@A3

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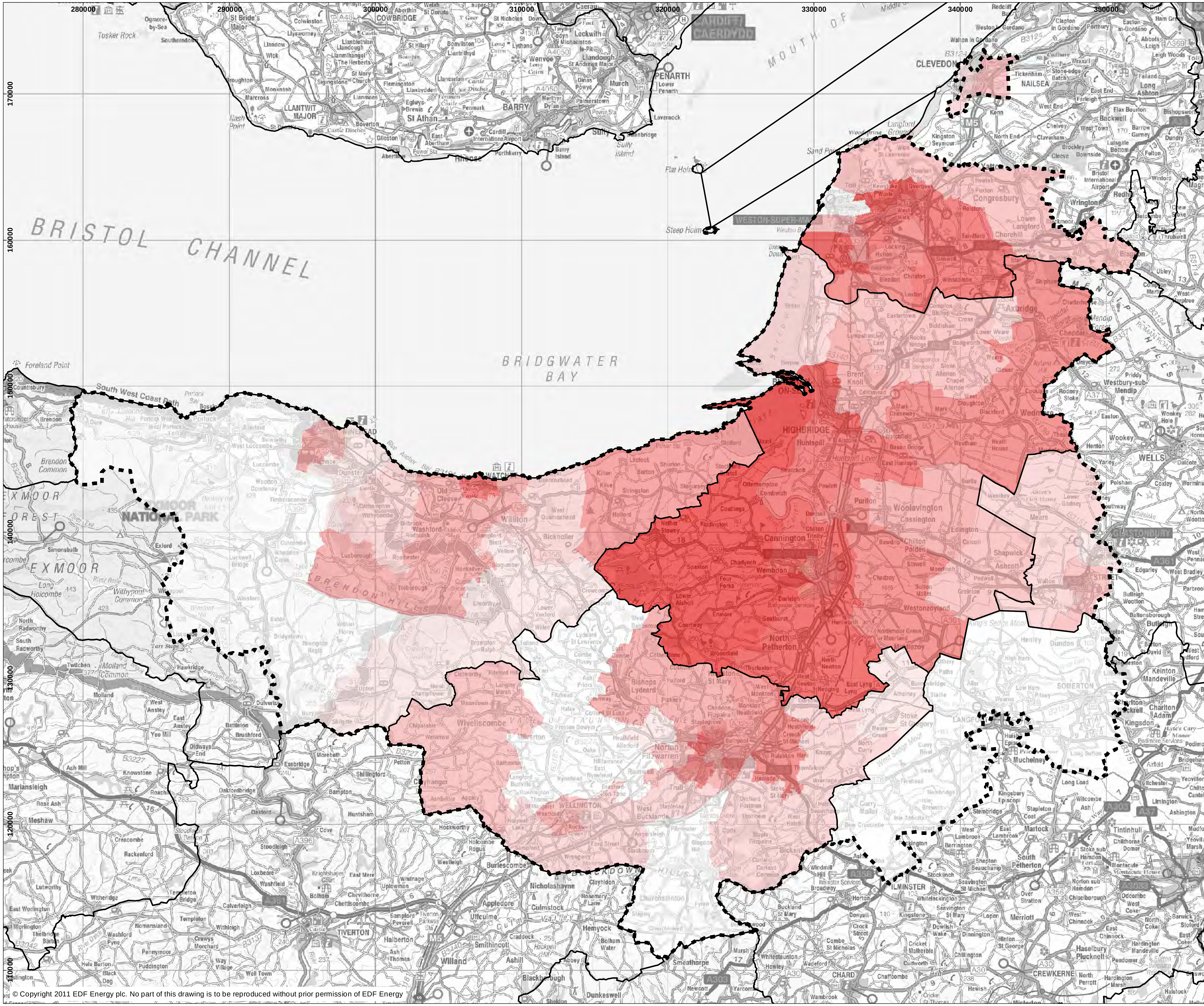

KEY

60-MINUTE TRAVEL ZONE

LOCAL AUTHORITIES

NHB WORKER DISTRIBUTION

OWNER OCCUPIED ACCOMMODATION

0

1 - 2

3

4

5

6

7

8 - 10

11 - 15

16 - 37

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9B

FIGURE TITLE:

DISTRIBUTION OF NON-HOME-BASED WORKERS IN OWNER-OCCUPIED ACCOMMODATION

FIGURE NO:		REVISION:
FIGURE 1.2		01
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APPENDIX 9C: TECHNICAL NOTE 3: SPATIAL DISTRIBUTION OF WORKERS

FOREWORD

This Technical Note:

1. Briefly describes the input datasets to the Gravity Model produced by SBA for ‘home-based’ and ‘non-home-based’ construction workers; and

2. Summarises the modelled spatial distribution of home-based and non-home-based workers, by demographic characteristics.

An accompanying technical note produced by SBA describes the technical inputs into the distribution model, including the application of a distance-decay function and travel-time data.

9C. TECHNICAL NOTE 3: SPATIAL DISTRIBUTION OF WORKERS

9C.1 Assumptions

9C.1.1 Overall, it is assumed that home-based workers will travel a maximum journey time of 90 minutes, also referred to as the CDCZ, and non-home-based workers will travel a maximum of 60-minutes journey time. This includes drive time to the closest park & ride, transfer, and bus journey to site.

9C.1.2 The Gravity Model applies a peak workforce of 5,600 construction employees to the CDCZ, of whom 34% (1,904) would be home-based and 66% (3,696) non-home-based. (Ref. 9C.1)

9C.1.3 Non-home-based workers are assumed to split between the following types of accommodation in the 60-minute area:

Table A9C.1: Accommodation for Non-Home-Based Workers in the 60-Minute Area

Type of Accommodation	Percentage of Workers	Number of Workers
Campus	39%	1,450*
Tourist Accommodation	16%	596
Private Rented	20%	750
Owner Occupied	14%	500
Latent Accommodation	11%	400
Total non-home-based	66%	3,696

** 97% Occupancy*   *Source: HPC Gravity Model*

9C.2 Input Datasets

a) Tourist Accommodation:

9C.2.1 The amount of available tourist accommodation was provided by SWT from their database (Nov 2008).

b) Private Rented Accommodation:

9C.2.2 To provide a distribution of those workers living within private rented accommodation, the number of dwellings within each 2003 CAS ward at the time of the 2001 Census was extracted, and the percentage within the private rented sector identified. This was scaled up based on recent estimates of PRS sector at district-level taken from Strategic Housing Market Assessments undertaken between 2006-8 for relevant districts.

9C.2.3 The SHMA is considered to be the most up to date information on the housing market across the area and reflects the information the local authorities return to central Government for the Housing Strategy Statistical Appendix (HSSA).

c) Owner-Occupied Accommodation

9C.2.4 The Gravity Model is based on the total number of family sized owner-occupied units (defined as houses with three or more bedrooms) in each ward within the 60-minute travel time catchment. This is based on Census data.

d) Latent Accommodation

9C.2.5 In addition to the existing accommodation that is currently accounted for in the gravity model, the refined gravity model now considers latent accommodation. This is additional accommodation that has been offered to EDF Energy in response to adverts placed in November 2009 and again in the Spring of 2011. In addition to private rented properties, this provided a source of ‘latent’ accommodation, i.e. property which had not previously been offered for rent and primarily comprising rooms within people’s houses. As a consequence of these advertisements and ongoing calls to EDF Energy, over 1,500 bedspaces in private accommodation have been registered to date of which over 400 are rooms within people’s houses.

9C.2.6 The responses of the latent accommodation surveys have been used to provide a spatial distribution of this accommodation within the catchment area.

9C.3 Distribution of Home-Based Construction Workers

9C.3.1 Around 34% of peak construction employees are expected to be home-based, living within the 90-minute travel-time CDCZ. The distribution across wards is based on factors including travel-time from the ward to the site, Standard Occupational Classification (SOC) level of the population, and the proportion of 16-74 year olds in work.

9C.3.2 The ward-based distribution of home-based workers across the CDCZ is outlined in **Figure 1.1**.

9C.4 Distribution of Non-Home-Based Construction Workers

9C.4.1 The distribution of construction workers has been assessed on a ward-level basis for the wards within a 60-minute travel distance from the site. The distribution is based on a number of factors relevant to the type of accommodation construction workers would be expected to live in, for example:

- The total number of family-sized owner-occupied units in each ward;
- The total number and estimated vacancy of PRS units in each ward; and
- The total number and occupancy level of tourist bedspaces in each ward.

9C.4.2 **Figure 1.2** shows overall distribution of non-home-based workers in the 60-minute area (with the exception of campus-based workers), 9C.4.3 In order to assess the spatial distribution of non-home-based construction workers by demographic characteristics, it has been considered sensible to split the area into a number of 'ward clusters' as shown on **Figure 1.3**.

9C.4.4 The following table identifies the location of these non-home-based construction workers by 'ward cluster' with accommodation campuses:

Table A9C.2: Non-Home-Based Workers by Ward Cluster

	Accommodation					
Ward Cluster	Non-Home-Based Latent	Non-Home-Based Tourist	Non-Home-Based PRS	Non-Home-Based OO	Campus	Non-Home-Based Total
Bridgwater	137	67	110	108	970	1,392
Burnham and Highbridge	39	201	64	74	-	378
Cannington	31	28	24	37	-	120
Cheddar	7	40	11	12	-	70
Glastonbury	0	40	22	19	-	81
Hinkley Point	0	2	8	6	480	496
Minehead	24	49	28	17	-	119
Somerset South	0	8	29	19	-	55
Somerset West	2	6	7	4	-	19
Taunton	117	28	134	83	-	362
Watchet and Williton	41	59	27	24	-	150
Weston-super-Mare	1	69	286	98	-	454
TOTAL	400	596	750	500	1,450	3,696

Source: Quod

a) Demographic Distribution

9C.4.5 EDF Energy has been working with the Councils to agree the evidence base for assessing the likely impacts of the HPC scheme. This has involved the production of a series of Technical Notes. **Technical Note 1** (which has been signed off by the Councils) sets out the overall workforce profile and **Technical Note 2** (which is being reviewed by the Councils) sets out the demographic breakdown of the workforce.

i. Families

9C.4.6 A notional additional population assumption has been made on the location and demographic make-up of families accompanying non-home-based workers.

9C.4.7 Around 500 non-home-based workers will live in family-type households, i.e. with one or more dependents (although not necessarily children). In order to assess the spatial distribution, it has been estimated that each family contains one construction worker, 1.2 non-construction-worker adults and 0.85 children (the age of children has been determined based on the methodology outlined **in Technical Note 2, Section 1.2 - d)**. This is an estimate for peak employment.

Table A9C.3: Non-Home-Based Peak Employment Population Projections, in Owner Occupation by Location

	Owner Occupied	Children		
	Families	Pre-School	Primary	Secondary
Bridgwater	108	18	37	27
Burnham and Highbridge	74	13	26	18
Cannington	37	6	13	9
Cheddar	12	2	4	3
Glastonbury	19	3	6	5
Hinkley Point	6	1	2	2
Minehead	17	3	6	4
Somerset South	19	3	6	5
Somerset West	4	1	2	1
Taunton	83	14	29	21
Watchet and Williton	24	4	8	6
Weston-super-Mare	98	17	34	24
TOTAL	500	85	174	124

Source: Quod

ii. Age and Gender

9C.4.8 While women make up the majority of the workforce in Administrative and Secretarial Occupations (of which there will be a number at HPC (see Technical Note1), and between 10 and 20% of professional and managerial positions, the on-site operative occupations (skilled trades, elementary and operatives) are male dominated. As these dominate the sector as a whole, just fewer than 9 out of 10 workers in the construction sector are men.

9C.4.9 The recent Gibson Report, reviewing productivity and skills in the UK Engineering Construction Industry (Ref. 9C.2) notes the predominantly male workforce, and the ageing of the UK engineering construction workforce - with about 65% of the current workforce over the age of 40. This covers the more skilled roles involved in designing, engineering, constructing and maintaining process plant.

9C.4.10 The 2001 Census gives a comprehensive overview of the age and gender structure of the UK construction industry. (Ref. 9C.3) **Figure 1.1** in **Technical Note 2** shows the split between age ranges and males and females. It demonstrates that the construction workforce is overwhelmingly male and in the 20 to 49 age range.

9C.4.11 The largest age group in the construction industry are males in their 30s, who make up 25% of the of all construction workers. The next largest group is males in their 40s, at 21%, followed by those over 50 and under 30 who make up around 19% of the industry each. Overall, females make up 10% of the industry and they are fairly evenly distributed amongst the age groups.

9C.4.12 The peak non-home-based workforce has therefore been split accordingly by age and gender. The following table summarises the spatial distribution of construction workers (and partners in the case of those in owner-occupied units) by gender and age:

Table A9C.4: Non-Home-Based Workforce, and Families (in Owner Occupation) by Age and Location

		Male			Female		
	Dependent Children	Under 35	35-49	50+	Under 35	35-49	50+
Bridgwater	82	**449**	**464**	**350**	**81**	**87**	**68**
Burnham and Highbridge	56	**123**	**128**	**96**	**36**	**38**	**30**
Cannington	28	**40**	**41**	**31**	**15**	**17**	**13**
Cheddar	9	**23**	**24**	**18**	**6**	**7**	**5**
Glastonbury	14	**26**	**27**	**21**	**8**	**9**	**7**
Hinkley Point	5	**5**	**6**	**4**	**2**	**3**	**2**
Minehead	13	**192**	**199**	**150**	**26**	**28**	**22**
Somerset South	14	**18**	**19**	**14**	**8**	**8**	**6**
Somerset West	3	**6**	**7**	**5**	**2**	**2**	**2**
Taunton	64	**119**	**123**	**93**	**38**	**41**	**32**
Watchet and Williton	18	**49**	**50**	**38**	**12**	**13**	**11**
Weston-super-Mare	75	**149**	**154**	**116**	**46**	**49**	**39**
TOTAL	383	**736**	**761**	**574**	**231**	**249**	**195**

Source: Quod

9C.5 District-Level Assumptions by Tenure

9C.5.1 The following table outlines, by local authority, the anticipated distribution of non-home-based workers by accommodation type in the 60-minute travel area.

Table A9C.5: Non-Home-Based Workers by LA and Accommodation Type (Not including Campus)

	Accommodation				
Local Authority	Total	Latent	Tourist	Private Rented	Owner Occupied
West Somerset	**292**	**65**	**115**	**64**	**48**
Sedgemoor	**996**	**214**	**336**	**212**	**234**
Taunton Deane	**430**	**119**	**37**	**168**	**105**
North	**454**	**1**	**69**	**286**	**98**

	Accommodation				
Local Authority	Total	Latent	Tourist	Private Rented	Owner Occupied
Somerset					
Mendip	**74**	**0**	**40**	**19**	**15**
TOTAL	**2,246**	**400**	**596**	**750**	**500**

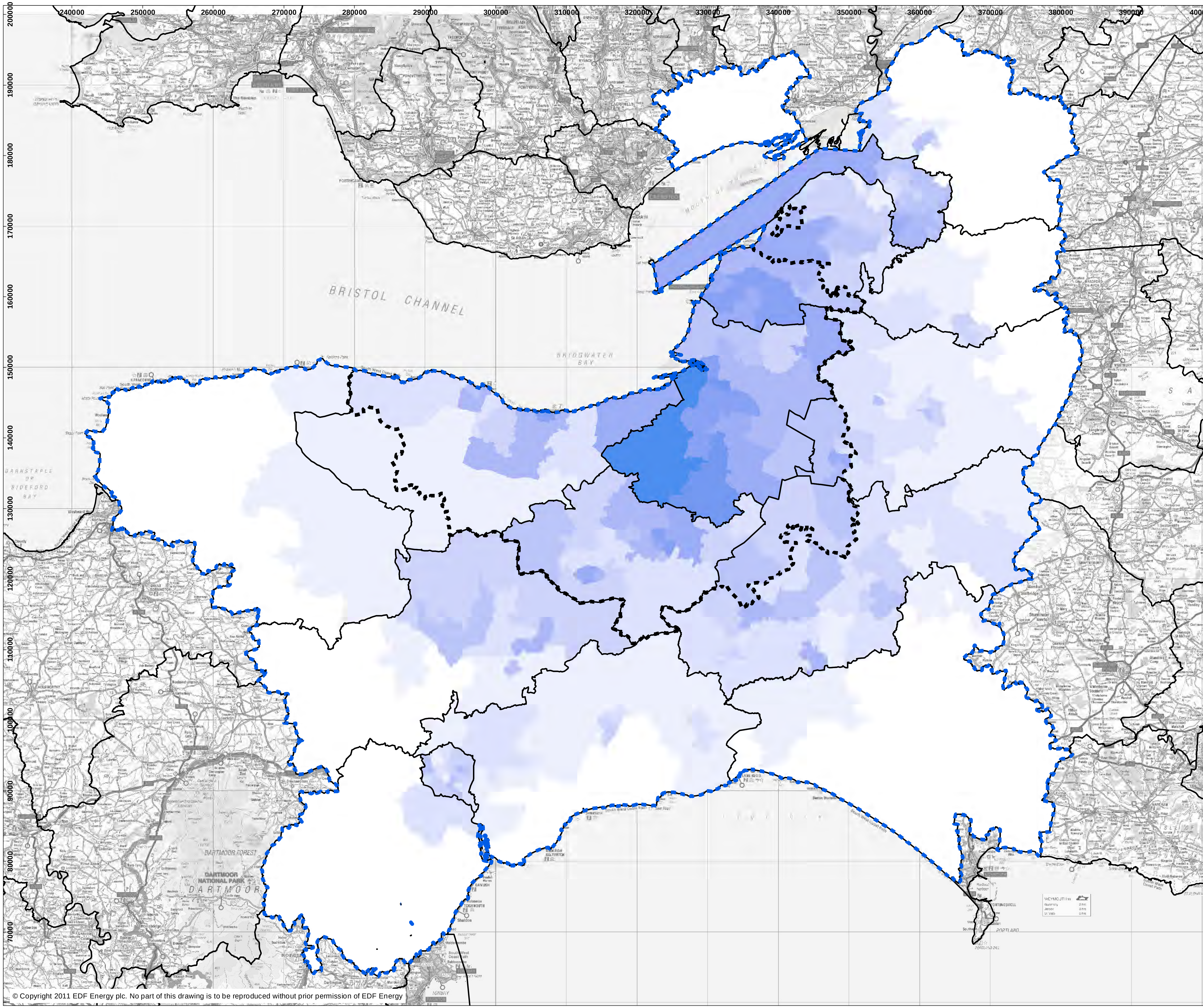
Source: Quod

References

9C.1 Savill Bird and Axon (SBA). Hinkley Point C gravity model datasets technical Note. Submitted to Somerset County Council, 14th December 2010.

9C.2 The Whitehall & Industry Group and M. Gibson. Changing to compete: review of productivity skills in the UK: engineering construction BIS: London, 2009.

9C.3 ONS. Census 2001. (Online) Available from www.ons.gov.uk (Accessed 23 August 2011).



KEY

- CDCZ
- 60-MINUTE TRAVEL ZONE
- LOCAL AUTHORITIES

CONSTRUCTION WORKER DISTRIBUTION

HOME-BASED

- 0 - 1
- 2
- 3
- 4 - 5
- 6 - 7
- 8 - 9
- 10 - 16
- 17 - 27
- 28 - 46
- 47 - 74

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9C

FIGURE TITLE:

DISTRIBUTION OF ALL HOME-BASED AND NON-HOME-BASED CONSTRUCTION WORKERS AT PEAK

FIGURE NO:		REVISION:
FIGURE 1.1		01
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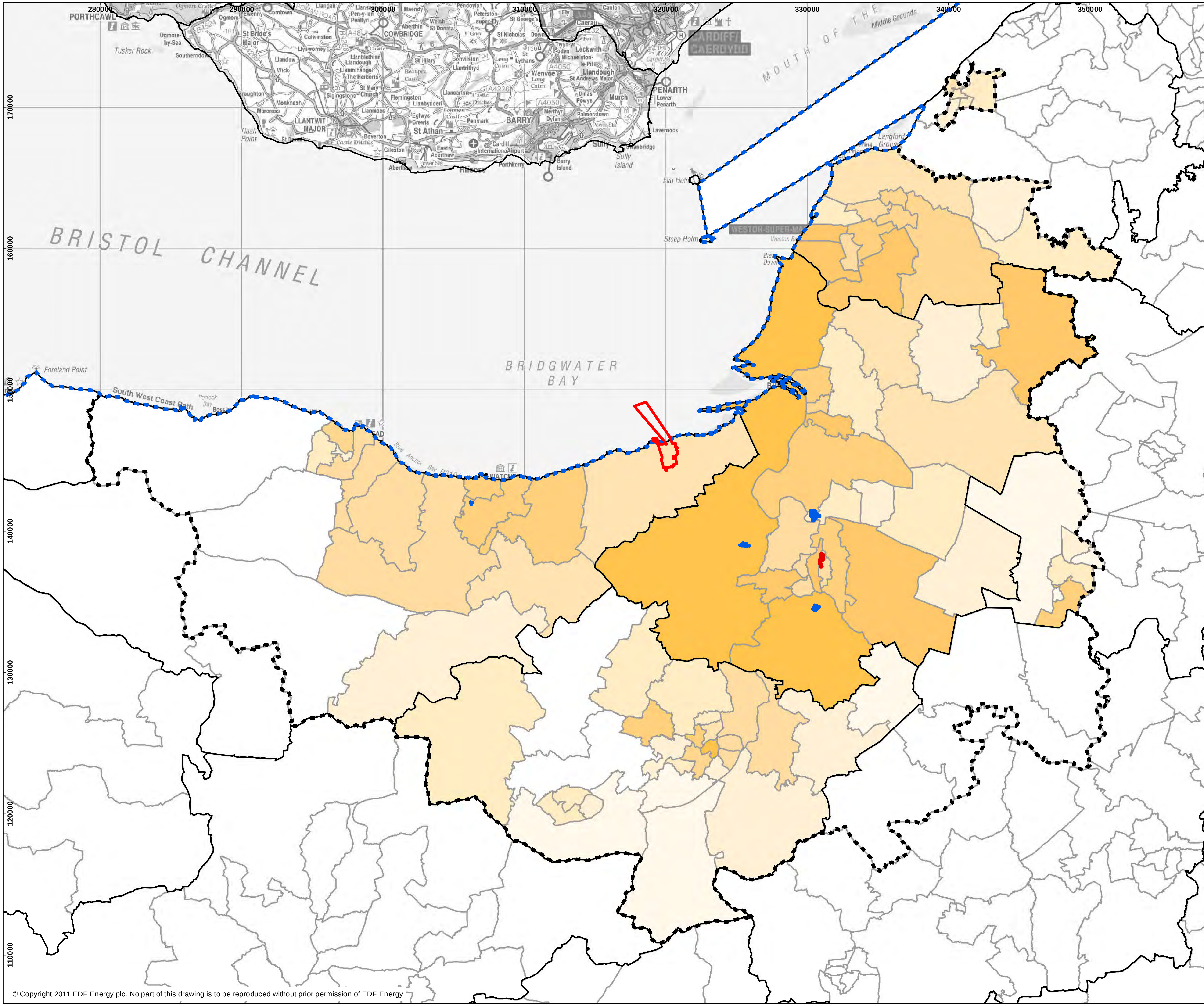

KEY

- HINKLEY POINT C DEVELOPMENT SITE
- CDCZ
- ACCOMMODATION CAMPUS
- PARK AND RIDE
- 60-MINUTE TRAVEL ZONE
- LOCAL AUTHORITIES

CONSTRUCTION WORKER DISTRIBUTION NON-HOME-BASED

- 0 - 1
- 2 - 5
- 6 - 9
- 10 - 13
- 14 - 18
- 19 - 24
- 25 - 32
- 33 - 43
- 44 - 75
- 76 - 143

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9C

FIGURE TITLE:
DISTRIBUTION OF NON-HOME-BASED CONSTRUCTION WORKERS AT PEAK

FIGURE NO:		REVISION:
FIGURE 1.2		01
DATE: SEPT 2011	DRAWN: M.H	SCALE: 1:250,000@A3

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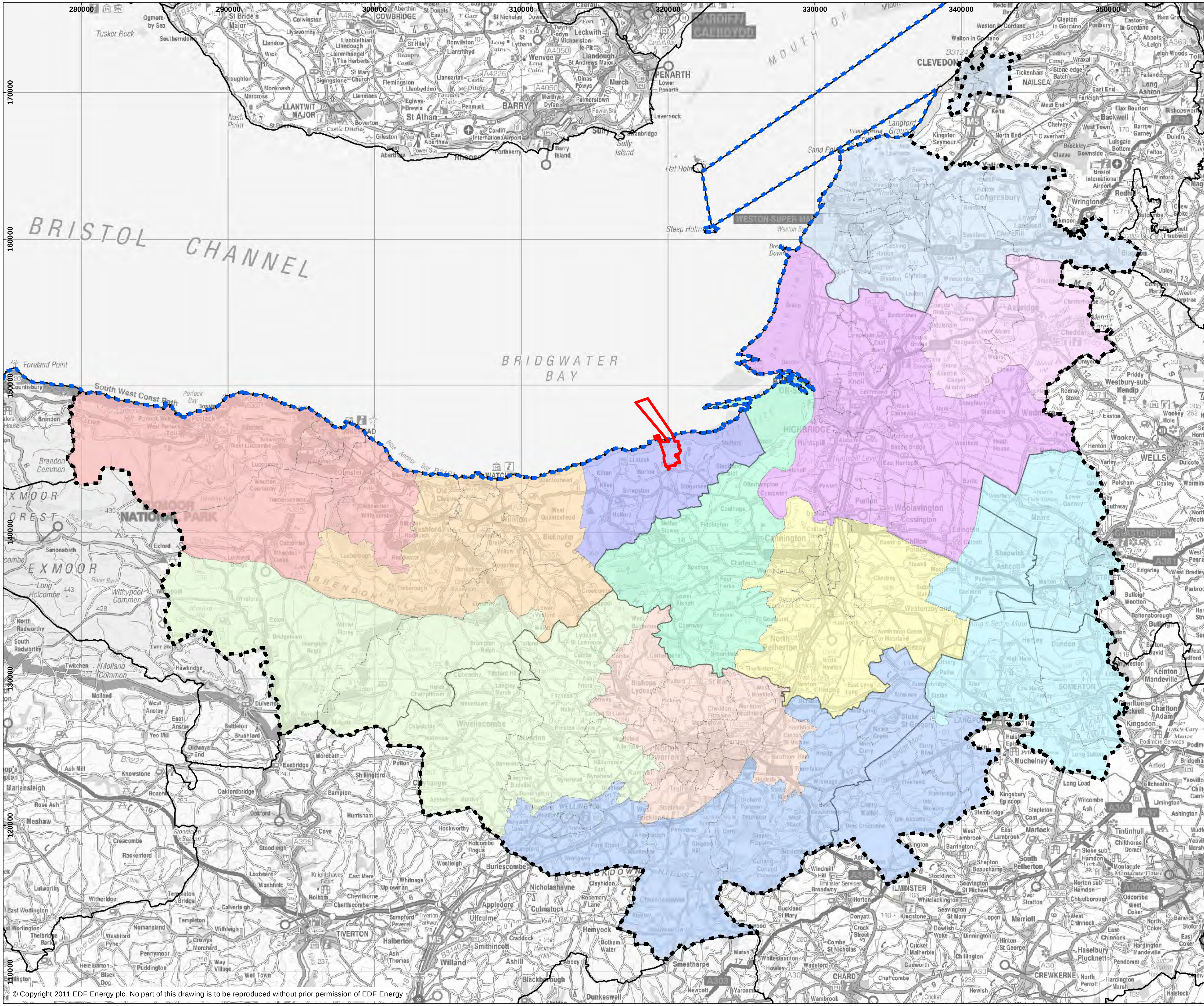


KEY

- HINKLEY POINT C DEVELOPMENT SITE
- CDCZ
- 60-MINUTE TRAVEL ZONE

DISTRIBUTION OF NHB WORKERS
JUNE 2011 GRAVITY MODEL

- BRIDGWATER
- BURNHAM AND HIGHBRIDGE
- CANNINGTON
- CHEDDAR AND CLEVEDON
- GLASTONBURY
- HINKLEY POINT
- MINEHEAD
- SOMERSET SOUTH
- SOMERSET WEST
- TAUNTON
- WATCHET AND WILLITON
- WESTON-SUPER-MARE
- LOCAL AUTHORITIES

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9C

FIGURE TITLE:
WARD CLUSTERS FOR SOCIO-ECONOMIC BASELINE (NON-HOME-BASED CONSTRUCTION WORKERS)

FIGURE NO:		REVISION:
FIGURE 1.3		01
DATE: SEPT 2011	DRAWN: M.H	SCALE: 1:241,000@A3

SCALE BAR:
0 3 6 9Kilometres

APPENDIX 9D: SOCIO-ECONOMIC TECHNICAL NOTE 4: ACCOMMODATION DATASETS

FOREWORD

This Technical Note:

1. Briefly describes the Gravity Model Approach to distribution of non-home-based workers; and

2. Summarises the approach taken to accommodation datasets, identifying across sectors the location of stock, capacity and vacancy estimates.

An accompanying technical note produced by SBA describes the technical inputs into the distribution model, including the application of a distance-decay function and travel-time data, and describes how the Gravity Model ascribes non-home-based workers to different sectors.

9D. APPENDIX 9D: SOCIO-ECONOMIC TECHNICAL NOTE 4: ACCOMMODATION DATASETS

9D.1 Introduction

9D.1.1 This Technical Note outlines the initial data and processes used to define the accommodation baseline for the socio-economic assessment, and should be read in conjunction with the Accommodation strategy. It highlights the approach to estimating current levels of stock, vacancy rates and occupancy across private rented, tourist, owner-occupied and latent sectors, and how these are applied to the spatial distribution of workers via the Gravity Model to underpin accommodation assumptions.

9D.2 Estimated Accommodation Locations

9D.2.1 The precise location that workers choose to live will be dependent on a number of factors, including their duration of stay, the price of accommodation, access to their permanent homes, proximity to park and ride facilities and the HPC site (via direct buses), and access to amenities such as sport and leisure, and, in the case of families, schools.

9D.2.2 EDF Energy has developed a Gravity Model to estimate the locations of HPC workers – both home-based and non-home-based (Ref. 9D.1). Based on typical travel times for construction workers in the South West, this assumes that people already living in the local area will be willing to travel up to 90 minutes each way in order to work at HPC. Where workers are moving to the local area in order to work on the project, it is assumed that they will want to move closer to the site. Therefore a 60 minute zone has been used to assess the availability of local accommodation. These travel times assume workers are travelling either via the park and ride sites or using direct bus services.

9D.2.3 **Figure 1.1** shows the limit of the 60 minute zone, adjusted slightly to fit electoral ward boundaries. It covers all of the Districts of Sedgemoor and Taunton Deane, most of West Somerset, and parts of North Somerset, Mendip and South Somerset.

9D.2.4 For non-home-based workers, the model has two elements – a weighting based on the amount of accommodation in the area and one based on the distance from the site. The more accommodation there is in an area the more workers are assumed to live there and the shorter the time to the site, the more workers are assumed to work there. This means workers are estimated to cluster in more urban area (where there is more accommodation), especially those with quicker access to the sites. As a result, relatively few workers will be located towards the extremities of the 60 minute zone, especially those which are rural areas with relatively little accommodation.

9D.2.5 A full explanation of the model is set out in **Chapter 10** of the **Transport Assessment**.

9D.2.6 The local authorities have agreed that the Gravity Model is an acceptable method of estimating the spatial distribution of workers, although they have expressed concern that 60 minutes is too long for people to travel on a daily basis and suggested that a 45 minute travel time should be used as a sensitivity test. The effect of this would be to reduce the area over which workers are dispersed from the site and the park and rides.

9D.2.7 The 60 minute zone is more appropriate, for three reasons:

- Construction workers will travel up to 90 minutes for work – the 60 minute assumption therefore already reflects the fact that non-home-based workers will choose to live closer to the site.
- The Gravity Model is already weighted so that areas close to the 60 minute limit are assumed to house relatively few workers.
- There is little difference between the catchment for a 45 minute journey via bus direct to the site and that for a 60 minute catchment via the park and ride sites.

9D.2.8 The central assessment case is therefore based on the 60 minute catchment. This Accommodation Strategy is based on that central assessment case.

9D.2.9 The Environmental Statement sets out sensitivity tests based on higher overall numbers in given locations, and the ability of different types of accommodation to meet the needs of those higher numbers.

9D.2.10 EDF Energy's socio-economic consultants have examined in detail the scope for existing accommodation in Somerset to meet the additional demand created by the project. This has involved careful consideration of the potential scale of accommodation available in four sectors:

- tourist accommodation.
- Private Rented Sector (PRS).
- Owner Occupied Sector (OOS).
- latent accommodation – i.e. accommodation that is either new or not currently counted within the PRS and tourist databases and could, for instance, include renting out a spare room.

9D.2.11 The following main data sources have been used for this analysis:

- Tourist: South West Tourist Board's Accommodation Database and a survey undertaken by Arup on behalf of the local authorities.
- Private rented: Census (for ward level data), estate agents, and local authority data including the Strategic Housing Market Assessment and Housing Strategy Statistical Appendix (HSSA) returns.
- Owner occupied: Census (for ward level data), and local authority data including the Strategic Housing Market Assessment and HSSA returns.
- Latent: EDF Energy's office in Bridgwater has created a database that captures responses from local people and businesses wanting to supply accommodation to HPC workers. This was informed, in part, by two newspaper surveys asking local

people to contact EDF Energy if they had accommodation they would like to make available to EDF Energy's workforce.

9D.2.12 The remainder of this section sets out how much accommodation of each type is expected to be available across the 60 minute zone.

9D.2.13 The following sections outline, for each accommodation sector, the approach taken to estimate the quantity and location of bedspaces, seasonal availability, and estimated vacancy levels.

9D.3 Tourist Accommodation

9D.3.1 There is a substantial local supply of tourist accommodation in the Somerset area. **Table A9D.1** provides information on supply in the six districts in the wards that are wholly or partly within the 60 minute zone, taken from data supplied on a ward-level basis by the South West Tourist Board (2009 survey).

Table A9D.1: Tourist Accommodation in wards within the 60-minute Zone that are in Sedgemoor, Taunton Deane, West Somerset, North Somerset Mendip and South Somerset

	West Somerset	Taunton Deane	Sedgemoor	North Somerset	Mendip	South Somerset	TOTAL
Serviced	1,507	2,203	1,757	2,533	532	125	8,657
Self-Catering	1,228	550	516	434	18	72	2,818
Caravan/ Camping	4,116	734	15,321	1,919	0	174	22,264
Campus/hostel	284	0	67	0	1,097	0	1,448
Total	7,135	3,487	17,661	4,886	1,647	371	35,187

Source: SWTB Database

9D.3.2 There are approximately 35,000 tourist bed spaces within the 60 minute zone. However, this includes 14,600 in holiday villages which HPC workers are unlikely to be able to use. This is an underestimate of the total tourist accommodation in the area because it only includes accredited or "rated" accommodation. There are many businesses that are not rated and therefore do not appear on the SWTB database.

9D.3.3 In assessing the potential availability of tourist accommodation for EDF Energy's workforce, a conservative estimate has been made, based on the peak levels of tourist demand in August. **Table A9D.2** shows the SWTB's estimates of occupancy throughout the year of each type of accommodation likely to be available and used by HPC workers. (Ref. 9D.2).

Table A9D.2: Tourist Accommodation Occupancy Rates in Somerset (2009)

Somerset	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Self-Catering	33%	43%	44%	70%	72%	84%	80%	94%	77%	52%	29%	35%
Camping and Caravan Pitches	5%	4%	15%	19%	63%	64%	59%	81%	45%	22%	21%	27%
Serviced Rooms	35%	47%	54%	60%	67%	67%	74%	76%	73%	64%	55%	50%

Source: SWTB Accommodation Report March 2010

9D.3.4 Average occupancy levels for this accommodation outside of peak holiday periods are typically much lower. **Table A9D.3** shows a comparison of March and August. This shows that there are 24,500 vacant bedspaces in March and 6,500 in August.

Table A9D.3: Comparison Between Tourist Accommodation Vacancy Rates in March and August in Somerset (2009) in the 60-minute Zone

Type	Total	% Vacant in March	No. Vacant in March	% Vacant in August	No. Vacant in August
Serviced	8,748	46%	4,024	24%	2,100
Self-catering	2,873	56%	1,609	6%	172
Caravan/Camping	22,264	85%	18,924	19%	4,230
			24,557		6,502

Source: SWTB Accommodation Report March 2010

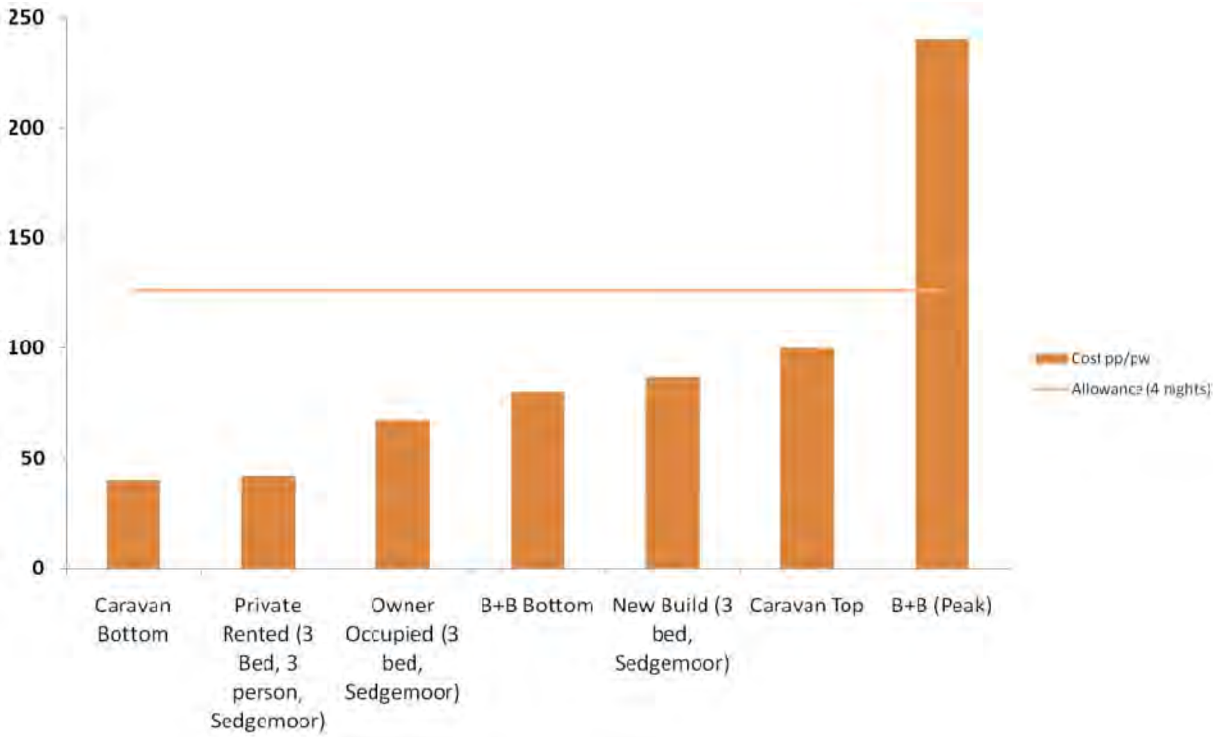
9D.3.5 There is therefore a large pool of tourist accommodation that could potentially be utilised by the construction workforce particularly in off-peak periods. Use of some of this accommodation during off-peak periods would clearly offer economic benefits to tourist accommodation providers and other related local businesses.

9D.3.6 However, it is recognised that not all of this accommodation is suitable for workers. Some rooms will be double or family rooms which workers are unlikely to want to share or be willing to pay a premium for larger accommodation.

9D.3.7 There are also planning restrictions on the use of camping and caravan sites. These include restrictions on the use of sites during winter months, limits on the length of time a person can occupy a site for and restrictions on non-tourist use. This will reduce the available supply to HPC workers below the figure above (and also limit demand to those who want only short-stay accommodation).

9D.3.8 In addition, some accommodation will not be affordable to workers **Plate A9D.1** shows the average costs per week of different forms of accommodation. The horizontal line shows the union-agreed accommodation allowance paid to construction workers (assuming they stay an average of four nights per week, i.e. work five days in every seven). (N.B. Actual pay scales have not been determined, but the chart uses the union-agreed accommodation allowance as a benchmark).

Plate A9D.1: Average Accommodation Costs



Source: Arup; SHMA (Ref. 9D.3); Dataspring (Ref. 9D.4); *EDF Energy*

9D.3.9 This shows that a significant proportion of serviced tourist accommodation will not be affordable to HPC construction workers. However, caravans and the bottom end of the bed and breakfast market will be accessible in price terms.

9D.3.10 To account for the fact that not all accommodation will be suitable or affordable, discounts have been applied to availability.

- Only 40% of serviced accommodation is suitable and affordable.
- Only 25% of camping and caravan sites can be used.

9D.3.11 That leaves an estimate of 2,070 spare bedspaces in August, as shown in **Table** A9D.4.

Table A9D.4: Estimated Supply of Tourist Accommodation

Type	August Vacant & Affordable
Serviced	840
Self-catering	172
Caravan/Camping	1,058
TOTAL	2,070

9D.3.12 In practice, the risk of adverse effects on the tourism sector will also be further reduced by the seasonal pricing operating within tourist markets. Providers tend to put their prices up quite significantly over the peak holiday periods, such that it would not be affordable for the vast majority of Hinkley Point C workers. This is likely to act to significantly reduce the take up by the HPC construction workforce of tourist accommodation during peak periods – for example the average price of a hotel or bed & breakfast accommodation in Somerset in August is substantially above the normal union-agreed accommodation allowance for the majority of the construction workforce. Therefore, the normal operation of market mechanisms would be likely to encourage the use of tourist accommodation mainly during the cheaper non-peak periods when there is significant spare capacity and when the tourism industry stands to benefit from the additional demand generated by the construction workforce.

9D.4 Private Rented Accommodation

9D.4.1 There is a substantial quantity of PRS housing within the 60 minute zone. **Table** A9D.5 shows the number of PRS units at the time of the 2001 Census (Ref. 9D.5) and in 2008 when a Housing Needs Survey was undertaken as part of the local authorities' Strategic Housing Market Assessment. (Ref. 9D.6).

Table A9D.5: Private Rented Accommodation in the wards within the 60-minute zone

District	PRS Units 2001	PRS Units 2008
Sedgemoor	3,199	4,689
Taunton Dean	3,598	5,522
West Somerset	1,347	1,870
South Somerset	335	518
North Somerset	6,457	8,069
Mendip	1,002	1,151
TOTAL	15,958	21,819

9D.4.2 In total it can be seen that there are around 21,800 PRS units in the 60 minute zone. It should be noted that these are PRS units rather than bed spaces. The vast majority of units have more than one bedspace. Data has been collected by SBA that identifies an average of 2.29 bedspaces per PRS unit in Sedgemoor, 2.49 in Taunton Deane, 2.30 in West Somerset, and an average of 2.26 per unit in other local authorities with wards in the 60-minute zone (Based on analysis of 2001 Census). This produces a total of 50,796 bedspaces across the 60 minute travel zone.

9D.4.3 The overall vacancy rate for dwellings in West Somerset, Sedgemoor and Taunton Deane were set out in the Strategic Housing Market Assessment (SHMA) at 3.5%, 4.2% and 3.3% respectively (similar data are not available for the other Districts). However, there is significant difference in vacancy between tenures. The results from the Department for Communities and Local Government's 2008 English Housing Survey (EHS) (Ref. 9D.7) show national average vacancy rates by tenure of housing (where the tenure assigned to vacant properties relates to the previous occupancy), as follows:

- owner-occupied: 2.7% of properties vacant;
- social rented: 4.6% of properties vacant; and
- private rented: 13.3% of properties vacant.

9D.4.4 These vacancy levels exist even when there is significant housing need and when local authorities have housing waiting lists. The existence of need in one part of the market does not demonstrate that there is a shortage of housing overall, or that there is no additional capacity that could be used in some sectors.

9D.4.5 It is also important to note the degree of annual turnover (or 'churn') in the property market. The greater the rate or percentage, the more dynamic the market. There is no comprehensive data on levels of turnover within the local housing stock; however evidence from the Strategic Housing Market Assessment and the Census indicates the following annual turnover (churn) rates in the PRS for which data are included:

- West Somerset:13%;
- Sedgemoor: 20%; and
- Taunton Deane: 24%.

9D.4.6 An indication of the likely degree of turnover can also be obtained from national survey-based evidence. The EHS provides data on the proportion of households living in their current home for less than a year. This provides an indication of typical annual turnover in the housing stock, and illustrates for example the very high churn in the private rented market. The latest results for 2008 are as follows:

- owner-occupied: 4% of households have moved within the last 12 months;
- social rented: 8% of households have moved within the last 12 months; and
- private rented: 36% of households have moved within the last 12 months.

9D.4.7 In order to assess spare capacity in the private rented sector, capacity has been broken down into two components. First, to operate effectively housing markets need a small level of capacity to allow for people in the process of moving, or the process of letting homes. This is called "frictional" capacity. Capacity on top of that can be described as additional or spare capacity and it is this capacity that has been assumed would be available to HPC workers.

9D.4.8 There is no single data source which provides this capacity at the local level so we have used a combination of national and local datasets to identify some parameters.

9D.4.9 Using the English Housing Survey data some parameters can be established. The annual churn rate of 36% equates to an average of 3% of all properties turning over in each month. This would be the absolute minimum vacancy required for the market to function[1]. Using the same dataset, the vacancy rate at a given point in time is 13%, which suggests a maximum spare capacity of up to 10%.

9D.4.10 Using more local data, annual turnover is highest in Taunton Deane at 24%, which means 2% of all stock turns over each month. This sets the minimum benchmark for spare capacity required for the market to function. The local vacancy rate in the PRS is not known, however if it is similar to the national rate this suggests capacity up to a maximum of 11%.

9D.4.11 **Table A9D.6** shows how many bedspaces would be available under different depending upon assumptions made about spare capacity at any given point in time (2.5%-10%). It shows that even with the most cautious assumptions the 900

[1] In practice a slightly higher level would be required to allow some degree of choice.

bedspaces we estimate HPC workers will demand would be available in the PRS and in practice this figure is likely to be significantly higher.

Table A9D.6: Available Bedspaces in Private Rental Sector

District	PRS Bedspaces 2008	2.5% Spare Capacity	5.0% Spare Capacity	7.5% Spare Capacity	10.0% Spare Capacity
Sedgemoor	10,738	268	537	805	1,074
Taunton Dean	13,750	344	687	1,031	1,375
West Somerset	4,301	108	215	323	430
South Somerset	1,170	29	59	88	117
North Somerset	18,235	456	912	1,368	1,824
Mendip	2,602	65	130	195	260
TOTAL Bedspaces	50,796	1,270	2,540	3,810	5,080

Source: English Housing Survey, local data and EDF Energy

9D.5 Owner Occupied

9D.5.1 As set out above, it is estimated that by the time of peak construction, around 450 workers will have moved to the area with their families. Some of these will form part of the operational workforce, others will be long-term construction workers.

9D.5.2 If spread over a number of years, this should be within the capacity of the local housing market, and may provide a valuable boost if the housing market remains subdued.

9D.5.3 If spread over four years of the construction programme, the resulting 100+ units per year would account for no more than 3% of all sales registered with the Land Registry in 2009, which was a low year for sales. A comparison with the higher level of sales in 2006 reduces the figure to only 1.5%. (Ref. 9D.8) These are very small impacts in the context of the regular churn of the owner–occupied housing market.

9D.6 Latent Accommodation

9D.6.1 In late 2009 and again in the spring of 2011 an advertisement was placed in several local weekly papers (Bridgwater Mercury, West Somerset Free Press, Somerset County Gazette and Burnham and Highbridge Times) inviting people to register an interest in providing accommodation to HPC workers. In addition to private rented properties, this provided a source of 'latent' accommodation, i.e. property which had not previously been offered for rent and primarily comprising rooms within people's houses. As a consequence of these advertisements and ongoing calls to EDF Energy, over 1,500 bedspaces in private accommodation have been registered to date of which over 400 are rooms within people's houses.

9D.6.2 It is likely that the amount of latent accommodation of this kind will increase over time as the construction phase starts and more people realise that they can take advantage of the commercial opportunities which arise from it. Once people are aware of construction workers arriving in the area, and see others they know renting out rooms, it is likely that more people will come forward with offers of rooms to rent. EDF Energy has recently contacted those who expressed an interest in providing accommodation to check their availability and from a limited sample it appears that most of the rooms remain available to rent.

9D.7 Summary of Accommodation Capacity

9D.7.1 Based on the above analysis it is estimated that, during the peak tourist period, and looking across all sources of accommodation, the minimum capacity that HPC construction workers would be able to use across the 60 minute zone without creating any risk of significant disruption to accommodation markets is 4,200 spaces. As explained above, this figure is based on very conservative assessments of spare capacity, in particular in relation to tourist accommodation where there is much more spare capacity outside the peak tourist season. For most of the year, there will be much more accommodation available without any risk of significant disruption to accommodation markets.

9D.7.2 This central estimate of total spare capacity is based on a number of assumptions, most notably about the spatial spread of workers and about the split between different types of accommodation that workers are likely to use. Whilst EDF Energy has some influence over the choices workers make, and can encourage them to make choices that fit better with available supply, it will not be able to direct them to specific locations or types of accommodation and workers are free to make their own decisions. The Accommodation Strategy needs to allow for that, and therefore does not assume that workers can, or should, use all the existing spare capacity across the 60 minute zone.

References

9D.1 Savill Bird and Axon (SBA). Hinkley Point C gravity model datasets technical Note. Submitted to Somerset County Council, 14 December 2010.

9D.2 South West Tourist Board Research Team. Regional Occupancy Data Report. March 2010.

9D.3 Taunton and South Somerset Councils and Fordham Research. Strategic housing market assessment, Fordham Research: London, 2008.

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9D.6 Taunton and South Somerset Councils and Fordham Research. Housing needs surveys. (Online) Available from http://www.southsomerset.gov.uk/planning-and-building-control/planning-policy/evidence-base/district-wide-documents/strategic-housing-market-assessment-(shma)-taunton--south-somerset-housing-market-areas (Accessed 23 August 2011).

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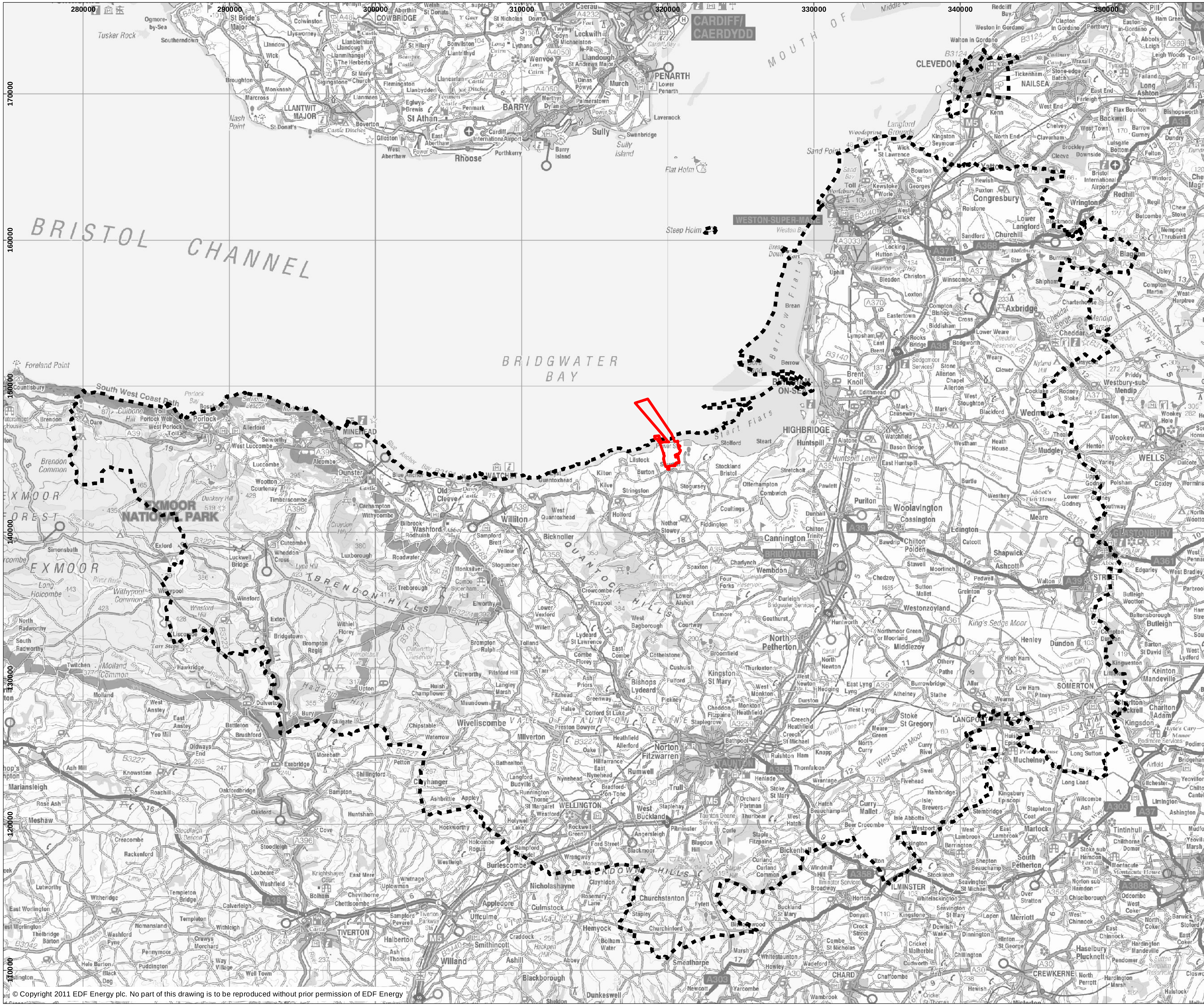
9D.8 Land Registry. Average price and volume of sales by region and district 2006-2009. Land Registry: Birkenhead, 2011. (Available with licence).



KEY

HINKLEY POINT C DEVELOPMENT SITE

60-MINUTE TRAVEL ZONE

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9D

FIGURE TITLE:

60-MINUTE TRAVEL ZONE

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APPENDIX 9E: SOCIO-ECONOMIC TECHNICAL NOTE 5: SPORT / LEISURE AUDIT AND ESTIMATED DEMAND

FOREWORD

EDF Energy and the local authorities wish to ensure that they understand what sports and leisure facilities the temporary Hinkley Point C (HPC) construction workers will require, and the extent to which these are already provided in the areas where workers are expected to live.

This report includes an audit of existing provision of sports facilities in Sedgemoor, West Somerset and Taunton Deane districts, and calculates the estimated usage of facilities by number and typology of construction workers.

9E. SOCIO-ECONOMIC TECHNICAL PAPER 5: SPORT / LEISURE AUDIT AND ESTIMATED DEMAND

9E.1 Introduction and Methodology

9E.1.1 EDF Energy and the local authorities wish to ensure that they understand what sports and leisure facilities the temporary Hinkley Point C (HPC) construction workers will require, and the extent to which these are already provided in the areas where workers are expected to live.

9E.1.2 This report includes an audit of existing provision of sports facilities in Sedgemoor, West Somerset and Taunton Deane districts, and calculates the estimated usage of facilities by number and typology of construction workers.

9E.1.3 The approach taken to assessment of the existing provision of sports facilities is based on two sources of information:

- A survey undertaken by ARUP in 2010 which highlights the location and type of a range of sports and leisure facilities in West Somerset and Sedgemoor.
- Sport England's Active Places database, (Ref. 9E.1) which includes a list of facilities by type and size/capacity for all areas, and Sports Facilities Calculator. (Ref. 9E.2).

9E.1.4 Expected demand is based on an estimate of the workforce age and gender profile which is then entered into Sport England's Sports Facilities Calculator.

9E.2 Workforce Profile and Typologies

9E.2.1 The demand for sports and leisure facilities arises particularly from the proposed temporary increase in population as a result of the construction stage of Hinkley Point C.

9E.2.2 EDF has been working with the Councils to agree the evidence base for assessing the likely impacts of the HPC scheme. This has involved the production of a series of "Technical Notes". **Technical Note 1** (which has been signed off by the Councils) sets out the overall workforce profile and **Technical Note 2** (which is being reviewed by the Councils) sets out the demographic breakdown of the workforce.

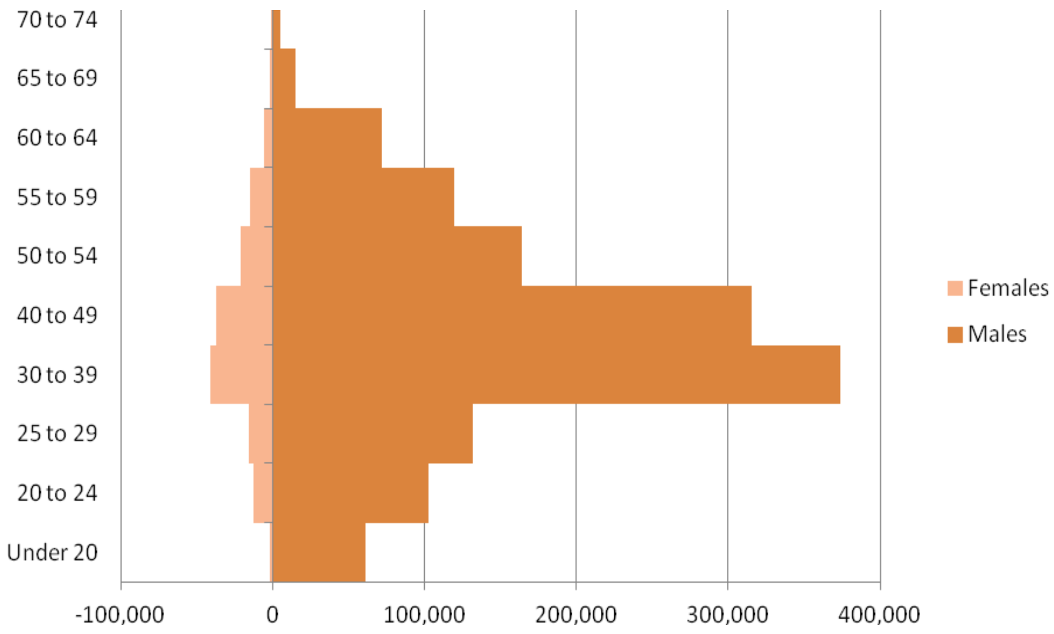
9E.2.3 The overall HPC construction workforce is expected to peak at 5,600, of which 3,700 (66%) will be non-home-based, i.e. will temporarily move into the area and therefore cause a temporary increase in demand for sports and leisure facilities.

a) Age and Gender

9E.2.4 Analysis has been undertaken using publicly-available datasets from the 2001 Census to outline the age and gender profile of construction workers in England and

South West England in particular. (Ref. 9E.3) The following split has been applied to the total non-home-based construction workers estimated at Hinkley Point C.

Plate 1.1: Age and Gender Profile Non-Home-Based HPC Workers



9E.2.5 The largest age group in the construction industry are males in their 30s, who make up 25% of the of all construction workers. The next largest group is males in their 40s, at 21%, followed by those over 50 and under 30 who make up around 19% of the industry each. Females make up 10% of the industry and they are fairly evenly distributed amongst the age groups.

b) Education

9E.2.6 According to 2001 Census data 70% of construction workers are educated to GCSE level or below; 15% are educated to A level or above. The following table translates Census (2001) data into a breakdown of expected age group and qualification level for non-home-based employees at Hinkley Point C.

Table A9E.1: Qualification Level of Non-Home-Based Workers

Age Group	Qualification Level	
	Level 3 or Lower	Level 4 or Higher
Males Under 35	1,081	101
Males 35-49	1,125	105
Males 50+	838	78
Females Under 35	117	15
Females 35-49	127	16
Females 50+	98	13

Source: Census 2001

c) Leisure Preferences

9E.2.7 Sport England, in partnership with Experian, has developed a market segmentation model to analyse the sport and leisure behaviour of England's residents based on age, gender, life situation and socio-economic characteristics. (Ref. 9E.4) Each segment is assigned a named representative person, who embodies the key characteristics of the group.

9E.2.8 Using this data, and the demographics above, we can make some predictions as to what the leisure needs of construction workers at Hinkley Point C may be.

i. Jamie

9E.2.9 Male operative construction workers in their teens and twenties will make up approximately 29% of the workforce. Sport England identifies this group as 'Jamies'. Jamie is:

- under the age of 35;
- is educated to below degree level, most likely in a vocational qualification; and
- is likely to be working class

9E.2.10 60% of this group do 30 minutes of sport at least once a week (compared to a national average of 40%) and 31% do so at least 3 times a week (compared to an average of only 15%).

9E.2.11 The most popular sports for this group are football (28%) and keep fit/gym (22%). Around 30% are members of teams or clubs, and 24% take part in competitions. This reflects the fact that amongst the most commonly cited reasons for doing sport amongst this group are: 'to meet with friends' and 'just to enjoy it.' Improving personal performance and keeping fit are also important, but losing weight is not a consideration.

9E.2.12 The group is hampered in their access to sport because they left school, have no opportunity to take part, or because of economic and work reasons. Work commitments are a concern for 27% of this group, compared to only 19% in the general population.

9E.2.13 The group is least satisfied by the quality of coaching, officials and available facilities, and have a lower impression of the value for money of sport than other groups. Improved facilities are by far the most commonly cited improvement that would encourage this group to do more sport.

9E.2.14 Apart from sport, the most common out of home pastimes for this group is going to pubs, bars and clubs or go to the cinema. They are more unlikely than most groups to visit libraries, museums or the theatre.

ii. Kev

9E.2.15 Male operative construction workers in their 30s and 40s are expected to make up approximately 30% of the workforce. Sport England identifies this group as 'Kevs'. Kev is:

- between the ages of 25 and 56, but is most likely to be 36-45;

- is likely to work in a vocational job; and
- is likely to be working class.

9E.2.16 42% of this group take part in sport at least once a week, and 17% do so at least three times a week. The most popular sports in this group are going to the gym or keep fit (14%); football (11%) and cycling (11%). They also swim and take part in athletics. 33% take part in organised sport, but only 16% take part in competitions.

9E.2.17 The group mostly take part in sport 'just to enjoy it' but also consider keeping fit to be important. Work commitments are the most likely factor to prevent the group from doing as much sport as they would like to. 'Being less busy' is the most commonly cited factor that would increase uptake.

9E.2.18 The group's satisfaction levels are broadly in line with the general population. They are especially dissatisfied by the quality of facilities and coaching. They are less satisfied with their levels of fitness than average.

9E.2.19 The group are not that likely to take part in much leisure outside the home. 57% go shopping and 54% go to restaurants, but these proportions are both less than in the general population. They are less likely than other groups to visit the theatre, library or museums.

iii. Terry

9E.2.20 Male operative construction workers in their 50s and older will be expected to make up approximately 22% of the workforce. this group are represented by Terry who:

- is aged 46-65;
- is likely to be working class, or living at subsistence level;
- works or did work as a manual labourer; and
- suffers relatively high levels of deprivation (according to the IMD) than other groups, especially with health and disability.

9E.2.21 25% of this group play sport at least once a week, but only 8% do so three times a week or more. 70% did no sport at all in the four weeks prior to the survey. The group are most likely to go to the gym (8%), or go cycling or swimming (6% each) but these levels are significantly lower than in the wider population.

9E.2.22 17% of the group are members of a club, but only 4% play team sports. Like their younger counterparts, the group's main motivation for taking part in sport is enjoyment, followed by the desire to keep fit. The group is most hampered by their injuries and disabilities, with 59% citing this as a reason for not doing as much sport as they would like. 17% of the group would do more sport if they had someone to go with.

9E.2.23 The group are less likely than average to take part in leisure activities in general. Outside the home, 56% go shopping, 55% go on days out and 41% go to bars or pubs. The group is one of the least likely to visit libraries, museums or the theatre.

iv. Paula

9E.2.24 Female operative construction workers (approximately 9% of the workforce) are likely to be in the 'Paula' market segment. Paula is:

- aged 18-45, but most commonly between 25 and 36;
- is likely to be a single mother; and
- is likely to be in low skilled or part time work .

9E.2.25 36% of this group take part in sport at least once a week and 12% do so at least three times a week. However, 63 % did not sport at all in the four weeks prior to the survey. They are unlikely to be members of a club or to compete. The most popular activities in this group are going to the gym (18%) swimming (17%).

9E.2.26 This group take part in sport because they enjoy it, (21%) to keep fit (26%) and to take their children (21%). The most important reason for not doing as much sport as they would like is family commitments, which affects this group far more than the average. Factors such as leaving school, lack of opportunities and economic and work reasons are also important.

9E.2.27 The group is slightly more satisfied with overall sports provision than the average. However, they have below average satisfaction with the 'social aspects' of the sports experience, such as feeling comfortable in the sports environment, taking part without feeling embarrassed or awkward and having their cultural and religious beliefs respected. They are also slightly less satisfied than average with the 'ease of participation' which takes into account of issues such as transport access and balancing leisure time with work and family commitments.

9E.2.28 36% of this group would do more sport if they were less busy and 33% would do so if admission prices were cheaper. Admission prices are more important for this group than for any other of the market segments.

9E.2.29 This group goes shopping for leisure more often than average, with 85% going shopping in their spare time, 59% go on days out and 57% go to restaurants. In the last 12 months, this group were least likely to have been to the theatre or to a museum but were much more likely than their male counterparts to have been to a library.

v. Ben, Tim and Phillip

9E.2.30 Male workers above operative level are likely to make up approximately 8% of the workforce. Those working above operative level, in administrative or in managerial positions who are educated to degree level or above are likely to be in the Ben (18-25); Tim (25-45) and Phillip (46+) market segments, according to their age.

9E.2.31 These segments play more sport than any others in their respective age groups, with 68% of Bens, doing sport at least once a week, 62% of Tims, and 51% of Phillips.

9E.2.32 Football and going to the gym are significant sports for all age groups, but cycling and swimming are increasingly important in the older groups. All groups would like to increase their uptake of swimming and cycling. Participation in football declines from 33% in the 18-24 group to 9% in the 46+ group. However, it is suggested that the older men are likely to continue to be connected to football in club administration capacities, such as club secretary, and 30% retain club membership, so football remains important socially.

9E.2.33 Work commitments are the main reason that these segments do not do as much sport as they like, with more than 30% in each age group with this concern. All groups are least satisfied with the quality of facilities and coaching on offer.

9E.2.34 The younger groups are most likely to see go out to pubs, bars or clubs or to the cinema. As they get older, pubs and bars are replaced by restaurants and days out become more important. ‘Tim’ is the most likely to go to museums and galleries (62%) or to the theatre (57%). Participation amongst Bens and Philips is slightly lower. These groups are less likely than others in their age groups to visit libraries.

vi. Chloe and Jackie

9E.2.35 Female workers above operative level are likely to make up approximately 0.5% of the workforce. This small group is likely to be represented by Chloe (mainly early 20s) and Jackie (late 20’s+). Chloe is more likely than other women in her age group to do sport at least once a week, with 62% doing so. However, participation for Jackies is lower, at 49%, mostly due to the pressures of having a family. These groups are most likely to swim or go to the gym, and they like to do more of both. Jackies would benefit much more than average from help with childcare.

9E.2.36 Younger women are slightly more likely than average to go to museums, galleries, libraries or the theatre, whilst the older group are slightly less likely than average to do so. Shopping is an important pastime for both groups, whilst eating in restaurants and going to pubs are more popular pastimes for younger women.

vii.Families

9E.2.37 Around 500 non-home-based workers live in family-type households, i.e. with one or more dependents (although not necessarily children). In order to assess the demand for sports facilities created by this element, it has been estimated that each family contains one construction worker, 1.2 non-construction-worker adults and 0.85 children. This is an estimate for peak employment, which is scaled down ‘pro-rata’ for non-peak times (subtracting the weighting of the campuses, which are not expected to house families).

viii. Summary

9E.2.38 For the demographic of non-home-based workers, football and going to the gym are by far the most important sports. The vast majority of workers will be “Jamies” and “Kevs” for whom football and the gym are the main activities, along with cycling which is undertaken by 11% of Kevs. There is very limited demand for swimming and racquet sports barely feature in the demand profiles.

9E.3 Estimate of Sport / Leisure Facilities Demand

9E.3.1 Sport England provides a Sports Facility Calculator (SFC) to enable developers to assess the demand for sports facilities likely to arise from the permanent residents of their development. This calculator assesses the demand likely to arise for swimming pools, sports halls, indoor bowls and synthetic pitches.

9E.3.2 The Sports Facility Calculator (SFC) was created by Sport England to help local planning authorities quantify how much additional demand for the key community sports facilities (swimming pools and sports halls) is generated by populations of new growth, development and regeneration areas. The SFC was first developed to help estimate the facility needs of the new communities in the Eastern Quarry Development, Dartford, and the Milton Keynes future growth areas. It has been used to help local authorities in infrastructure planning, s.106 and Supplementary Planning Documents. The key functions of the SFC are:

- expresses demand as facilities, e.g., 400m^2 of water;
- uses local authority population profiles from the 2001 census;
- allows you to create your own population profile;
- has the ability to test out the effect of changes in levels of participation;
- converts need for facilities into price/value (£); and
- includes up to date regional building cost variations

9E.3.3 Whilst the SFC can be used to estimate the swimming and sports hall needs for whole area populations, such as for a whole local authorities, there are dangers in how these figures are subsequently used at this level in matching it with current supply for strategic gap analysis.

9E.3.4 The SFC should not be used for strategic gap analysis; this approach is fundamentally flawed. The SFC has no spatial dimension. The figure that is produced is a total demand figure for the chosen population. It is important to note that the SFC does not take account of:

- facility location compared to demand;
- capacity and availability of facilities - opening hours;
- cross boundary movement of demand;
- travel networks and topography; and
- attractiveness of facilities

9E.3.5 The model then applies the costs of provision associated with the county that the population is expected to live within.

9E.3.6 The SFC uses information Sport England has gathered on who uses facilities and then applies this to the actual local population profile of the local area. The SFC then turns this estimation of demand (visits per week) into the equivalent amount of facility which is needed to meet these visits each week.

9E.3.7 The SFC works by applying nationally derived demand rates to the existing local population profile of the local area. However, in this instance, the temporary non-home-based population that is expected to arise from the proposed development will have a different population profile than the existing area. Therefore, a population profile has been manually inserted into the SFC based on the demographic data outlined in Section 2.

9E.3.8 Estimates for demand have been undertaken in terms of the total demands of the temporary non-home-based construction workforce and associated families, and by smaller areas based on the estimated distribution of non-home-based construction workers as expressed in SBA's June 2011 'gravity model'. These ward clusters are outlined in **Figure 1.1**, including the estimated number of non-home-based construction workers at peak.

9E.3.9 An important consideration is that the SFC is based on **permanent** residents whereas demand of non-home-based workers at Hinkley Point C is temporary. The Sports Facilities Calculator is based on demand arising from permanent housing. In the case of HPC the increase in residents will be temporary over a nine year period, peaking at 3,700 in month 64 of construction. Simply feeding in the increase in population at peak (or at any point) would therefore overstate the demand for facilities. We need to convert the number of workers moving into the area into an equivalent permanent population.

9E.3.10 It is estimated that the construction of HPC will require 20,000 to 25,000 person years of construction work (50 million hours). Of these, 63% will be non-home based. Over the nine year construction period the top end of this range equates to an annual average of close to1,800 people being temporarily in the area to construct HPC.

9E.3.11 Whilst nine years is a relatively long time, it is less than the expected lifespan of most sports facilities. For example, the life of a swimming pool is 30 years (UK Sports Council (1999) Technical Unit for Sport, Handbook of Sports & Recreational Building Design) with refurbishment required after 10-15 years (Sport England (2008) Design Guidance, Swimming Pools). A further adjustment therefore needs to be made to account for that. Allowing for use in nine years of the 15 year maintenance lifespan of the facility means a further reduction of just over a quarter, or the equivalent of 1,310 permanent residents – an overall adjustment of 65% to convert from temporary residents to a permanent equivalent. The same lifespan / maintenance period is applied to sports halls.

9E.3.12 The following assessment is based on Sport England's Sports Facilities Calculator, applied to a 'user profile' based on the likely demographic characteristics of non-home-based workers and families and children at two intervals during the construction period. The first assessment point is immediately prior to completion of the campuses, and the second is at overall construction peak when non-home-based workforce is at its highest. Assumptions on the gender and age split of the construction workforce have been based on 2001 Census data, and each 'family' is estimated to contain 0.85 children, as outlined in the Methodology section.

9E.3.13 The following table outlines the number of non-home-based workers at 27 months (the month before the Campuses are 'on-line') and 64 months (peak construction employment), identifying within that the number of families (partners) and the Sport England Facilities Calculator outputs for each interval.

Table A9E.2: Sports Facilities Demand Arising from Non-Home-Based Workers at 27 Months and 64 Months (Peak) (Sport England, 2010)

		27 Months	64 Months (Peak)	Permanent Equivalent (Peak)
Total Construction Workers		3,026	5,600	
% of which non-home-based		54%	66%	
# non-home-based		1,798	3,746	
Families (pro-rata)		286	500	
Children		243	425	
Sports Facilities Calculator				
Pools	**Area**	17.24	35.92	23.35
	Lanes	0.32	0.68	0.44
	Pools	0.08	0.17	0.11
Halls	**Courts**	0.62	1.29	0.84
	Halls	0.15	0.32	0.21
Indoor Bowls	**Rinks**	0.09	0.18	
	Centres	0.01	0.03	
Synthetic Pitches	**Pitches**	0.09	0.19	

Source: Sport England 2010, Quod

9E.3.14 The Sport England Sports Facilities Calculator does not include the estimated demand for provision of gyms / health and fitness suites. Separate Sport England guidance suggests that the provision of 38 gym stations per 10,000 population is adequate provision.

9E.4 Existing Provision and Estimated Demand by Ward Cluster

9E.4.1 The Annex to this document outlines the existing provision in the area. In addition to this, there will be new on-site sports facilities provided at the BRI-A campus in Bridgwater and at the HPC site campus. This will include two synthetic pitches and a gym at each.

9E.4.2 This shows that in aggregate, the additional demand from HPC workers is modest. However, there may be local under-provision in some areas where HPC workers will live. The need for facilities locally has therefore been assessed and compared to estimated demand arising from non-home-based workers in 12 clusters across the three districts.

9E.4.3 Unfortunately, the audit undertaken by Arup does not include analysis of usage or capacity, only whether facilities exist or not. This assessment is therefore necessarily limited to whether or not facilities exist to meet forecast demand from temporary HPC workers.

9E.4.4 The following table summarises areas where facilities do not exist to meet forecast demand (using the “permanent equivalent” definition set out above):

Table A9E.3: Unmet Existing Demand for Sports Facilities (Permanent Equivalent)

Area	Possible Unmet Demand
Minehead	<0.01 of a swimming pool
Watchet/Williton	<0.01 of a swimming pool
Hinkley	0.01 of a swimming pool
Weston-Super-Mare	Adequate provision
Burnham/Highbridge	Adequate provision
Bridgwater	0.02 of a swimming pool
Cannington	<0.01 of a swimming pool <0.01 of a sports hall
Taunton	Adequate provision
Glastonbury	Adequate provision
Cheddar	Adequate provision
Somerset South	Adequate provision
Somerset West	<0.01 of a swimming pool

9E.5 Summary

9E.5.1 The Hinkley Point C (HPC) non-home-based workforce peaks at 3,700 and averages around 1,800 across the nine years of the construction phase.

9E.5.2 The age and gender profile of the workforce has been estimated based on the 2001 Census data for the construction industry.

9E.5.3 Estimates of demand for sports facilities have been based on the Sport England Sports Facilities Calculator (SFC). This relates to the need for new facilities for new permanent residential communities. The non-home-based workforce is only temporary and therefore an adjustment has been made to take account of this. The following table shows the additional demand at the peak and the average across the whole construction period.

Table A9E.4: Additional Demand for Sports Facilities: Peak and Average for Construction Period

Sports Facilities Calculator				
		Average	**Peak**	**Permanent Equivalent (Average)**
Pools	**Area**	17.24	35.92	11.21
	Lanes	0.32	0.68	0.21
	Pools	0.08	0.17	0.05
Halls	**Courts**	0.62	1.29	0.40
	Halls	0.15	0.32	0.10
Indoor Bowls	**Rinks**	0.09	0.18	

Sports Facilities Calculator				
		Average	**Peak**	**Permanent Equivalent (Average)**
	Centres	0.01	0.03	
Synthetic Pitches	**Pitches**	0.09	0.19	

9E.5.4 The Sport England Sports Facilities Calculator does not include the estimated demand for provision of gyms / health and fitness suites. Separate Sport England guidance suggests that the provision of 38 gym stations per 10,000 population is adequate provision.

9E.5.5 In addition to the SFC, Sport England has produced typologies of demand for a wider range of sports, based on key demographics such as age, gender and employment. For the demographic of non-home-based workers, football and going to the gym are by far the most important sports, along with cycling which is undertaken by a much smaller proportion. There is very limited demand for swimming, and racquet sports barely feature in the demand profiles.

9E.5.6 Demand for sports facilities is therefore very modest and is likely to be able to be met from existing provision. The exception to this is swimming pools in Minehead and Bridgwater where there is no publicly available swimming pool at present (although this may change in the near future).

9E.5.7 The provision being made on the campuses will meet most sports needs, and if this is made publicly available (either during construction or as legacy) this could be used as an off-set for the small provision of swimming pools that could be needed as mitigation.

9E.5.8 The Sports Facilities Calculator also gives indicative costs for the provision of sports facilities. In the case of the facilities (or proportions of facilities) outlined in **Table** A9E.2, this would equate to £425,794 for permanent equivalent provision at Month 27.

9E.5.9 The estimated cost of the facilities outlined above, in addition to the cost associated with the replacement of existing facilities at the Bridgwater Sports and Social Club (Bridgwater A site) is lower than the commitment to significant investment in local leisure provision in West Somerset and Sedgemoor districts as set out in the S106 for Site Preparation, and summarised in the **Section 106 Heads of Terms which are appended to the Planning Statement**.

ANNEX: ASSESSMENT OF LOCAL DEMAND FOR FACILITIES

9E.6 Minehead Ward Cluster

9E.6.1 The Minehead ward cluster, to the west of HPC, covers the northern area of Exmoor National Park and incorporates the coastal settlements of Minehead and Porlock.

a) Existing Facilities

9E.6.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.1**):

Table A9E.5: Sports Facilities in the Minehead Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
MI1	Carhampton Recreation Ground	Both	1 Cricket Pitch And 1 Badminton Court
MI2	Dunster Playing Field	Outdoor	2 Pitches (1 Full Size Football And 1 Cricket Pitch)
MI3	Minehead Barbarians RFC	Outdoor	1 Senior Rugby Union
MI4	Minehead Barbarians RFC	Outdoor	2 Senior Rugby Union Pitches
MI5	West Somerset Sports And Leisure Centre	Both	6 Lane Athletics Track, 4 Badminton Courts
MI6	West Somerset Community College	Outdoor	4 Pitches (2 Cricket Pitches, 1 Full Size Football, 1 Senior Rugby Union)
MI7	King George Fifth Recreation Grounds	Outdoor	1 Full Size Football Pitch
MI8	Minehead Middle School	Both	3 Pitches (1 Cricket Pitch, 1 Junior Football, 1 Rounders)
MI9	Minehead Bowling Club	Indoor	1 Rink
MI10	Minehead Football Club	Outdoor	1 Full Size Football Pitch
MI11	Butlins Skyline	Indoor	Leisure Pool (5 Lanes)
MI12	Minehead And West Somerset Golf Club	Outdoor	18 Hole Golf Course
MI13	Northfield Hotel Leisure Club	Indoor	Learner/Training/Teaching
MI14	Wheddon Cross Playing Fields	Outdoor	2 Pitches (1 Junior Football, 1 Cricket Pitch)
MI15	Allerford Recreation Ground	Outdoor	3 Pitches (2 Junior Football, 1 Cricket Pitch)
MI16	Porlock Recreation Ground	Outdoor	3 Pitches (1 Full Size Football, 1 Junior Football, 1 Cricket)
MI17	Hoburne Blue Anchor Caravan Park	Outdoor	Leisure Pool

9E.6.3 The following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.2**).

Table A9E.6: Sports Facilities in the Minehead Ward Cluster (ARUP Audit, 2010):

Code	Name	Facilities
Mia	Minehead Lawn Tennis Club	Tennis Courts x4
MIb	Hoburne Blue Anchor Holiday Park	Golf, Swimming
MIc	Blue Anchor Beach	Swimming
Mid	Dunster Packhorse Playing Field	Cricket, Football
Mie	Dunster Memorial Hall	Gymnastics
MIf	Minehead First School	Football (Youth), Gymnastics, Martial Arts, Netball, Swimming
MIg	Carhampton Village Hall	Badminton, Gymnastics, Martial Arts
MIh	Carhampton Recreation Field	Basketball, Cricket, Football (5-a-side)
MIi	King George V Playing Field	Football
MIj	Irnham Road Playing Field	Basketball, Football x2, Tennis Courts x2
MIk	Minehead Bowling Green	Bowls
MIl	Blenheim Gardens	Golf
MIm	Minehead Barbarians RFC	Rugby Pitches x2
Min	Timberscombe Playing Area	Football (Youth)
Mio	Alcombe Village Hall	Gymnastics
MIp	Withycombe War Memorial Hall	Bowls, Gymnastics
MIq	Timberscombe Cricket Club	Cricket x2
Mir	Butlins Minehead	Basketball x3, Football (5-a-side) x2, Football x2, Golf, Gymnastics, Swimming, Tennis x3
MIs	Minehead and West Somerset Golf Club	Golf
MIt	West Somerset Table Tennis Club	Table Tennis
MIu	The Dance Centre	Gymnastics
MIv	West Somerset Leisure Centre	Athletics, Badminton x4, Basketball x5, Cricket x4, Football (5-a-side) x2, Football, Gym x2, Gymnastics x2, Netball x3, Rugby, Squash x, Tennis x4
MIw	Minehead Middle School	Athletics, Cricket, Gym, Gymnastics, Netball x2, Swimming, Tennis x2
Mix	Timberscombe Village Hall	Gymnastics, Martial Arts
MIy	Plover Close MUGA	Basketball, Football (5-a-side)

b) Demand for Facilities

9E.6.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 57 non-home-based construction workers on average and 119 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.7: Sport England Sports Facilities Calculator Output: Minehead

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	0.55	1.14	0.74
	Lanes	0.01	0.02	0.01
	Pools	0.00	0.01	0.00
Halls	**Courts**	0.02	0.04	0.03
	Halls	0.00	0.01	0.01
Indoor Bowls	**Rinks**	0.00	0.01	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.01	

9E.6.5 The above table outlines demand for additional sports facilities, amounting to 0.00 swimming pools, 0.01 sports halls, and 0.01 synthetic turf pitches. At present in the Minehead ward cluster, there are no indoor swimming facilities. However, there is currently good provision of sports halls, pitches and bowling facilities along with notable multiple provision of facilities at West Somerset Leisure Centre.

9E.7 Weston-Super-Mare Ward Cluster

9E.7.1 The Weston-Super-Mare ward cluster, to the north-east of HPC, covers the coastal area north and south of Weston-Super-Mare, including the smaller settlements of Bourton-St-Georges and Locking.

a) Existing Facilities

9E.7.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.3**):

Table A9E.8: Sports Facilities in the Weston-Super-Mare Ward Cluster (Sport England Active Places, 2011):

Code	Name	Type	Facilities
WSM1	BLAGDON CRICKET CLUB	Outdoor	1 Cricket Pitch
WSM2	WINSCOMBE SPORTS CLUB	Outdoor	1 Cricket Pitch, 1 Football Pitch, 1 Junior Football Pitch, 2 Rugby Pitches
WSM3	JUBILEE SPORTS FIELD	Outdoor	1 Junior Football Pitch
WSM4	SPRINGWOOD SPORTS FIELD	Outdoor	1 Football Pitch
WSM5	OLD BANWELL PLAYING FIELDS	Outdoor	1 Cricket Pitch, 2 Football Pitches

Code	Name	Type	Facilities
WSM6	THE CAMPUS	Both	1 Football Pitch, 2 Junior Football Pitches, 2 Badminton Court
WSM7	PRIORY COMMUNITY SCHOOL	Both	2 Cricket Pitches, 5 Football Pitches, 4 Rugby Pitches, 4 Badminton Courts, 1 Floodlit Synthetic Pitch
WSM8	CASTLE BATCH PRIMARY SCHOOL	Outdoor	1 Junior Football Pitch, 1 Rounders Pitch
WSM9	QUEENSWAY PLAYING FIELDS	Outdoor	2 Junior Football Pitches
WSM10	WORLE RECREATION GROUND	Outdoor	1 Football Pitch, 1 Junior Football Pitch
WSM11	WORLE COMMUNITY SCHOOL	Both	1 Cricket Pitch, 2 Football Pitches, 2 Junior Football Pitches, 4 Rounders Pitches, 2 Senior Rugby Pitches
WSM12	MEAD VALE PRIMARY SCHOOL	Indoor	1 Badminton Court
WSM13	BAYTREE RECREATION GROUND	Outdoor	1 Cricket Pitch, 2 Junior Football Pitches
WSM14	WORLEBURY GOLF CLUB	Outdoor	1 Standard Golf Course
WSM15	KEWSTOKE VILLAGE HALL	Both	1 Football Pitch, 1 Junior Football Pitch, 1 Badminton Court
WSM16	SAND BAY LEISURE RESORT	Both	18 Stations, 20m Swimming Pool
WSM17	HORNETS RFC	Outdoor	2 Rugby Pitches
WSM18	HUTTON MOOR LEISURE CENTRE	Both	1 Cricket Pitch, 4 Football Pitches, 2 Junior Football Pitches, 2 Rugby Pitches, 110 Stations, 8 Badminton Courts, 8 Lane 25m Swimming Pool
WSM19	ESPORTA HEALTH & FITNESS (WESTON)	Indoor	120 Stations, 4 Lane 25m Swimming Pool
WSM20	ASHCOMBE PRIMARY SCHOOL	Outdoor	2 Junior Football Pitches
WSM21	BODYTONE HEALTH AND FITNESS	Indoor	59 Stations
WSM22	SWEAT FITNESS ACADEMY	Indoor	50 Stations
WSM23	GYM CENTRAL	Indoor	75 Stations
WSM24	VICTORIA BOWLING CLUB	Indoor	1 Indoor Bowls Rink
WSM25	WOODSPRING INDOOR BOWLS CLUB	Indoor	2 Indoor Bowls Rinks
WSM26	YMCA (WESTON-SUPER-MARE)	Indoor	1 Badminton Court
WSM27	WESTON COLLEGE	Indoor	1 Badminton Court
WSM28	TRIM WISE HEALTH + FITNESS	Indoor	40 Stations
WSM29	DROVE ROAD RECREATION GROUND	Outdoor	1 Cricket Pitch, 2 Football Pitches, 4 Hockey Pitches, 4 Rugby Pitches
WSM30	WESTON-SUPER-MARE RFC	Outdoor	1 Rugby Pitch
WSM31	WYVERN SPORTS CENTRE	Both	1 Football Pitch, 1 Rugby Pitch, 15 Stations, 4 Badminton Courts, 1 Floodlit Synthetic Pitch

Code	Name	Type	Facilities
WSM32	CLARENCE PARK	Outdoor	1 Cricket Pitch, 1 Football Pitch
WSM33	WESTON-SUPER-MARE GOLF CLUB	Outdoor	1 Standard Golf Course
WSM34	BROADOAK MATHEMATICS AND COMPUTING COLLEGE	Both	1 Football Pitch, 1 Junior Football Pitch, 2 Rugby Pitches, 4 Badminton Courts
WSM35	WESTON-SUPER-MARE CRICKET CLUB	Both	2 Cricket Pitches, 2 Badminton Courts
WSM36	UPHILL CASTLE CRICKET CLUB	Outdoor	1 Cricket Pitch
WSM37	ST. ANDREWS INDOOR BOWLS CLUB	Indoor	3 Indoor Bowls Rinks
WSM38	WESTON-SUPER-MARE AFC	Both	4 Football Pitches, 1 Badminton Court
WSM39	WESTON ST JOHNS FOOTBALL CLUB	Outdoor	1 Football Pitch
WSM40	OLDMIXON RECREATION GROUND	Outdoor	2 Junior Football Pitches
WSM41	SIDCOT SCHOOL SPORTS FIELD	Outdoor	1 Cricket Pitch, 2 Football Pitches, 1 Hockey Pitch, 3 Rounders Pitches, 3 Rugby Pitches
WSM42	SIDCOT SCHOOL	Indoor	4 Badminton Courts
WSM43	BANWELL PRIMARY SCHOOL	Indoor	1 Badminton Court
WSM44	BANWELL FOOTBALL CLUB	Outdoor	1 Football Pitch
WSM45	AVON SKI CENTRE	Outdoor	4 Ski Slopes
WSM46	WESTON-SUPER-RANGE	Outdoor	1 Driving Range, 1 Par3 Course
WSM47	CHURCHILL SPORTS CENTRE	Both	1 Cricket Pitch, 1 Football Pitch, 2 Junior Football Pitches, 22 Stations, 4 Badminton Courts, 5 Lane 20m Swimming Pool
WSM48	BANWELL & CHURCHILL CRICKET CLUB	Outdoor	1 Cricket Pitch
WSM49	CHURCHILL PARISH RECREATION GROUND	Outdoor	2 Football Pitches
WSM50	CHURCHILL C OF E PRIMARY SCHOOL	Outdoor	1 Junior Football Pitch
WSM51	CLEVEDON GOLF CENTRE	Outdoor	Standard Golf Course
WSM52	CADBURY HOUSE HOTEL & LEISURE CLUB	Indoor	105 Stations, 2 Lane 20m Swimming Pool
WSM53	ST ANDREWS CHURCH OF ENGLAND JUNIOR SCHOOL	Outdoor	1 Junior Football Pitch
WSM54	CONGRESBURY CRICKET CLUB	Outdoor	1 Cricket Pitch
WSM55	BROADSTONE PLAYING FIELD	Outdoor	2 Football Pitches
WSM56	STRODE LEISURE CENTRE	Both	2 Football Pitches, 1 Junior Football Pitches, 25 Stations, 4 Badminton Courts, 6 Lane 25m Swimming Pool

Code	Name	Type	Facilities
WSM57	MENDIP SPRING GOLF CLUB	Outdoor	Standard Golf Course, Driving Range
WSM58	HAZELL CLOSE	Outdoor	2 Junior Football Pitches
WSM59	COLERIDGE VALE PLAYING FIELDS	Outdoor	1 Football Pitch, 1 Junior Football Pitch, 1 Junior Rugby Pitch, 4 Rugby Pitches
WSM60	CLEVEDON BOWLING CLUB	Indoor	2 Indoor Bowls Rinks
WSM61	THE HEALTH CLUB (CLEVEDON) LTD	Indoor	31 Stations
WSM62	SWISS VALLEY SPORTS CENTRE	Both	1 Cricket Pitch, 3 Football Pitches, 3 Rugby Pitches, 9 Stations, 5 Badminton Courts, 1 Floodlit Synthetic Pitch
WSM1	BLAGDON CRICKET CLUB	Outdoor	1 Cricket Pitch

9E.7.3 The Arup Sports Facilities audit does not cover areas outside of West Somerset and Sedgemoor.

b) Demand for Facilities

9E.7.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 218 non-home-based construction workers on average and 454 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise.

Table A9E.9: Sport England Sports Facilities Calculator Output: Weston-Super-Mare Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	2.09	4.35	2.83
	Lanes	0.04	0.08	0.05
	Pools	0.01	0.02	0.01
Halls	**Courts**	0.07	0.16	0.10
	Halls	0.02	0.04	0.03
Indoor Bowls	**Rinks**	0.01	0.02	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.01	0.02	

9E.7.5 The above table outlines demand for additional sports facilities, amounting to 0.01 swimming pools, 0.03 sports halls, 0.02 bowling rinks and 0.02 synthetic turf pitches. At present in the Weston-Super-Mare ward cluster, there is one 8-lane 25m indoor swimming pool at Hutton Leisure Centre, and this is considered adequate provision. There is also currently good provision of sports halls, pitches and bowling facilities identified by Sport England.

9E.8 Bridgwater Ward Cluster

9E.8.1 The Bridgwater ward cluster, to the south-east of HPC, covers the urban area of Bridgwater and smaller settlements of Westonzoyland to the east, North Petherton to the south and Wembdon.

a) Existing Facilities

9E.8.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.4**):

Table A9E.10: Sports Facilities in the Bridgwater Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
BR1	Eastover Park	Outdoor	1 Football Pitch
BR2	Trimwise	Indoor	40 Stations
BR3	YMCA	Both	1 Junior Football Pitch, 10 Stations, 1 Badminton Court
BR4	Robert Blake Science College	Both	1 Cricket Pitch, 1 Football Pitch, 1 Rugby Pitch, 4 Badminton Courts
BR5	Bridgwater Town FC	Outdoor	1 Football Pitch
BR6	Mansfield Park	Outdoor	2 Football Pitch
BR7	Bridgwater Indoor Bowls Club	Indoor	2 Indoor Bowls Rinks
BR8	Victoria Park	Outdoor	1 Football Pitch
BR9	Bridgwater Cricket Club	Outdoor	1 Cricket Pitch
BR10	Bridgwater College	Outdoor	2 Football Pitches, 29 Stations, 4 Badminton Courts, 1 Floodlit Synthetic Pitch
BR11	Drove House Health And Rehabilitation	Indoor	45 Stations
BR12	Bridgwater And Albion RFC	Outdoor	2 Rugby Pitches
BR13	Haygrove School Sports Field	Outdoor	1 Cricket Pitch
BR14	Bridgwater Sports And Social	Both	1 Cricket Pitch, 2 Football Pitches, 2 Indoor Bowls Rinks
BR15	East Bridgwater Sports Centre	Both	2 Football Pitches, 3 Rounders Pitches, 1 Rugby Pitch, 4 Badminton Courts
BR16	Haygrove School Sports Hall	Both	1 Football Pitch, 3 Rounders Pitches, 1 Rugby Pitch, 4 Badminton Courts
BR17	Chilton Trinity Sport And Leisure	Both	32 Stations, 4 Badminton Courts, 1 Floodlit Synthetic Pitch
BR18	Chilton Technology College	Outdoor	1 Cricket Pitch, 1 Football Pitch, 1 Junior Rugby Pitch, 3 Rounders Pitches
BR19	Wembdon Cricket Club	Outdoor	1 Cricket Pitch, 1 Football Pitch

BR20	Unique Health And Fitness	Indoor	14 Stations
BR21	Morganians RFC	Outdoor	2 Rugby Pitches
BR22	Westonzoyland Primary School	Outdoor	1 Junior Football Pitch
BR23	Westonzoyland Community Centre	Outdoor	1 Cricket Pitch, 1 Football Pitch
BR24	Westonzoyland Airfield	Outdoor	1 Football Pitch
BR25	North Petherton Cricket Club	Outdoor	1 Cricket Pitch
BR26	North Petherton	Outdoor	1 Football Pitch, 1 Junior Football Pitch
BR27	North Petherton RFC	Outdoor	3 Rugby Pitches

9E.8.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.5**).

Table A9E.11: Sports Facilities in the Bridgwater Ward Cluster (ARUP Audit, 2010)

Name	Sport
Trinity Hall	Badminton, Gymnastics
Hamp Community Junior School	Football (Youth) x3, Gymnastics
Chedzoy Village Hall	Gymnastics
Middlezoy Village Hall	Gymnastics, Martial Arts
Bawdrip Parish Hall	Gymnastics
Kingsmoor Primary School	Basketball, Football (Youth), Gymnastics, Netball
East Bridgwater Community School	Badminton, Basketball, Football (5-a-side), Football x2, Football (Youth), Gym, Gymnastics, Hockey, Squash x4
Moorland & District Village Hall	Gymnastics, Martial Arts
Othery Village Hall	Bowling
Lyng Village Hall	Gymnastics
Chilton Trinity Village Hall	Gymnastics
North Newton Village Hall	Gymnastics
Thurluxton Village Hall	Gymnastics, Martial Arts
Bridgwater Town Hall	Gymnastics
Sedgemoor Manor Community Nursery and Infant School	Athletics, Basketball, Football (Youth), Gymnastics, Netball
St Joseph's Roman Catholic Primary School	Athletics, Basketball, Gymnastics, Netball, Swimming
Haygrove School	Athletics, Badminton x3, Basketball x3, Football, Gym, Gymnastics, Hockey, Netball x3, Rugby, Tennis x2
St Mary's Church of England Primary School	Athletics, Football (Youth, Gymnastics, Netball
North Petherton Community Junior School	Athletics, Cricket, Gymnastics

Name	Sport
Wembdon St George's Primary School	Athletics, Gymnastics, Netball, Tennis
Robert Blake Science College	Athletics, Badminton x4, Basketball x3, Cricket x1, Football x2, Gym, Gymnastics, Hockey, Netball x2, Rugby x2, Tennis x3
North Petherton Community Centre	Gymnastics, Martial Arts
Durleigh Reservoir	Fishing, Sailing
Victoria Park	Football, Skate Park, Tennis x2
Church Road Play Area Wembdon	Basketball, Football
Eastover Park	Football, Skate Park
Ansons Way Play Area	Football
Whitfield Road Play Area	Basketball
Gloucester Road Play Area	Basketball
Crowpill Lane Play Area	Football
Dunwear Ponds	Fishing
Fore Street	Basketball, Football
North Lane Play Area	Basketball, Football (5-a-side)
Victoria Park Bowling Green	Bowling
Wembdon Cricket Club	Cricket, Football x2
Furze Close Cricket Pitch	Cricket
Middlezoy Sports Field	Basketball, Cricket, Football
Mansfield Park	Football
Parkersfield Close Sports Field	Football x2, Tennis x2
Cheer Lane Playing Field	Basketball, Cricket, Football
Bridgwater College Campus	Badminton x4, Basketball x3, Football (5-a-side) x3, Football x 2, Gym, Hockey
Bridgwater Rugby Club	Rugby x2
Bridgwater Town FC	Football
Bridgwater Cricket Club	Cricket x2
Bridgwater Bowling Club	Bowling x2
Bridgwater Sports and Social Club	Bowling, Cricket, Football (5-a-side), Football x2
Bridgwater YMCA	Basketball, Football (5-a-side), Football, Gymnastics, Martial Arts, Netball, Tennis x2
Eastover Park Bowling Club	Bowling
Eastover Tennis Centre	Tennis x4
Morgains Rugby Club	Football, Rugby
North Petherton Bowling Green	Bowling x2
North Petherton Cricket Club	Cricket

b) Demand for Facilities

9E.8.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 683 non-home-based construction workers on average and 1,422 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.12: Sport England Sports Facilities Calculator Output: Bridgwater Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	6.55	13.63	8.86
	Lanes	0.12	0.26	0.17
	Pools	0.03	0.06	0.04
Halls	**Courts**	0.23	0.49	0.32
	Halls	0.06	0.12	0.08
Indoor Bowls	**Rinks**	0.03	0.07	
	Centres	0.01	0.01	
Synthetic Pitches	**Pitches**	0.04	0.07	

9E.8.5 The above table outlines demand for additional sports facilities, amounting to 0.04 swimming pools, 0.08 sports halls, 0.07 bowling rinks and 0.07 synthetic turf pitches. At present in the Bridgwater ward cluster, there is a lack of swimming facilities provision, although there is good provision of indoor and outdoor sports facilities, notably at East Bridgwater Sports Centre, Bridgwater College and Chilton Trinity. In addition the proposed BRI-A accommodation campus will include the provision of sports pitches and a 20-station fitness suite, and there will be a new indoor swimming pool at Chilton Trinity.

9E.9 Hinkley Point/Stogursey Ward Cluster

9E.9.1 The Hinkley Point/Stogursey ward cluster, covers the ward which contains the proposed Hinkley Point C development.

a) Existing Facilities

9E.9.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.6**):

Table A9E.13: Sports Facilities in the Hinkley Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
HP1	Holford Cricket Club	Outdoor	1 cricket pitch not floodlit
HP2	Kilve Cricket Club	Outdoor	1 cricket pitch not floodlit

9E.9.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.7**).

Table A9E.14: Sports Facilities in the Hinkley Ward Cluster (ARUP Audit, 2010)

Code	Name	Name
HPa	Stogursey Victory Hall	Basketball, Football (5-a-side), Football, Gymnastics
HPb	Stogursey Primary School	Gymnastics, Netball
HPc	Stogursey Youth Club	Gymnastics
HPd	Holford Village Hall	Gymnastics, Martial Arts
HPe	Stogursey Church Rooms	Gymnastics, Martial Arts
HPf	Kilve Village Hall	Gymnastics, Martial Arts
HPg	Holford Play Area and MUGA	Basketball, Football (5-a-side) (MUGA)
HPh	Kilve Cricket Club	Cricket
HPi	Holford Cricket Ground	Cricket

b) Demand for Facilities

9E.9.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 248 non-home-based construction workers on average and 516 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.15: Sport England Sports Facilities Calculator Output: Hinkley Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	2.38	4.95	3.22
	Lanes	0.04	0.09	0.06
	Pools	0.01	0.02	0.02
Halls	**Courts**	0.09	0.18	0.12
	Halls	0.02	0.04	0.03
Indoor Bowls	**Rinks**	0.01	0.02	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.01	0.03	

9E.9.5 The above table outlines demand for additional sports facilities, amounting to 0.02 swimming pools, 0.03 sports halls, 0.02 bowling rinks and 0.03 synthetic turf pitches. At present in the Hinkley ward cluster, there is a lack of formal sports facilities due to few large settlements in the area. The provision of a new accommodation campus would include sports pitches and a 20-station health and fitness suite to cater for additional demand.

9E.10 Taunton Ward Cluster

9E.10.1 The Taunton ward cluster, covers the urban area of Taunton and surrounding areas of Bishop's Lydeard and Kingston St Mary.

a) Existing Facilities

9E.10.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.8**):

Table A9E.16: Sports Facilities in the Taunton Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
TA1	Bishops Lydreard Cricket Club	Outdoor	
TA2	Cedar Falls Health Spa	Both	9 hole golf course, 1 leisure pool, 1 lido
TA3	Bishops Lydeard AFC	Outdoor	4 pitches (3 full size football, 1 junior football)
TA4	Kingston St Mary Village Hall	Indoor	1 badminton court
TA5	Wellsprings Leisure Centre	Indoor	6 badminton courts
TA6	The Taunton Academy	Outdoor	2 full size football pitches
TA7	Taunton Green Playing Fields	Outdoor	4 pitches (1 full size football, 2 junior football, 1 cricket pitch)
TA8	Cotford St Luke Playing Field	Outdoor	
TA9	Norton Fitzwarren Playing Field	Outdoor	2 full size football pitches
TA10	Bishops Hull Playing Field	Outdoor	2 pitches (1 full size football, 1 cricket pitch)
TA11	Trull Cricket Club	Outdoor	1 cricket pitch not floodlit
TA12	Queens College Sports Centre	Both	15 pitches, 4 badminton courts, 4 lane swimming pool, 2 sand-based pitches)
TA13	Galmington Playing Fields	Outdoor	3 pitches (1 full-size football, 2 junior football)
TA14	Somerset College Of Arts And Technology	Both	1 full size football pitch, 4 badminton court
TA15	The Castle School	Outdoor	6 pitches
TA16	Castle Sports Centre	Both	6 lane athletics track, 4 badminton court, 1 rubber crumb pile 3G pitch)
TA17	Staplegrove Sports Ground	Outdoor	2 pitches (1 full size football, 1 cricket pitch)
TA18	Corkscrew Lane Playing Fields	Outdoor	2 full size football pitches
TA19	Taunton Vale Sports Club	Both	2 cricket pitches, 1 sandbased pitch

Code	Name	Type	Facilities
TA20	Taunton School Playing Fields	Outdoor	9 pitches inc rugby, hockey, cricket and 1 sandbased astro
TA21	Taunton School Sports Club	Both	5 pitches inc cricket, hockey, rugby, 5 badminton courts,5 lane swimming pool
TA22	Taunton Swimming Pool	Indoor	6 lane swimming pool
TA23	St James Street Baths	Indoor	2 pools - 1 main and 1 learner/teaching/training pool
TA24	Esporta Health And Fitness	Indoor	n/a
TA25	Taunton Bowling Club	Indoor	3 rinks
TA26	Taunton Dean Cricket Club	Outdoor	1 cricket pitch not floodlit
TA27	Wyvern Club	Outdoor	3 pitches (1 full-size football, 1 senior rugby union, 1 cricket)
TA28	Bishop Fox's School	Both	9 pitches inc rugby, hockey, cricket, football
TA29	Richard Huish College	Indoor	4 badminton courts
TA30	Kings College	Both	5 badminton courts, 6 lane swimming pool, 1 rubber crumb pile pitch
TA31	Kings College Astroturf Pitch	Outdoor	1 sand-based astro
TA32	Spirit Health Club	Indoor	4 lane swimming pool
TA33	Hamilton Gault Playing Field	Outdoor	4 pitches (2 full size football, 1 junior football, 1 cricket pitch)
TA34	Taunton Town Football Club	Outdoor	1 full size football pitch
TA35	Victoria Park Playing Fields	Outdoor	4 pitches (3 full size football, 1 cricket pitch)
TA36	Hermes Health And Fitness Studio	Indoor	n/a
TA37	The Taunton Academy 2	Indoor	1 badminton court
TA38	Priorswood Playing Field	Outdoor	4 pitches (2 full size football, 1 junior football, 1 cricket pitch)
TA39	Priorswood Playing Field (East)	Outdoor	1 full size football pitch
TA40	Taunton Rugby Club	Outdoor	3 senior rugby union pitches
TA41	Heathfield Community School	Both	4 badminton courts, 1 sand-based pitch
TA42	West Monkton Cricket Club	Outdoor	1 cricket pitch not floodlit
TA43	Creech St Michael Recreation Ground	Outdoor	1 full size football pitch

9E.10.3 The Arup Sports Facilities audit does not cover areas outside of West Somerset and Sedgemoor.

b) Demand for Facilities

9E.10.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 174 non-home-based construction workers on average and 362 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.17: Sport England Sports Facilities Calculator Output: Taunton Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	1.67	3.47	2.26
	Lanes	0.03	0.07	0.04
	Pools	0.01	0.02	0.01
Halls	**Courts**	0.06	0.12	0.08
	Halls	0.01	0.03	0.02
Indoor Bowls	**Rinks**	0.01	0.02	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.01	0.02	

The above table outlines demand for additional sports facilities, amounting to 0.01 swimming pools, 0.02 sports halls, 0.02 bowling rinks and 0.02 synthetic turf pitches. At present in the Taunton ward cluster, there is a good provision of indoor and outdoor sports pitches, halls and bowling facilities, along with a 6-lane swimming pool

9E.11 Burnham / Highbridge Ward Cluster

9E.11.1 The Burnham / Highbridge ward cluster includes the coastal settlements of Highbridge and Burnham-on-Sea to the north-east of Bridgwater.

a) Existing Facilities

9E.11.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.9**):

Table A9E.18: Sports Facilities in the Burnham/Highbridge Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
BH1	ISLE OF WEDMORE GOLF CLUB	Outdoor	18 Hole Standard Golf Course
BH2	WEDMORE RECREATION GROUND	Outdoor	1 Cricket Pitch, 1 Football Pitch, 1 Junior Football Pitch
BH3	HUGH SEXEY CHURCH OF ENGLAND MIDDLE SCHOOL	Indoor	1 Badminton Court
BH4	PRIORY MARK COLLEGE	Indoor	4 Badminton Courts

Code	Name	Type	Facilities
BH5	PRIORY MARK COLLEGE PITCHES	Outdoor	1 Cricket Pitch, 1 Football Pitch, 2 Junior Rugby Pitches
BH6	MARK CRICKET CLUB AND FOOTBALL FIELD	Outdoor	1 Cricket Pitch, 1 Junior Football Pitch
BH7	EAST HUNTSPILL RECREATION GROUND	Outdoor	1 Cricket Pitch, 1 Football Pitch
BH8	EAST HUNTSPILL CRICKET GROUND	Outdoor	1 Cricket Pitch
BH9	HIGHER PLAYING FIELD WOOLAVINGTON	Outdoor	1 Football Pitch
BH10	R M SMITH PLAYING FIELD	Outdoor	1 Football Pitch
BH11	PURITON PLAYING FIELDS	Both	1 Cricket Pitch, 1 Football Pitch, 2 Bowls Rinks
BH12	PAWLETT PLAYING FIELD	Outdoor	1 Cricket Pitch, 1 Football Pitch, 1 Junior Football Pitch
BH13	THE WAR MEMORIAL GROUND	Outdoor	2 Cricket Pitch, 1 Football Pitch, 1 Junior Football Pitch, 1 Rounders Pitch
BH14	LYMPSHAM SPORTS CLUB	Outdoor	1 Cricket Pitch
BH15	BURNHAM AND BERROW GOLF CLUB	Outdoor	18 Hole Standard Golf Course, 9 Hole Standard Golf Course
BH16	BURNHAM ASSOCIATION SPORTS CLUB	Outdoor	1 Cricket Pitch, 1 Football Pitch, 2 Junior Rugby Pitches, 3 Senior Rugby Pitches
BH17	BURNHAM ON SEA SWIM AND SPORTS ACADEMY	Indoor	4 Lane 25m Swimming Pool
BH18	FIT 4 ALL HEALTH AND FITNESS STUDIO	Indoor	60 Stations
BH19	FUSION LEISURE CENTRE	Indoor	21 Stations, 15m Swimming Pool
BH20	BURNHAM GOLF RANGE	Outdoor	Driving Range
BH21	HIGHBRIDGE RECREATION GROUND	Outdoor	1 Football Pitch
BH22	THE KING ALFRED SCHOOL	Outdoor	1 Cricket Pitch, 2 Football Pitches, 1 Rounders Pitch, 2 Senior Rugby Pitches
BH23	KING ALFRED SPORTS CENTRE (HIGHBRIDGE)	Both	26 Stations, 4 Badminton Courts, 1 Floodlit Synthetic Pitch
BH24	BURNHAM ROAD PLAYING FIELD	Outdoor	4 Football Pitches, 1 Junior Football Pitch
BH25	RED ROAD PLAYING FIELDS	Outdoor	3 Football Pitches, 1 Junior Football Pitch
BH26	BREAN GOLF CLUB	Outdoor	1 Standard, 1 Par3

9E.11.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.10**).

Table A9E.19: Sports Facilities in the Burnham/Highbridge Ward Cluster (ARUP Audit, 2010)

Code	Name	Facilities
BHa	Puriton Village Hall	Martial Arts
BHb	Mark Village Hall	Bowling, Gymnastics
BHc	Woolavington Village Hall	Gymnastics, Martial Arts
BHd	Woolavington Primary School	Athletics, Basketball, Football (Youth), Gymnastics
BHe	Puriton Primary School	Football (Youth), Gymnastics, Netball
BHf	Edington Village Hall	Gymnastics
BHg	Cossington Village Hall	Gymnastics
BHh	Burtle Village Hall	Gymnastics, Martial Arts
BHi	St Andrew's Church of England School	Athletics, Basketball, Football (Youth), Gymnastics, Netball
BHj	St Joseph's Primary School	Football (Youth), Gymnastics
BHk	East Huntspill Village Hall	Gymnastics
BHl	Watchfield Hall	Gymnastics
BHm	Brent Knoll Parish Hall	Gymnastics
BHn	East Brent Village Hall	Bowling, Gymnastics, Martial Arts
BHo	Manor Hall	Gymnastics
BHp	Catcott Primary School	Football (5-a-side), Football (Youth), Gymnastics
BHq	Wedmore Village Hall	Badminton, Gymnastics
BHr	Wedmore Primary School	Athletics, Football (Youth), Gymnastics, Swimming
BHs	Brent Knoll Primary School	Athletics, Football (Youth), Gymnastics, Netball
BHt	East Brent C of E Primary School	Gymnastics
BHu	The King Alfred Secondary School	Athletics, Badminton x3, Basketball x3, Cricket, Football, Gymnastics, Hockey, Netball x3, Rugby, Tennis x11
BHv	St John's Church of England Junior School	Athletics, Cricket, Gymnastics
BHw	Beechfield Infant School	Athletics, Gymnastics
BHx	Pawlett Primary School	Athletics, Football (Youth), Gymnastics
BHy	Mark College	Athletics, Badminton x3, Basketball x2, Cricket x1, Football x3, Gymnastics, Rugby x3, Tennis x3
BHz	Theale Village Hall	Gymnastics
BHaa	Blackford Village Hall	Gymnastics, Martial Arts
BHbb	Pawlett Village Hall	Gymnastics
BHcc	Hugh Sexey Middle School	Athletics x2, Basketball, Cricket x2, Football x2, Gym, Gymnastics, Hockey x2, Netball, Rugby x2, Swimming, Tennis x3
BHdd	Burnham on Sea Community Centre	Gym, Hockey

Code	Name	Facilities
BHee	Highbridge Community Hall	Gym, Hockey
BHff	The Princess Hall	Gymnastics, Martial Arts
BHgg	Puriton Sports Centre	Bowling, Martial Arts
BHhh	Burnham-on-Sea Swimming Centre	Swimming
BHii	Riverton Road Play Area	Basketball
BHjj	Woolavington Play Area	Football (Youth)
BHkk	Woolavington Playing Field	Football, Skate Park
BHll	Rosewood Close Play Area	Football (Youth)
BHmm	Winchester Road Play Area	Basketball, Football (Youth)
BHnn	Apex Park	Fishing, Football, Skate Park
BHoo	East Brent Village Green	Football (Youth)
BHpp	Westfield Road Play Facility	Tennis x2
BHqq	Mark Village Hall Fields	Basketball, Football
BHrr	New Road Playing Field	Basketball, Cricket, Football x2
BHss	Burnham-on-Sea Beach	Sailing, Swimming
BHtt	Haven Caravan Park at Burnham	Football (5-a-side) x2, Sailing, Swimming, Tennis x2
BHuu	Middlemoor Waterpark	Sailing
BHvv	Puriton Playing Fields	Football
BHww	West Huntspill Memorial Field	Cricket x2, Football (5-a-side), Football
BHxx	Pawlett Sports Field	Basketball, Football x2, Skate Park
BHyy	Cassis Close Sports Field	Basketball, Football (5-a-side), Football x4
BHzz	Brent Knoll Tennis Club	Tennis x2
BHaaa	Isle of Wedmore Bowls Green	Bowling
BHbbb	Wedmore Playing Field	Cricket, Football x3
BHccc	Wedmore Tennis Club	Tennis x3
BHddd	Mark Moore Bowling Green	Bowling
BHeee	mark cricket field	Cricket
BHfff	Merry Lane Cricket Field	Cricket
BHggg	Southwell Gardens	Football (5-a-side), Football
BHhhh	Lympsham Sports Field	Cricket, Tennis x2
BHiii	Burnham-on-Sea Bowling Club	Bowling
BHjjj	Burnham and Berrow Golf Club	Golf
BHkkk	Isle of Wedmore Golf Club	Golf
BHlll	BASC ground	Cricket, Football (Youth) x2, Rugby x4
BHmmm	The Avenue Tennis Club	Tennis x8
BHnnn	Burnham on Sea BMX Track	Squash(?)
BHooo	Brean Village Hall	Martial Arts

Code	Name	Facilities
BHppp	Berrow Church of England Primary School	Athletics, Football (Youth), Gymnastics, Football
BHqqq	Berrow Village Green	Football
BHrrr	Brean Leisure Park	Swimming
BHsss	Brean Beach	Swimming
BHttt	Berrow Parish Playing Fields	Basketball (MUGA), Football x6
BHuuu	Brean Golf Club	Golf

b) Demand for Facilities

9E.11.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 181 non-home-based construction workers on average and 378 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.20: Sport England Sports Facilities Calculator Output: Burnham / Highbridge Ward Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	1.74	3.62	2.36
	Lanes	0.03	0.07	0.04
	Pools	0.01	0.02	0.01
Halls	**Courts**	0.06	0.13	0.08
	Halls	0.02	0.03	0.02
Indoor Bowls	**Rinks**	0.01	0.02	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.01	0.02	

9E.11.5 The above table outlines demand for additional sports facilities, amounting to 0.01 swimming pools, 0.02 sports halls, 0.02 bowling rinks and 0.02 synthetic turf pitches. At present in the Burnham / Highbridge ward cluster, there is a wide provision of indoor and outdoor sports pitches including cricket and football provision, halls, athletics and bowling facilities, although a lack of formal indoor swimming.

9E.12 Glastonbury Ward Cluster

9E.12.1 The Glastonbury ward cluster includes the urban area of Glastonbury and surrounding villages and countryside, including Street and Somerton.

a) Existing Facilities

9E.12.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.11**):

Table A9E.21: Sports Facilities in the Glastonbury Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
GL1	LONG SUTTON GOLF CLUB	Outdoor	1 Standard Golf Course, Driving Range
GL2	LONG SUTTON	Outdoor	1 Cricket Pitch, 1 Football Pitch
GL3	SOMERTON SPORTS FIELD	Outdoor	1 Cricket Pitch, 3 Football Pitches, 1 Junior Football Pitch, 1 Rounders Pitch, 1 Rugby Pitch
GL4	PITNEY PLAYING FIELD	Outdoor	1 Cricket Pitch, 1 Football Pitch
GL5	HIGH HAM PLAYING FIELD	Outdoor	1 Junior Football Pitch
GL6	COMPTON DUNDON CRICKET CLUB	Outdoor	1 Cricket Pitch
GL7	MILLFIELD SENIOR SCHOOL SPORTS FACILITIES	Both	1 6-Lane Athletics Track, 6 Cricket Pitches, 10 Football Pitches, 7 Rugby Pitches, 3 Indoor Tennis Courts, 5 Badminton Courts, 1 8-Lane 50m Swimming Pool, 1 Floodlit Synthetic Pitch
GL8	STRODE COLLEGE SPORTS CENTRE	Both	1 Football Pitch, 4 Badminton Courts, 1 Floodlit 3G Synthetic Pitch
GL9	CRISPIN COMMUNITY SCHOOL	Both	2 Football Pitches, 2 Hockey Pitches, 1 Rounders Pitch, 2 Rugby Pitches, 5 Badminton Courts
GL10	STRODE SWIMMING POOL	Indoor	34 Stations, 6 Lane 33.3m Swimming Pool
GL11	GREENBANK SWIMMING POOL	Outdoor	1 32m Lido
GL12	ELMHURST JUNIOR SCHOOL	Outdoor	1 Cricket Pitch, 1 Junior Football Pitches, 3 Rounders Pitches
GL13	VICTORIA FIELD SPORTS AND SOCIAL CLUB	Both	1 Cricket Pitch, 1 Football Pitch, 2 Rounders Pitches
GL14	BROOKSIDE COMMUNITY PRIMARY SCHOOL	Outdoor	1 Junior Football Pitch
GL15	SHAPWICK SCHOOL (SHAPWICK SENIOR)	Indoor	3 Badminton Courts
GL16	ASHCOTT AND SHAPWICK CRICKET CLUB	Outdoor	1 Cricket Pitch
GL17	MEARE & WEST HAY PLAYING FIELDS	Outdoor	1 Cricket Pitch, 2 Football Pitches
GL18	WALTON VILLAGE HALL	Both	1 Cricket Pitch, 1 Football Pitch, 1 Badminton Court
GL19	TOR LEISURE CENTRE	Outdoor	2 Cricket Pitches, 3 Football Pitches, 8 Junior Football Pitches, 6 Rounders Pitches

Code	Name	Type	Facilities
GL20	TRAIN STATION HEALTH AND FITNESS (GLASTONBURY)	Indoor	61 Stations

9E.12.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.12**).

Table A9E.22: Sports Facilities in the Glastonbury Ward Cluster (ARUP Audit, 2010)

Code	Name	Facilities
GLa	Ashcott Village Hall	Badminton, Bowling, Martial Arts
GLb	Ashcott Primary School	Athletics, Gymnastics
GLc	Shapwick Village Hall	Gymnastics
GLd	Shapwick School	Athletics, Badminton, Basketball, Cricket, Football x2, Gymnastics, Rugby x2, Tennis
GLe	Ashcott Playing Field	Football x2, Tennis
GLf	Ashcott and Shapwick Cricket Ground	Cricket

b) Demand for Facilities

9E.12.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 39 non-home-based construction workers on average and 81 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.23: Sport England Sports Facilities Calculator Output: Glastonbury Ward Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	0.78	0.37	0.50
	Lanes	0.01	0.01	0.01
	Pools	0.00	0.00	0.00
Halls	**Courts**	0.03	0.01	0.02
	Halls	0.01	0.00	0.00
Indoor Bowls	**Rinks**	0.00	0.00	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.00	

9E.12.5 The above table outlines demand for additional sports facilities, amounting to 0.00 swimming pools, 0.00 sports halls, 0.00 bowling rinks and 0.00 synthetic turf pitches. At present in the Glastonbury ward cluster, there is a good provision of indoor and outdoor sports pitches, halls and bowling facilities, and potentially accessible swimming facilities.

9E.13 Watchet /Williton Cluster

9E.13.1 The Watchet / Williton ward cluster includes the urban area of Glastonbury and surrounding villages and countryside, including Street and Somerton.

a) Existing Facilities

9E.13.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.13**):

Table A9E.24: Sports Facilities in the Watchet/Williton Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
WW2	Watchet War Memorial Ground	Outdoor	3 pitches (1 full size football, 1 junior football, 1 cricket pitch)
WW3	Watchet Indoor Bowling Club	Indoor	1 rink
WW4	The Knights Templar School	Indoor	Learning/teaching/training
WW5	Danesfield Coe Community Middle School	Both	3 grass pitches (1 junior football, 1 junior rugby union, 1 cricket pitch) and 1 badminton court
WW6	Williton Memorial Ground	Outdoor	2 pitches (both full size football)
WW7	Stogumber Cricket Club	Outdoor	1 cricket pitch not floodlit
WW8	Crowcombe Cricket Club	Outdoor	2 pitches (1 junior football, 1 cricket pitch)
WW9	Roadwater Cricket Club	Outdoor	1 cricket pitch not floodlit
WW10	Hoburne Blue Anchor Caravan Park	Outdoor	Leisure pool

9E.13.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.14**).

Table A9E.25: Sports Facilities in the Watchet/Williton Ward Cluster (ARUP Audit, 2010)

Code	Name	Facilities
WWa	East Quantoxhead Village Hall	Gymnastics
WWb	Washford Memorial Hall	Gymnastics, Martial Arts
WWc	Old Cleeve Community Hall	Badminton, Bowling
WWd	Stogumber Village Hall	Bowling, Football (Youth), Gymnastics
WWe	Sandford Brett Village Hall	Gymnastics
WWf	Watchet Youth Club	Football (Youth), Gymnastics
WWg	Danesfield Church of England Middle School	Athletics x2, Basketball, Football (5-a-side), Football, Gym, Gymnastics, Hockey, Martial Arts, Netball x3, Tennis x4
WWh	Bicknoller Village Hall	Gymnastics, Martial Arts
WWi	St Audries Village Hall	Gymnastics, Martial Arts
WWj	Watchet Boxing Club	Boxing

WWk	Watchett Marina	Sailing
WWl	Bicknoller Play Area	Basketball, Football (5-a-side)
WWm	Williton Recreation Ground	Football
WWn	Watchett Memorial Playing Field	Basketball, Cricket, Football (5-a-side), Football x2, Tennis x2
WWo	Henry Davey Playing Field	Basketball, Football (Youth) x2, Skate Park
WWp	Watchet Bowling Green	Bowling
WWq	Kesteven Recreation Ground	Cricket x2, Tennis
WWr	Stogumber Cricket Club	Cricket
WWs	Wiliton Bowling Club	Bowling

b) Demand for Facilities

9E.13.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 72 non-home-based construction workers on average and 150 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.26: Sport England Sports Facilities Calculator Output: Watchet/ Williton Ward Cluster

Sports Facilities Calculator				
		27 Months	**64 Months**	**Permanent Equivalent**
Pools	**Area**	0.69	1.44	0.93
	Lanes	0.01	0.03	0.02
	Pools	0.00	0.01	0.00
Halls	**Courts**	0.02	0.05	0.03
	Halls	0.01	0.01	0.01
Indoor Bowls	**Rinks**	0.00	0.01	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.01	

9E.13.5 The above table outlines demand for additional sports facilities, amounting to 0.00 swimming pools, 0.01 sports halls, 0.01 bowling rinks and 0.01 synthetic turf pitches. At present in the Watchet / Williton ward cluster, there is a good provision of bowling facilities and some indoor and outdoor sports pitches / halls, but a lack of formal indoor swimming facilities.

9E.14 Cheddar Ward Cluster

9E.14.1 The Cheddar ward cluster includes the urban area of Cheddar and Axbridge and surrounding villages and countryside, and is bisected by the A38 and A371.

a) Existing Facilities

9E.14.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.15**):

Table A9E.27: Sports Facilities in the Cheddar Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
CH1	WEBBINGTON HOTEL LEISURE CLUB	Indoor	29 Stations
CH2	ALLERTON CRICKET CLUB	Outdoor	1 Cricket Pitch
CH3	CHEDDAR FOOTBALL CLUB	Outdoor	1 Football Pitch
CH4	FAIRLANDS MIDDLE SCHOOL	Both	1 Cricket Pitch, 1 Rounders Pitch
CH5	KINGS FITNESS AND LEISURE	Indoor	29 Stations
CH6	SHARPHAM ROAD PLAYING FIELDS	Outdoor	1 Cricket Pitch, 1 Football Pitch, 1 Junior Football Pitch, 1 Rugby Pitch
CH7	THE FURLONG	Outdoor	1 Football Pitch

9E.14.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.16**):

Table A9E.28: Sports Facilities in the Cheddar Ward Cluster (ARUP Audit, 2010)

Code	Name	Facilities
CHa	Shipham Village Hall	Badminton, Gymnastics, Martial arts
CHb	Axbridge Town Hall	Martial Arts
CHc	Badgworth & Biddisham Hall	Gymnastics
CHd	Cross Memorial Hall	Gymnastics
CHe	Old School Rooms Allerton	Gymnastics
CHf	Axbridge Youth Club	Basketball, Football (5-a-side)
CHg	The Kings of Wessex Community School	Athletics, Badminton x3, Cricket, Gymnastics, Hockey, Rugby
CHh	Fairlands Middle School	Athletics, Cricket, Football, Gymnastics, Netball x5, Tennis x5
CHi	Shipham Church of England First School	Athletics, Football (Youth), Gymnastics, Netball
CHj	King of Wessex Leisure Centre	Badminton x3, Basketball x3, Football (5-a-side), Gym x3, Gymnastics, Hockey, Martial Arts, Squash x2, Swimming, Tennis x4
CHk	Penn Way Recreation Ground	Football x3, Football (youth) x1
CHl	War Memorial Playing Field	Cricket, Football
CHm	Cheddar Reservoir	Fishing

Code	Name	Facilities
CHn	Cheddar Lawn Tennis Club	Tennis x4
CHo	Cheddar Valley Rugby Club	Rugby x2
CHp	Sharpham Road Playing Field	Cricket, Football x3
CHq	Cheddar FC Sports and Social	Football
CHr	Bristol Corinthian Yacht Club	Sailing
CHs	Shipham Sports Field	Football
CHt	Allerton Cricket Ground	Cricket

b) Demand for Facilities

9E.14.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 34 non-home-based construction workers on average and 70 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.29: Sport England Sports Facilities Calculator Output: Cheddar Ward Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	0.33	0.67	0.44
	Lanes	0.01	0.01	0.01
	Pools	0.00	0.00	0.00
Halls	**Courts**	0.01	0.02	0.02
	Halls	0.00	0.01	0.00
Indoor Bowls	**Rinks**	0.00	0.00	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.00	

9E.14.5 The above table outlines demand for additional sports facilities, amounting to 0.00 swimming pools, 0.00 sports halls, 0.00 bowling rinks and 0.00 synthetic turf pitches. At present in the Cheddar ward cluster, there is a good provision of sports halls, pitches and swimming, for example at King of Wessex Leisure Centre and Churchill Sports Centre.

9E.15 Somerset South Ward Cluster

9E.15.1 The Somerset South ward cluster includes the area to the south-east of Taunton, including the settlements of Wellington and Ilminster.

a) Existing Facilities

9E.15.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.17**):

Table A9E.30: Sports Facilities in the Somerset South Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
SS1	STOKE ST GREGORY PLAYING FIELD	Outdoor	1 cricket pitch not floodlit
SS2	CURRY RIVAL CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SS3	WESTFIELD RECREATION GROUND	Outdoor	2 pitches (1 full size football pitch, 1 junior football pitch)
SS4	ILTON CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SS5	FIVEHEAD PLAYING FIELD	Both	2 pitches (1 full size football pitch, 1 junior football pitch), 1 badminton court hall
SS6	GREENWAY PLAYING FIELD PAVILION	Outdoor	1 full size football pitch
SS7	TAUNTON VALE GOLF COURSE	Outdoor	1 driving range and 2 18 hole courses
SS8	SWINGRATE GOLF CENTRE	Outdoor	1 driving range and 1 par 3
SS9	STOKE ST MARY CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SS10	TAUNTON AND PICKERIDGE GOLF CLUB	Outdoor	18 hole golf course
SS11	CHURCHINFORD SPORT CLUB	Outdoor	2 pitches (1 full size football pitch, 1 cricket pitch)
SS12	PITMINSTER & ANGERSLEIGH PLAYING FIELDS	Outdoor	1 full size football pitch
SS13	SAMPFORD ARUNDEL CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SS14	DOBREE PARK	Outdoor	1 full size football pitch
SS15	BODYWISE HEALTH AND FITNESS SPA	Indoor	n/a
SS16	COURT FIELDS COMMUNITY SCHOOLS	Both	3 pitches (1 full size football, 1 junior football, 1 cricket pitch), 4 badminton court hall

Code	Name	Type	Facilities
SS17	THE PRINCESS ROYAL SPORTS COMPLEX	Both	6 badminton courts, 1 sand-based pitch
SS18	WELLINGTON RECREATION GROUND	Outdoor	2 pitches (1 full size football and 1 junior football)
SS19	WELLINGTON PLAYING FIELD	Outdoor	4 pitches (1 full size football, 1 senior rugby union, 1 junior football, 1 cricket pitch)
SS20	WELLINGTON SPORTS CENTRE	Indoor	4 badminton court hall, 6 lane swimming pool
SS21	WELLINGTON RUGBY CLUB	Outdoor	2 senior rugby union

9E.15.3 The Arup Sports Facilities audit does not cover areas outside of West Somerset and Sedgemoor.

b) Demand for Facilities

9E.15.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 27 non-home-based construction workers on average and 55 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.31: Sport England Sports Facilities Calculator Output: Somerset South Ward Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	0.26	0.53	0.34
	Lanes	0.00	0.01	0.01
	Pools	0.00	0.00	0.00
Halls	**Courts**	0.01	0.02	0.01
	Halls	0.00	0.00	0.00
Indoor Bowls	**Rinks**	0.00	0.00	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.00	

9E.15.5 The above table outlines demand for additional sports facilities, amounting to 0.00 swimming pools, 0.00 sports halls and 0.00 synthetic turf pitches. At present in the Somerset South ward cluster, there is a good level of playing pitch provision and sports halls / courts and bowling rinks, and there is a 6-lane swimming pool at Wellington Sports Centre.

9E.16 Somerset West Ward Cluster

9E.16.1 The Somerset West ward cluster includes the area to the west of Taunton, including the southern section of Exmoor National Park and small settlements including Milverton and Wiveliscombe.

a) Existing Facilities

9E.16.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.18**):

Table A9E.32: Sports Facilities in the Somerset West Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
SW1	WINSFORD VILLAGE HALL	Indoor	1 badminton court
SW3	BRIDGTOWN CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SW2	WINSFORD RECREATION GROUND	Outdoor	1 cricket pitch not floodlit
SW4	ASHBRITTLE CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SW5	KINGSMEAD COMMUNITY SCHOOL	Indoor	4 badminton courts
SW6	WIVELISCOMBE RECREATION GROUND	Both	3 pitches (1 senior rugby union, 1 junior rugby union, 1 cricket pitch) and 1 lido
SW7	BROMPTON RALPH CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SW8	LYDEARD ST LAWRENCE CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SW9	FITZHEAD CRICKET CLUB	Outdoor	1 cricket pitch not floodlit
SW10	MILVERTON RECREATION GROUNDS	Outdoor	2 pitches (1 full size football, 1 cricket pitch)
SW11	OAKE MANOR GOLF CLUB	Outdoor	Driving range and standard golf course
SW12	HILLVIEW GROUND	Outdoor	1 full size football pitch
SW13	BAGBOROUGH CRICKET CLUB	Outdoor	1 cricket pitch not floodlit

9E.16.3 The Arup Sports Facilities audit does not cover areas outside of West Somerset and Sedgemoor.

b) Demand for Facilities

9E.16.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 9 non-home-based construction workers on average and 19 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise.

Table A9E.33: Sport England Sports Facilities Calculator Output: Somerset West Ward Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	0.09	0.18	0.12
	Lanes	0.00	0.00	0.00
	Pools	0.00	0.00	0.00
Halls	**Courts**	0.00	0.01	0.00
	Halls	0.00	0.00	0.00
Indoor Bowls	**Rinks**	0.00	0.00	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.00	

The above table outlines demand for additional sports facilities, amounting to less than 0.00 swimming pools, less than 0.00 sports halls and less than 0.00 synthetic turf pitches. At present in the Somerset West ward cluster, there are several facilities that include indoor and outdoor halls and pitches, although no swimming facilities.

9E.17 Cannington Ward Cluster

9E.17.1 The Cannington ward cluster, to the south-east of Hinkley C, covers a single ward between the site and the closest large settlement of Bridgwater. It includes the smaller settlement of Cannington.

a) Existing Facilities

9E.17.2 An audit of existing sport and leisure facilities, using Sport England's Active Places website, has identified the following existing sports facilities in the area (See **Figure 2.19**):

Table A9E.34: Sports Facilities in the Cannington Ward Cluster (Sport England Active Places, 2011)

Code	Name	Type	Facilities
CA2	Over Stowey Cricket Club	Outdoor	1 cricket pitch not floodlit
CA3	Quantock Lodge	Indoor	5 badminton courts, 6 lane pool
CA4	Spaxton Village Hall Playing Field	Outdoor	3 pitches (2 full size football, 1 cricket pitch)
CA5	Enmore Park Golf Club	Outdoor	18 hole golf course
CA6	Cannington Playing Field	Outdoor	3 pitches (1 full size football, 1 senior rugby union, 1 cricket pitch)
CA7	Cannington Golf Centre	Outdoor	1 driving range and a 9 hole course

9E.17.3 In addition, the following sports facilities were identified by ARUP through their sports and leisure facilities audit (See **Figure 2.20**).

Table A9E.35: Sports Facilities in the Cannington Ward Cluster (ARUP Audit, 2010)

Code	Name	Facilities
CAa	Enmore Memorial Hall	Badminton
CAb	St Mary's Church Centre	Badminton
CAc	Nether Stowey Primary School	Football (Youth), Gym, Gymnastics
CAd	Nether Stowey Village Hall	Gymnastics
CAe	Brymore Boarding School	Basketball, Cricket, Football (5-a-side), Football x2, Gym, Hockey, Rugby x2, Swimming
CAf	Otterhampton Primary School	Football (Youth), Gymnastics, Netball
CAg	Otterhampton Village Hall	Bowling
CAh	Spaxton Church of England School	Football (Youth), Gymnastics, Netball
CAi	Cannington Youth Club	Gymnastics
CAj	Quantock Lodge Leisure Centre	Gym, Swimming
CAk	Fiddington Play Area	Football (Youth)
CAl	Spaxton Village Play Area	Cricket, Football x2, Football (Youth)
CAm	Hawkridge Reservoir	Fishing, Sailing
CAn	Cannington Play Area	Football (Youth)
CAo	Combwich Common	Football
CAp	Combwich Fishing Lake	Fishing
CAq	Over Stowey Cricket and Tennis Field	Cricket
CAr	Enmore golf club	Golf
CAs	Cannington Sports Field	Football
CAt	Cannington Pitch and Putt	Golf
CAu	Cannington Golf Course	Golf
CAv	Bridgwater College Cannington Campus	Cricket, Football x2, Rugby x2

b) Demand for Facilities

9E.17.4 Based on the latest version of the Gravity Model, the wards that make up this cluster are expected to accommodate 58 non-home-based construction workers on average and 120 non-home-based construction workers at peak. Using Sport England's Sports Facility Calculator (see main report for methodology notes), the following demands are estimated to arise:

Table A9E.36: Sport England Sports Facilities Calculator Output: Cannington Ward Cluster

Sports Facilities Calculator				
		27 Months	64 Months	Permanent Equivalent
Pools	**Area**	0.56	1.15	0.75
	Lanes	0.01	0.02	0.01
	Pools	0.00	0.01	0.00
Halls	**Courts**	0.02	0.04	0.03
	Halls	0.00	0.01	0.01
Indoor Bowls	**Rinks**	0.00	0.01	
	Centres	0.00	0.00	
Synthetic Pitches	**Pitches**	0.00	0.01	

9E.17.5 The above table outlines demand for additional sports facilities, amounting to 0.00 swimming pools, 0.01 sports halls and 0.01 synthetic turf pitches. At present in the Cannington ward cluster, there are several indoor and outdoor facilities, with potentially a lack of indoor courts and public swimming facilities.

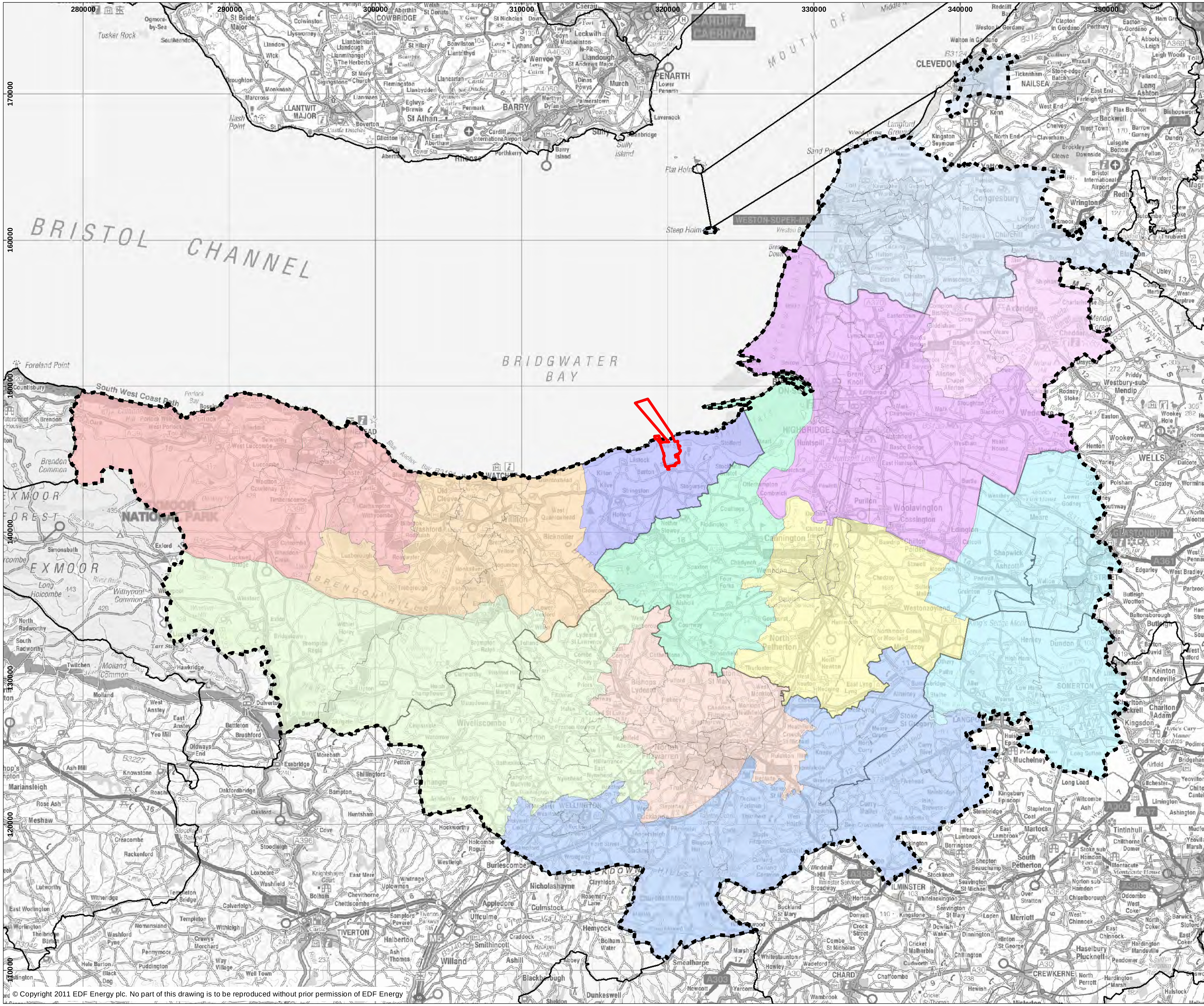
References

9E.1 Sport England. Sport England active places. (Online) Available from: http://www.activeplaces.com (Accessed 23 August 2011).

9E.2 Sport England. Sport England facilities calculator. (Online) Available from: http://www.sportengland.org/facilities_planning/planning_tools_and_guidance/sports_facility_calculator.aspx (Accessed 23 August 2011).

9E.3 ONS. Census 2001. (Online) Available from: www.ons.gov.uk (Accessed 23 August 2011).

9E.4 Experian / Sport England. Sports Market Segmentation. (Online) Available from http://segments.sportengland.org/index.aspx (Accessed 23 August 2011).



KEY

HINKLEY POINT C DEVELOPMENT SITE
60-MINUTE TRAVEL ZONE
DISTRIBUTION OF NHB WORKERS
WARD CLUSTERS
BRIDGWATER
BURNHAM AND HIGHBRIDGE
CANNINGTON
CHEDDAR AND CLEVEDON
GLASTONBURY
HINKLEY POINT
MINEHEAD
SOMERSET SOUTH
SOMERSET WEST
TAUNTON
WATCHET AND WILLITON
WESTON-SUPER-MARE
LOCAL AUTHORITIES

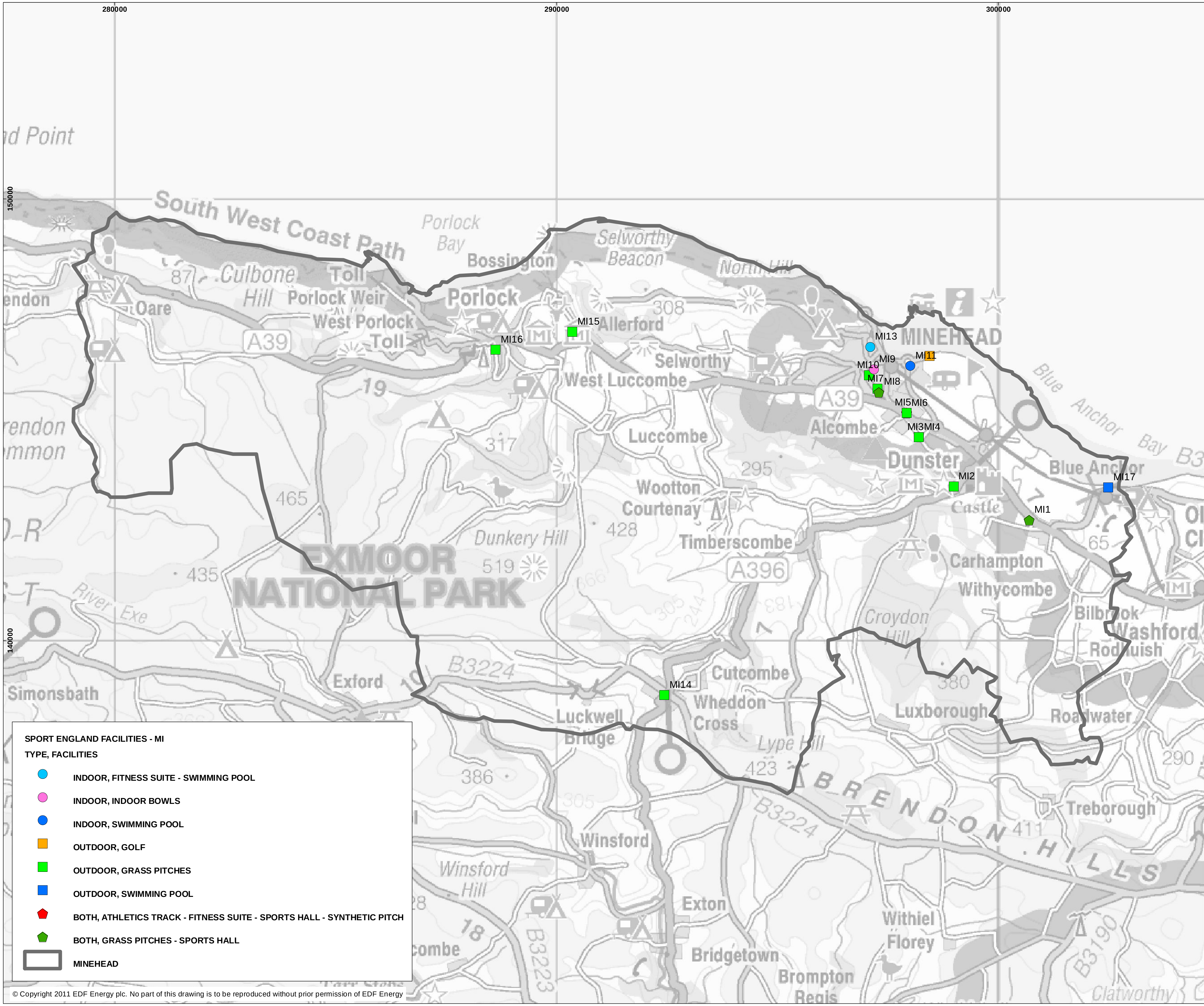
EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENT STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
DISTRIBUTION OF NON-HOME-BASED CONSTRUCTION WORKERS BY WARD CLUSTER

FIGURE NO:		REVISION:
FIGURE 1.1		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:241,800@A3

SCALE BAR: 0 3 6 9Kilometres



SPORT ENGLAND FACILITIES - MI

TYPE, FACILITIES

- INDOOR, FITNESS SUITE - SWIMMING POOL
- INDOOR, INDOOR BOWLS
- INDOOR, SWIMMING POOL
- OUTDOOR, GOLF
- OUTDOOR, GRASS PITCHES
- OUTDOOR, SWIMMING POOL
- BOTH, ATHLETICS TRACK - FITNESS SUITE - SPORTS HALL - SYNTHETIC PITCH
- BOTH, GRASS PITCHES - SPORTS HALL
- MINEHEAD

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(MINEHEAD)

FIGURE NO:		REVISION:
FIGURE 2.1		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:80,000 @ A3

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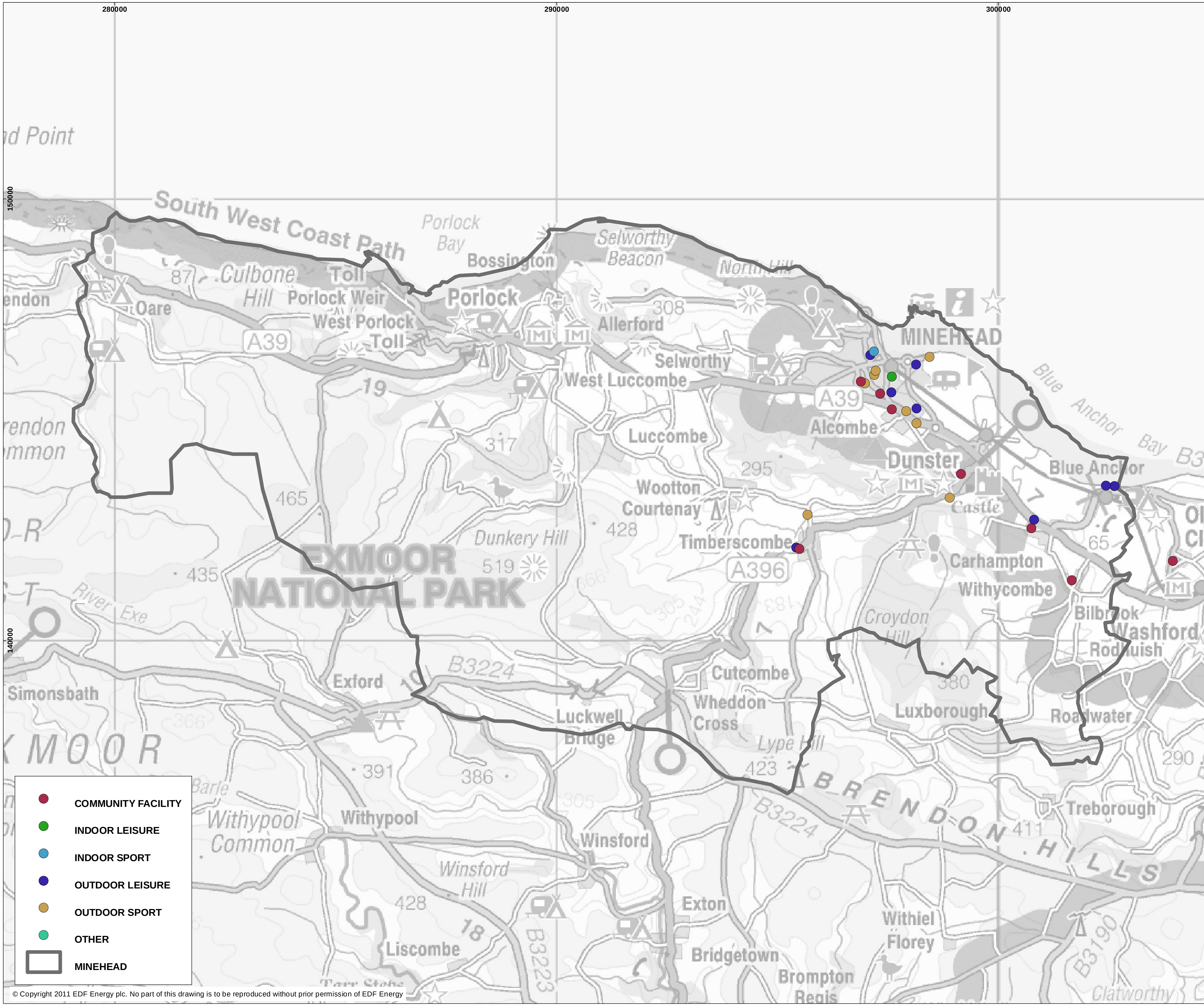

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
ARUP
FACILITIES AUDIT
(MINEHEAD)

FIGURE NO:		REVISION:
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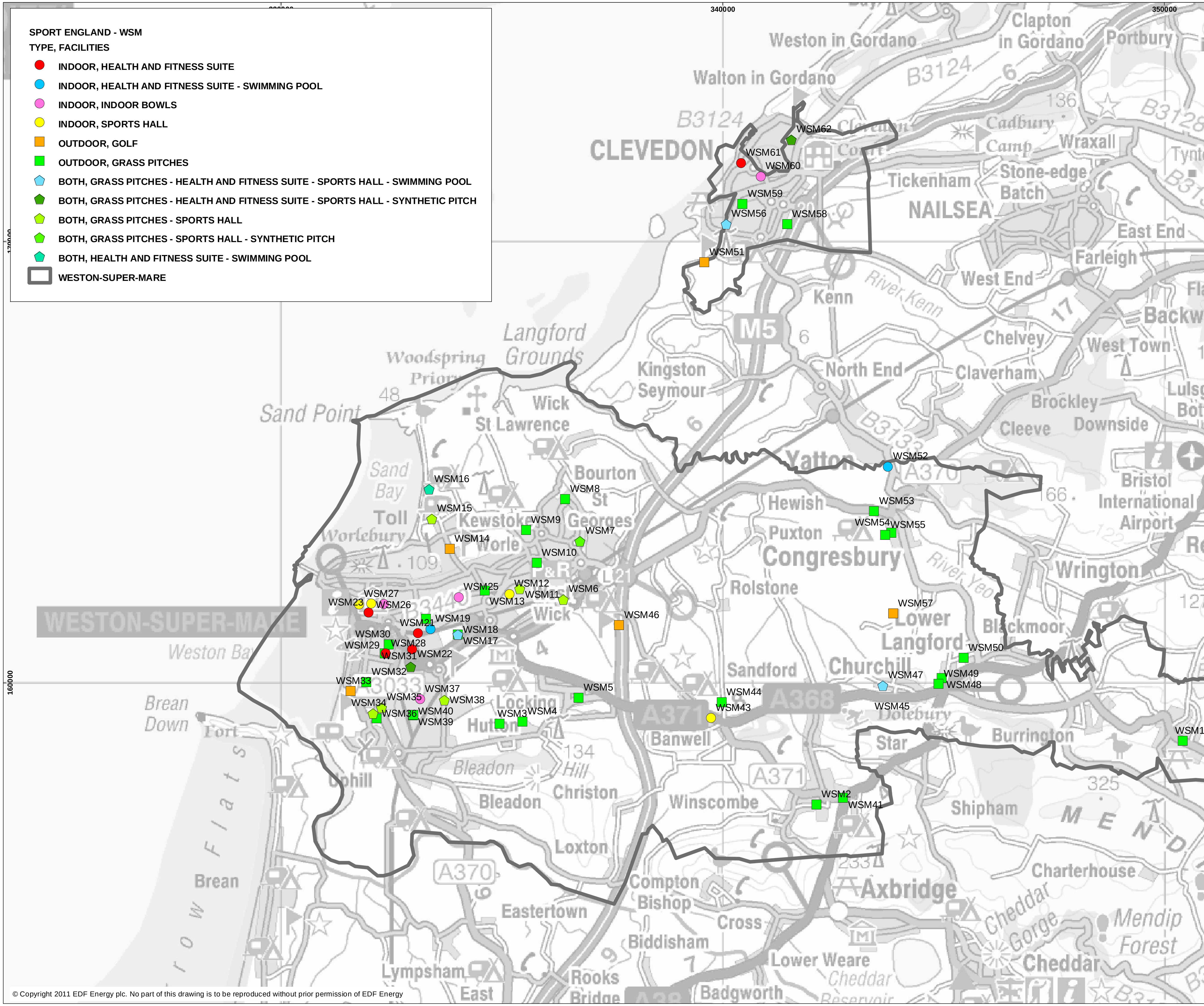

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES FACILITIES AUDIT (WESTON-SUPER-MARE)

FIGURE NO:		REVISION:
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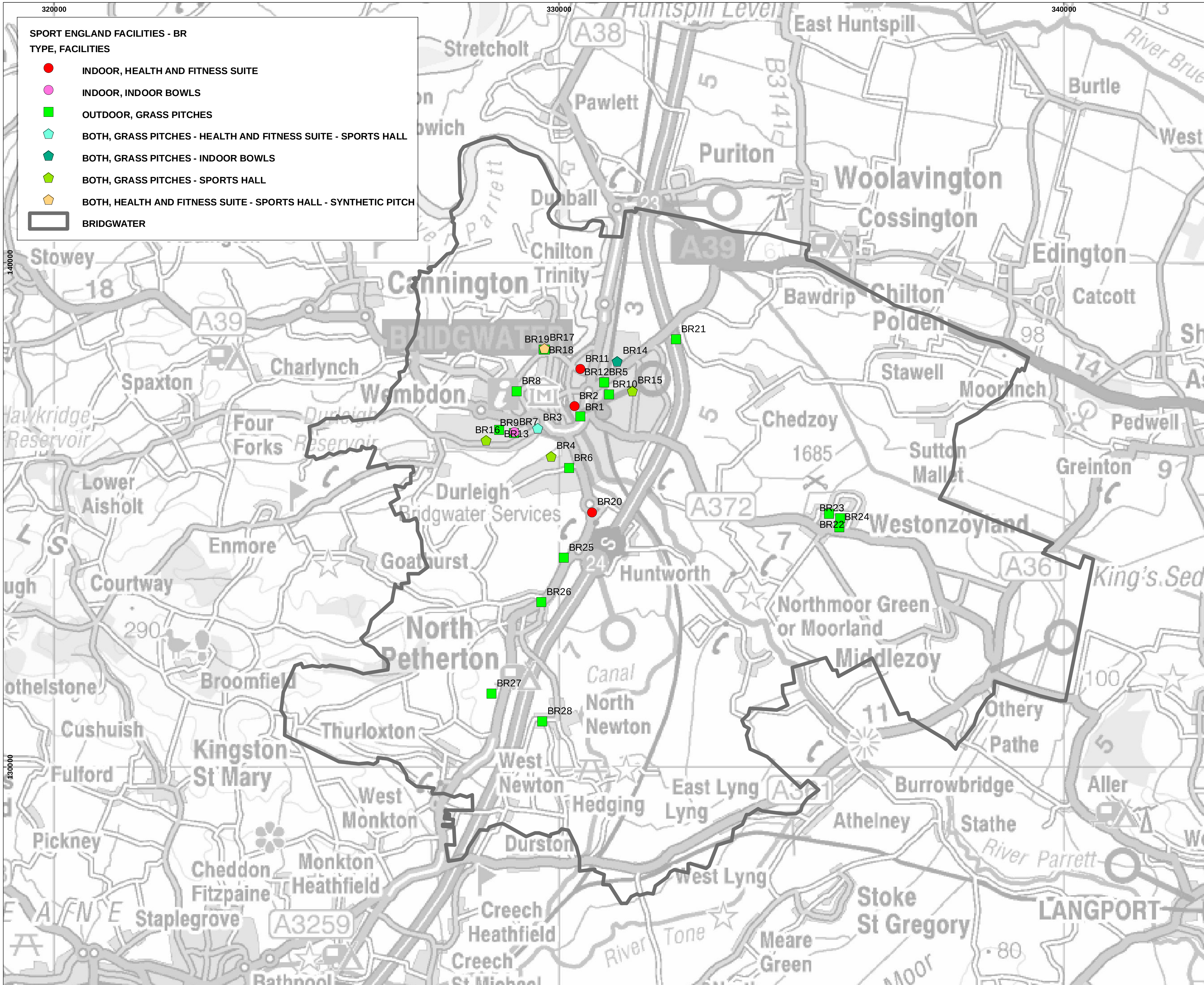

EDF ENERGY

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HINKLEY POINT C PROJECT
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(BRIDGWATER)

FIGURE NO:		REVISION:
FIGURE 2.4		01
DATE: SEPT 2011	DRAWN: M.H	SCALE: 1:70,000 @ A3

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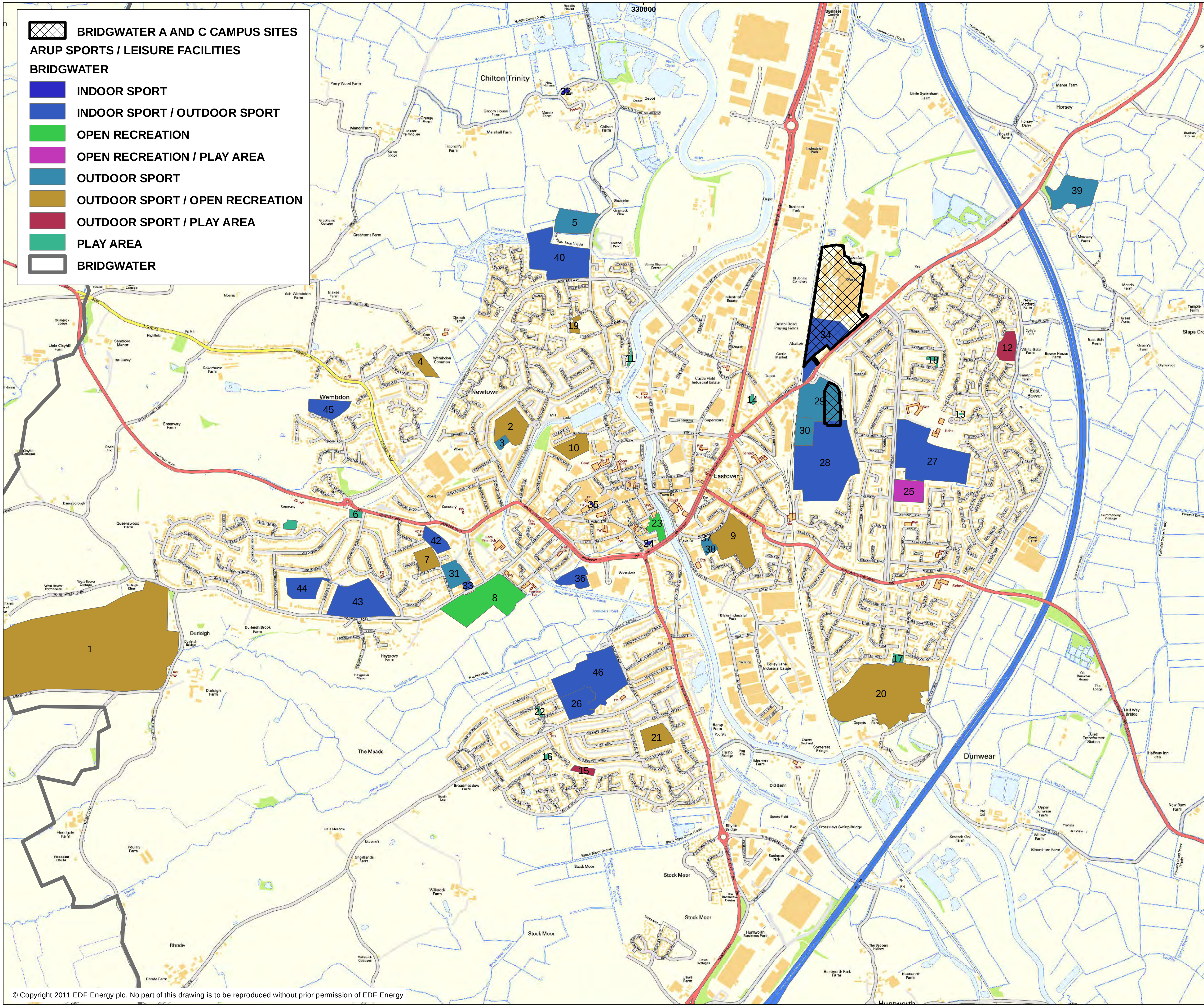

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HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
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FIGURE TITLE:
ARUP
FACILITIES AUDIT
(BRIDGWATER)

FIGURE NO:		REVISION:
FIGURE 2.5		01
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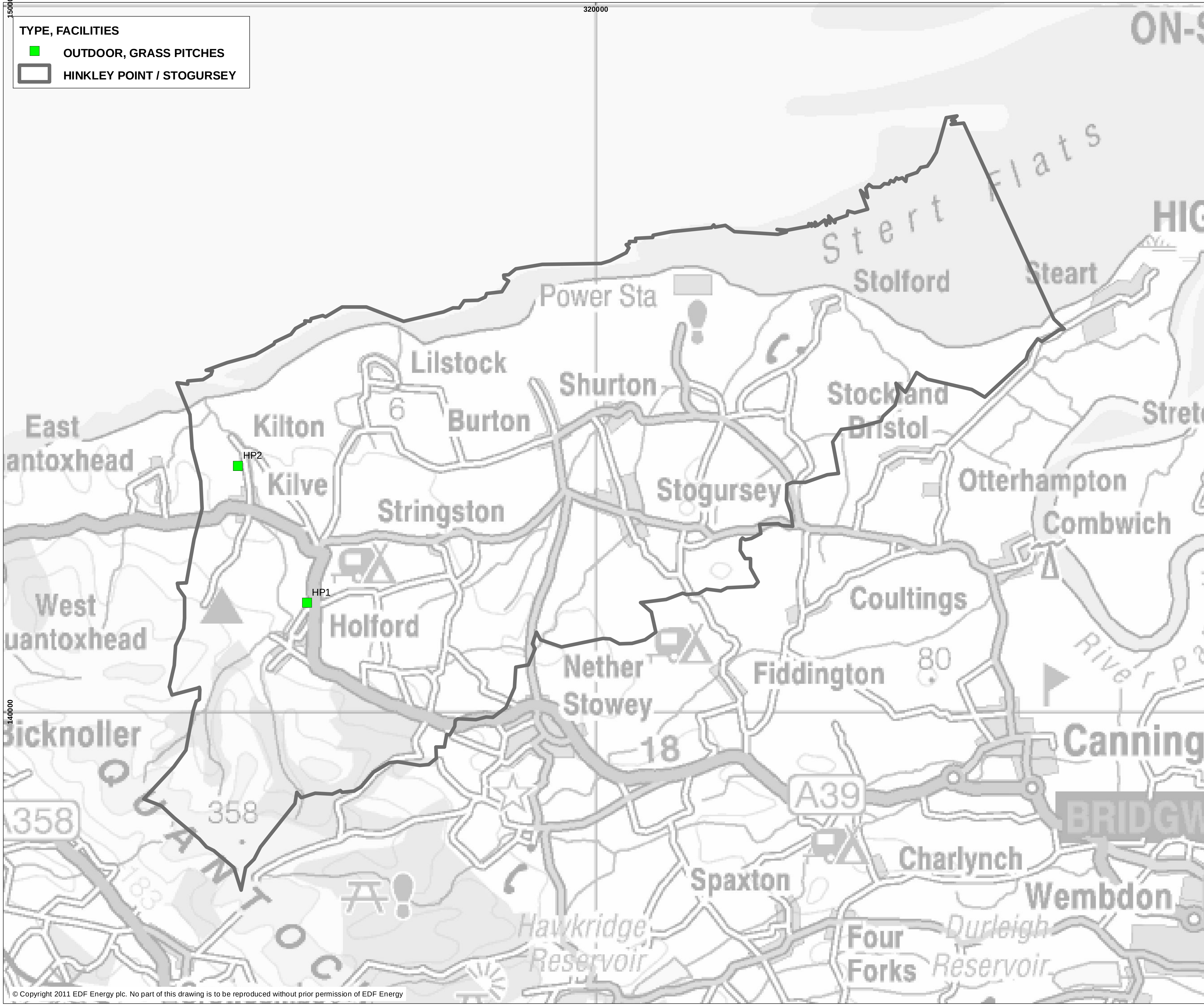

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(HINKLEY POINT/ STORGURSEY)

FIGURE NO:		REVISION:
FIGURE 2.6		01
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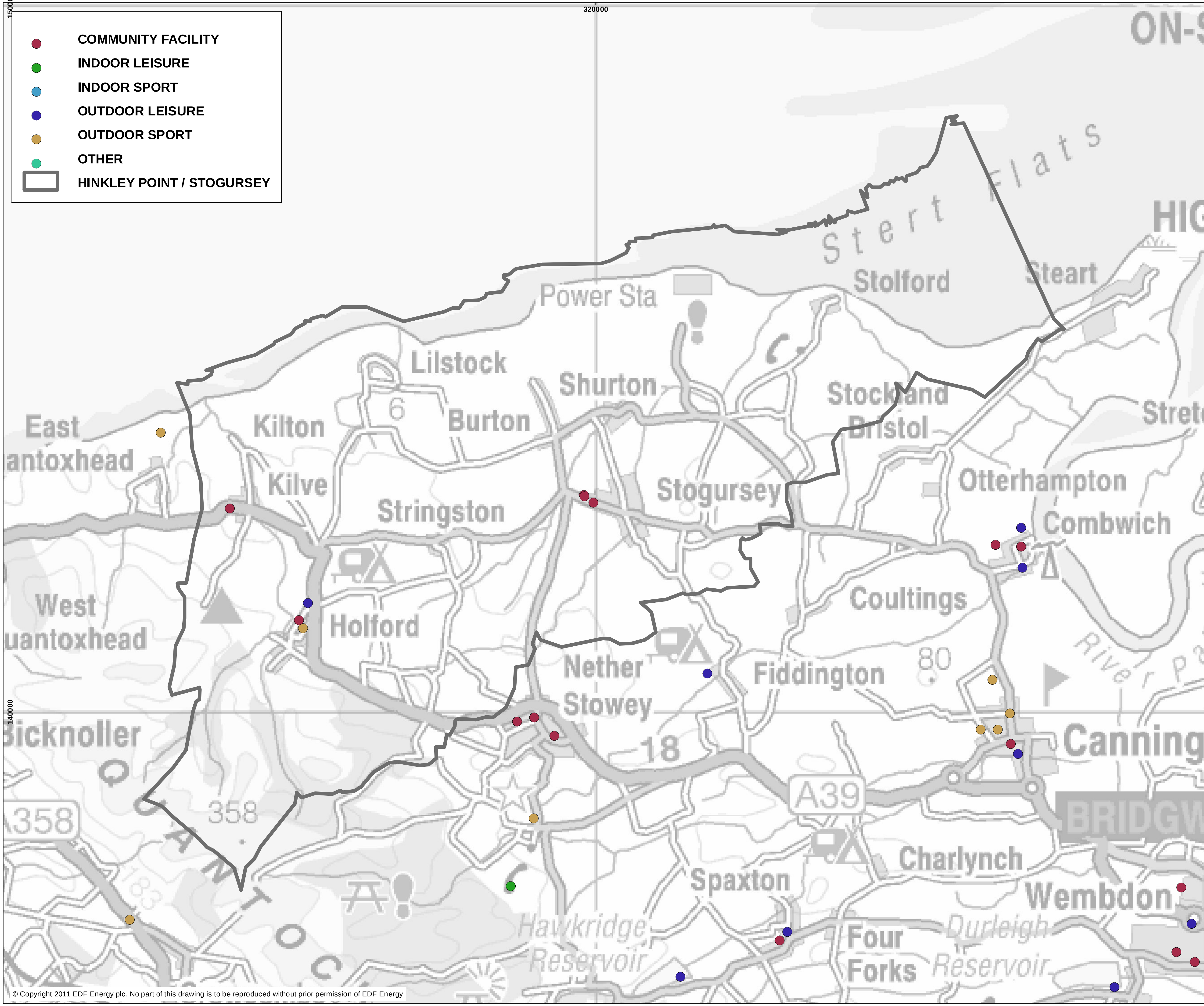

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
ARUP
FACILITIES AUDIT
(HINKLEY POINT/ STORGURSEY)

FIGURE NO:		REVISION:
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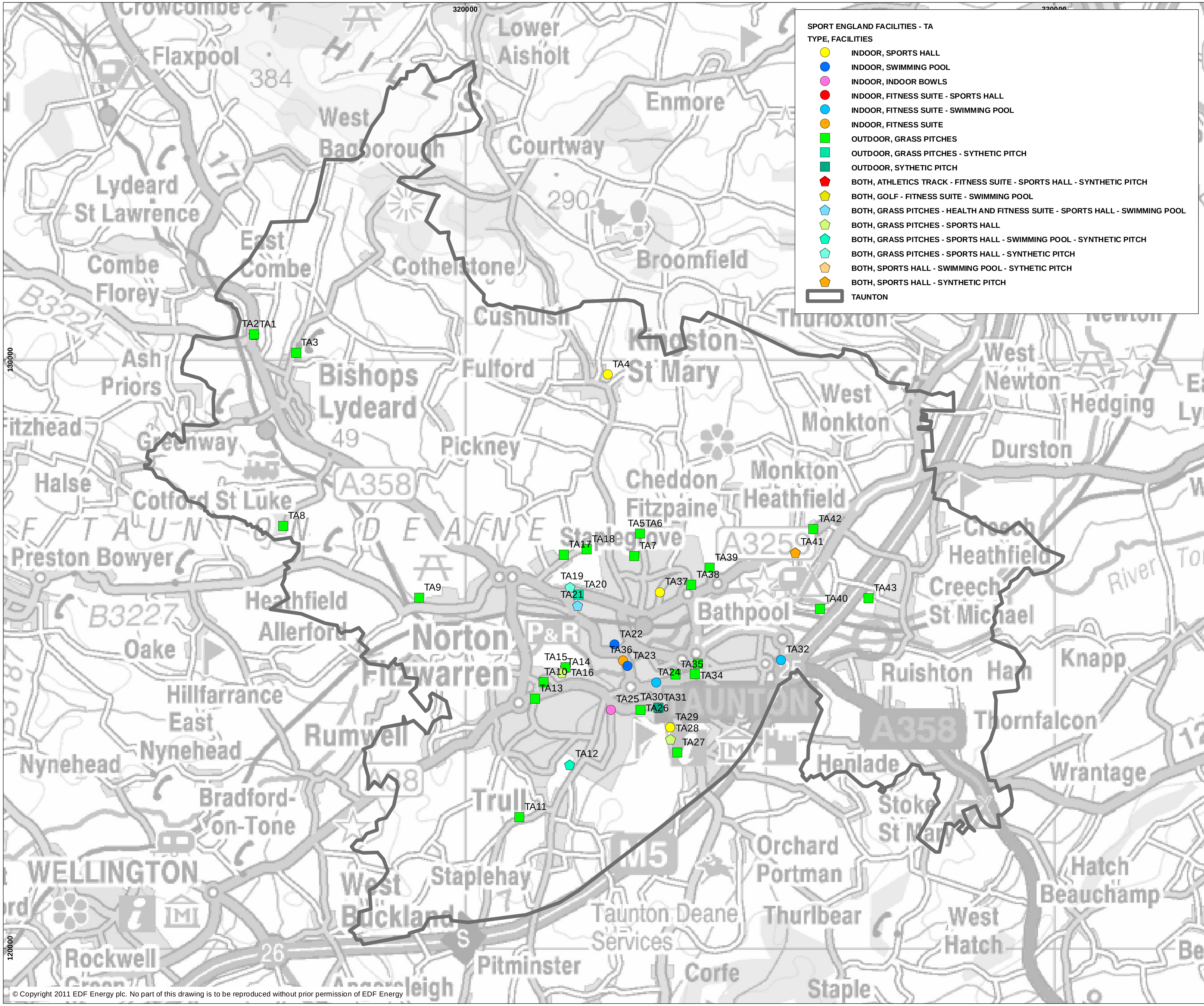

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(TAUNTON)

FIGURE NO:		REVISION:
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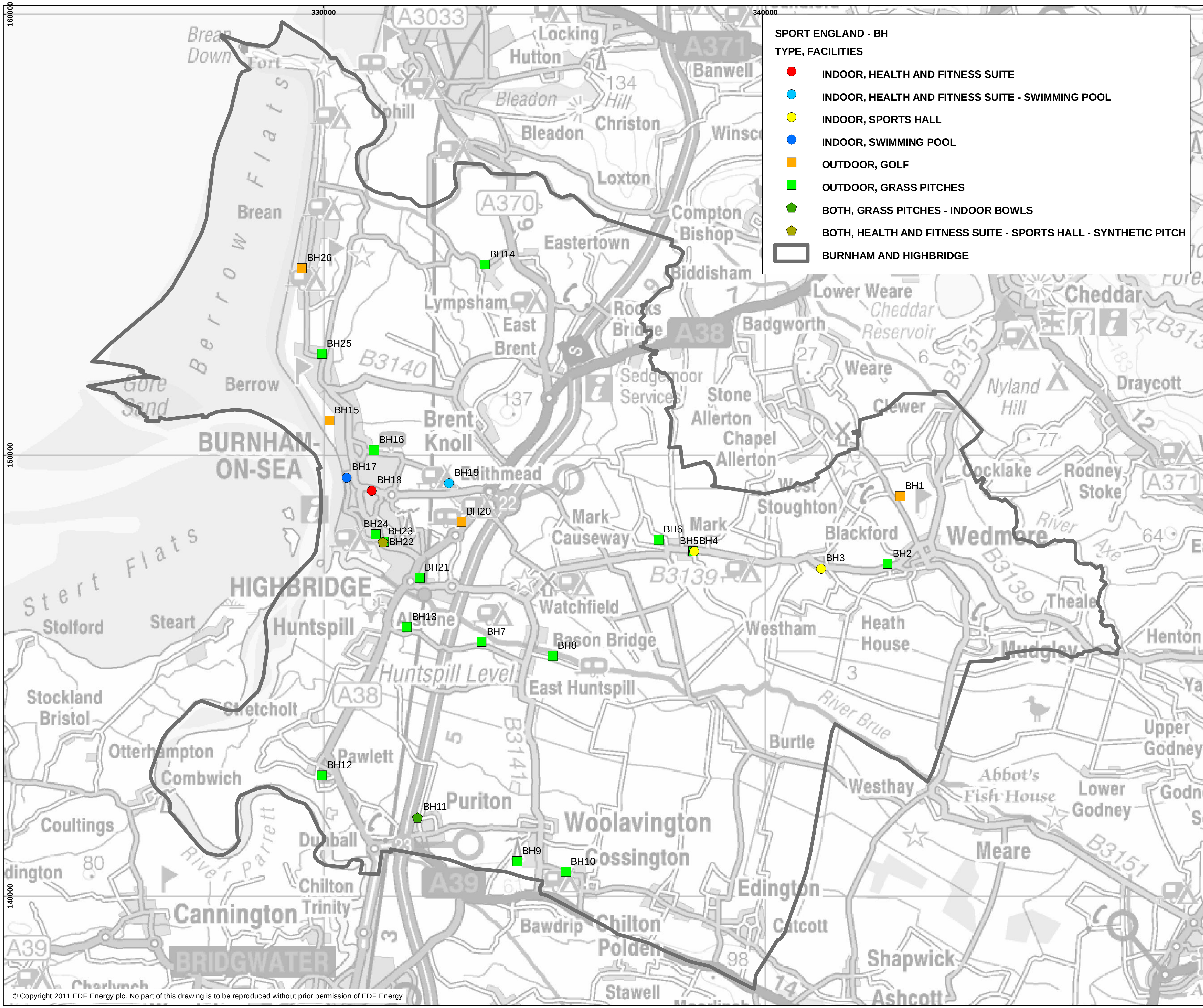

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(BURNHAM AND HIGHBRIDGE)

FIGURE NO:		REVISION:
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DATE:	DRAWN:	SCALE:
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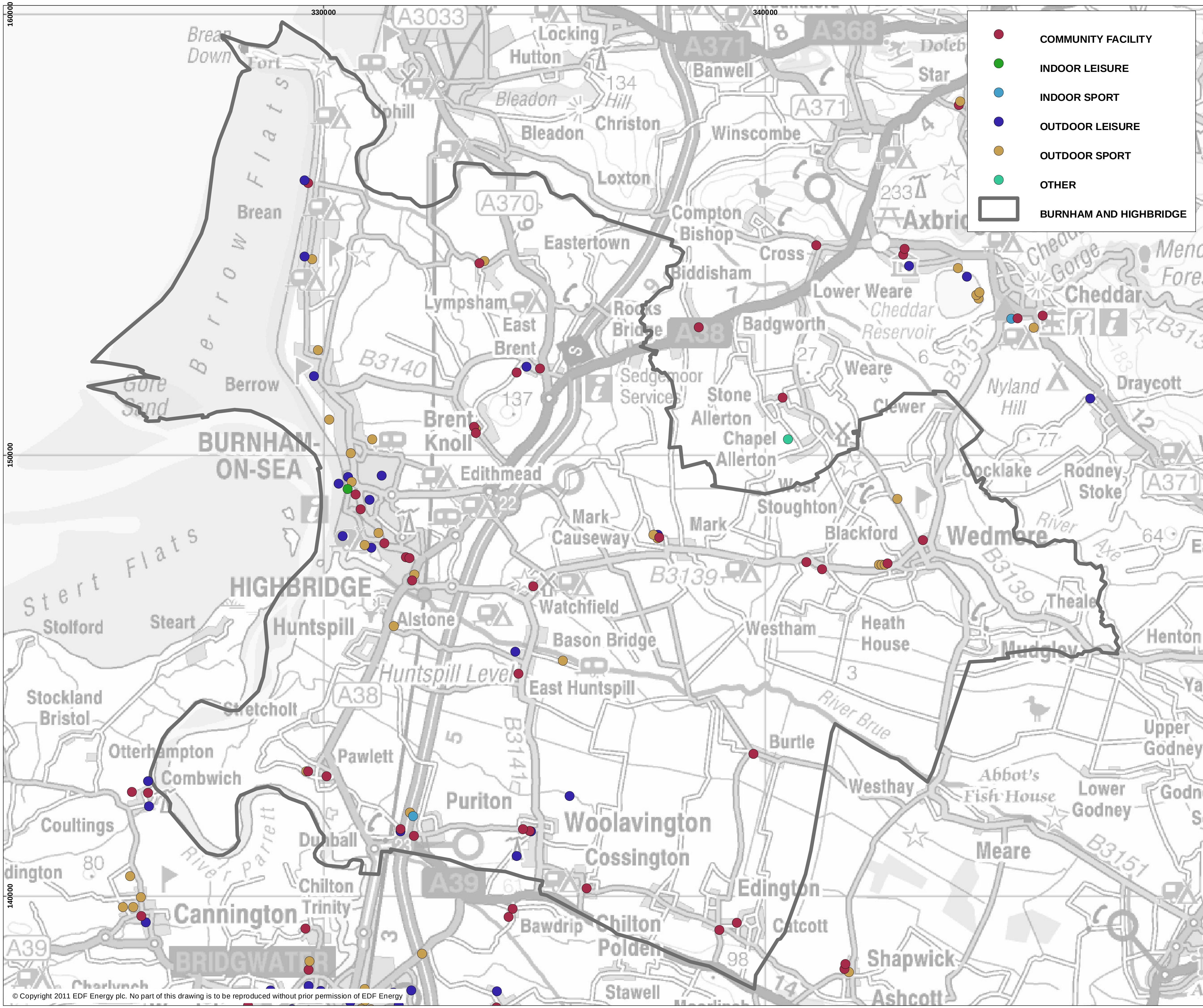

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
ARUP
FACILITIES AUDIT
(BURNHAM AND HIGHBRIDGE)

FIGURE NO:		REVISION:
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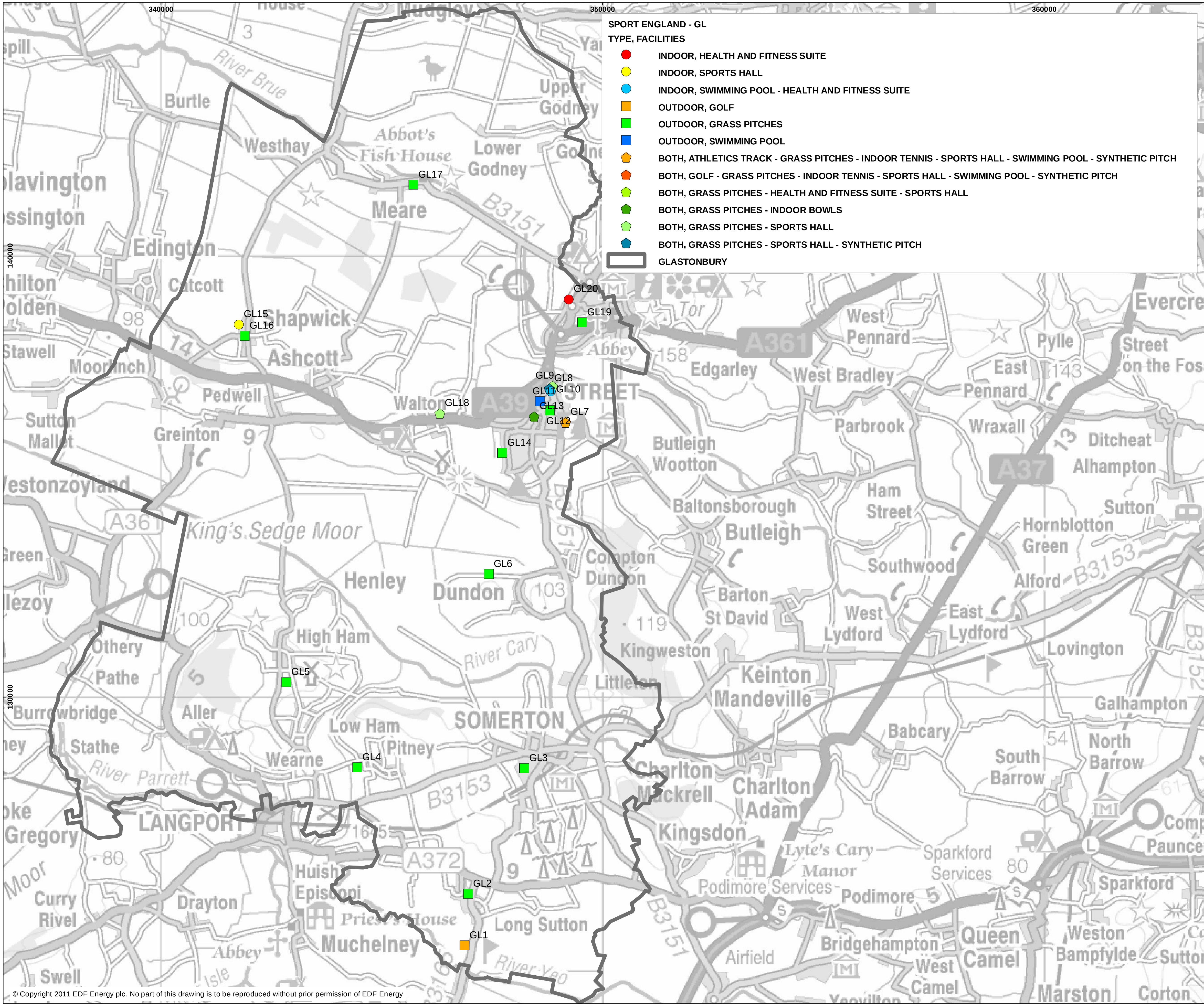

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES FACILITIES AUDIT (GLASTONBURY)

FIGURE NO:		REVISION:
FIGURE 2.11		01
DATE:	DRAWN:	SCALE:
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SCALE BAR:
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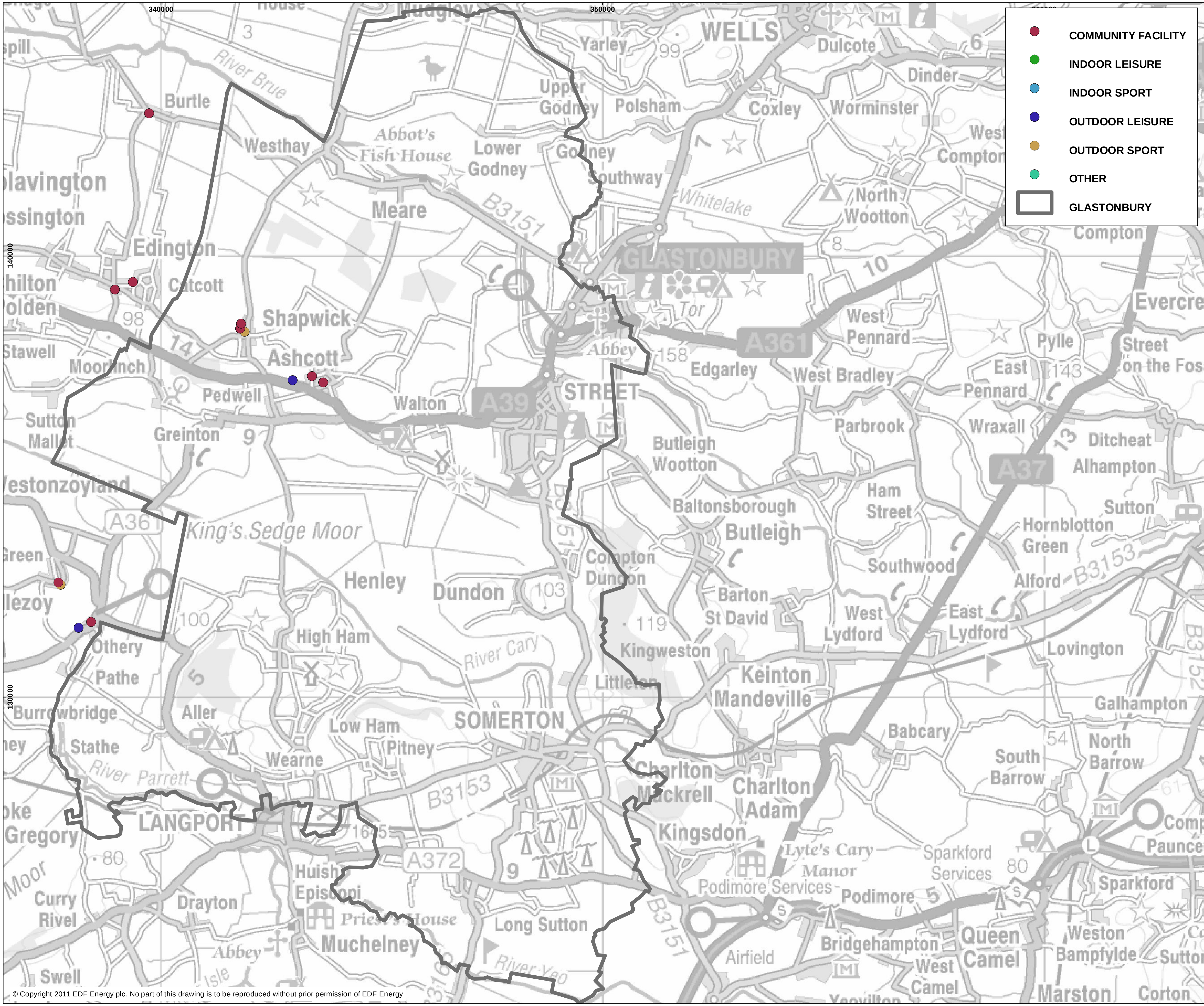

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
ARUP
FACILITIES AUDIT
(GLASTONBURY)

FIGURE NO:		REVISION:
FIGURE 2.12		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:80,000 @ A3

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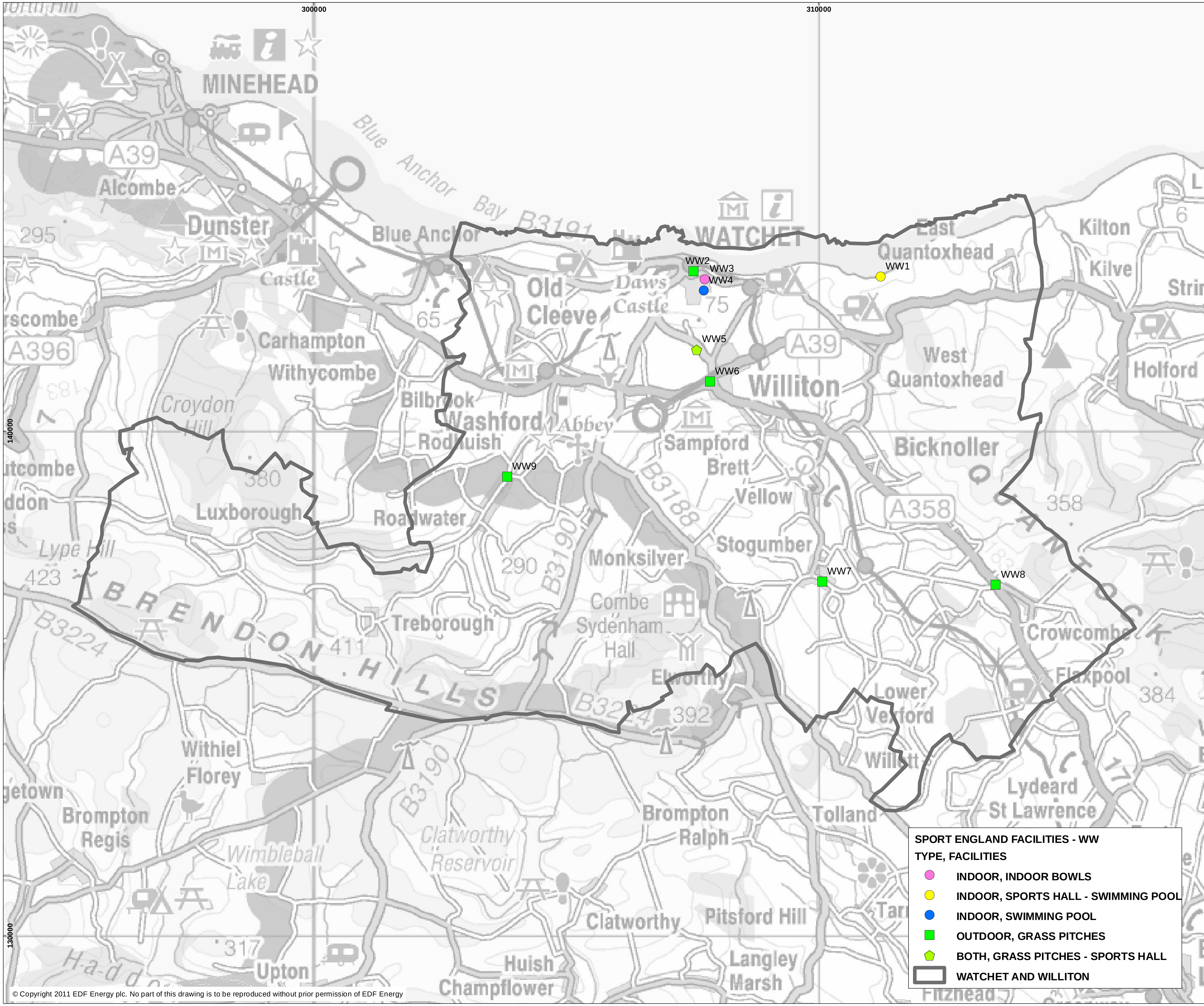

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(WATCHET AND WILLITON)

FIGURE NO:		REVISION:
FIGURE 2.13		01
DATE: SEPT 2011	DRAWN: M.H	SCALE: 1:70,000 @ A3

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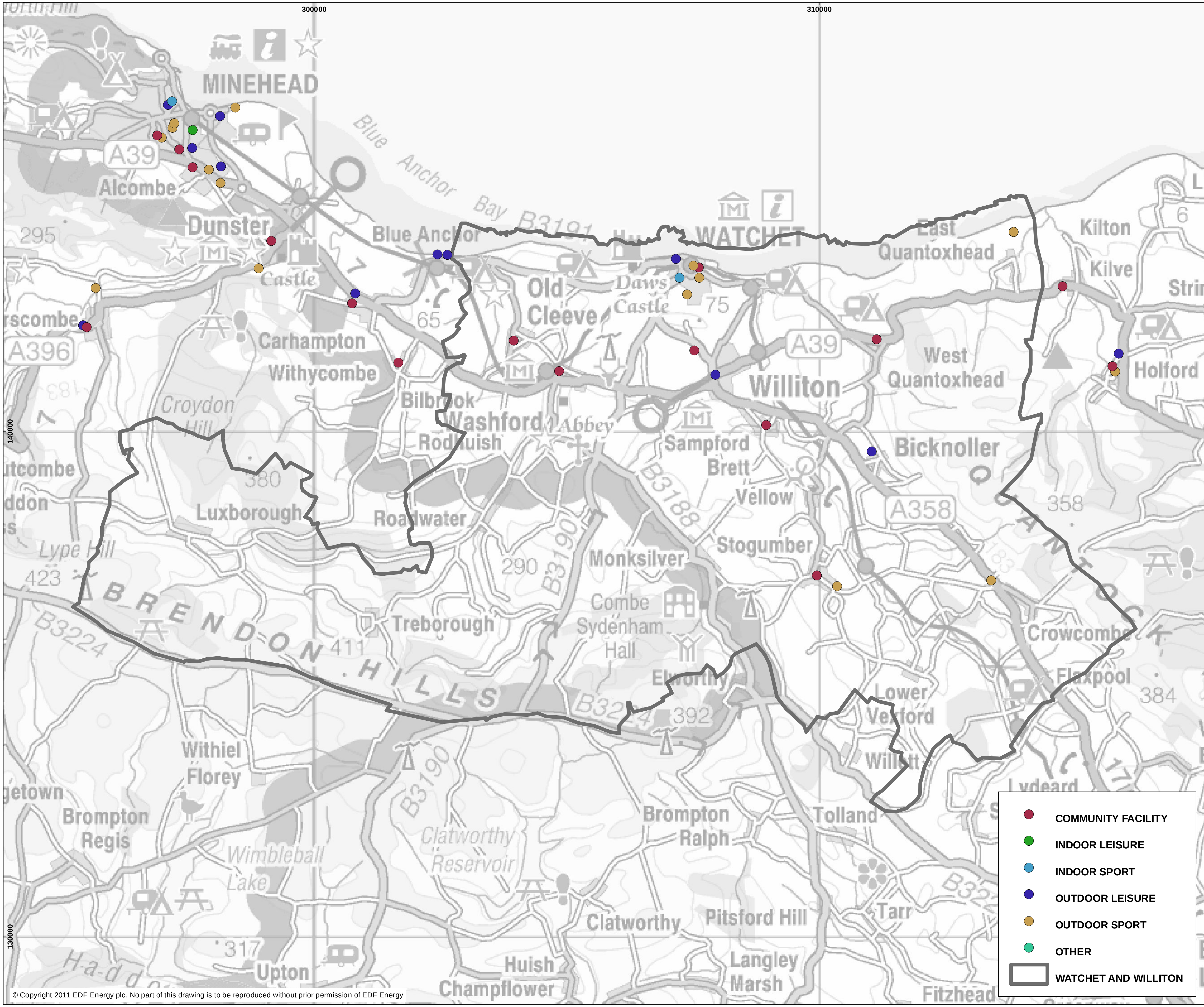

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 9E

FIGURE TITLE:
ARUP
FACILITIES AUDIT
(WATCHET AND WILLITON)

FIGURE NO:		REVISION:
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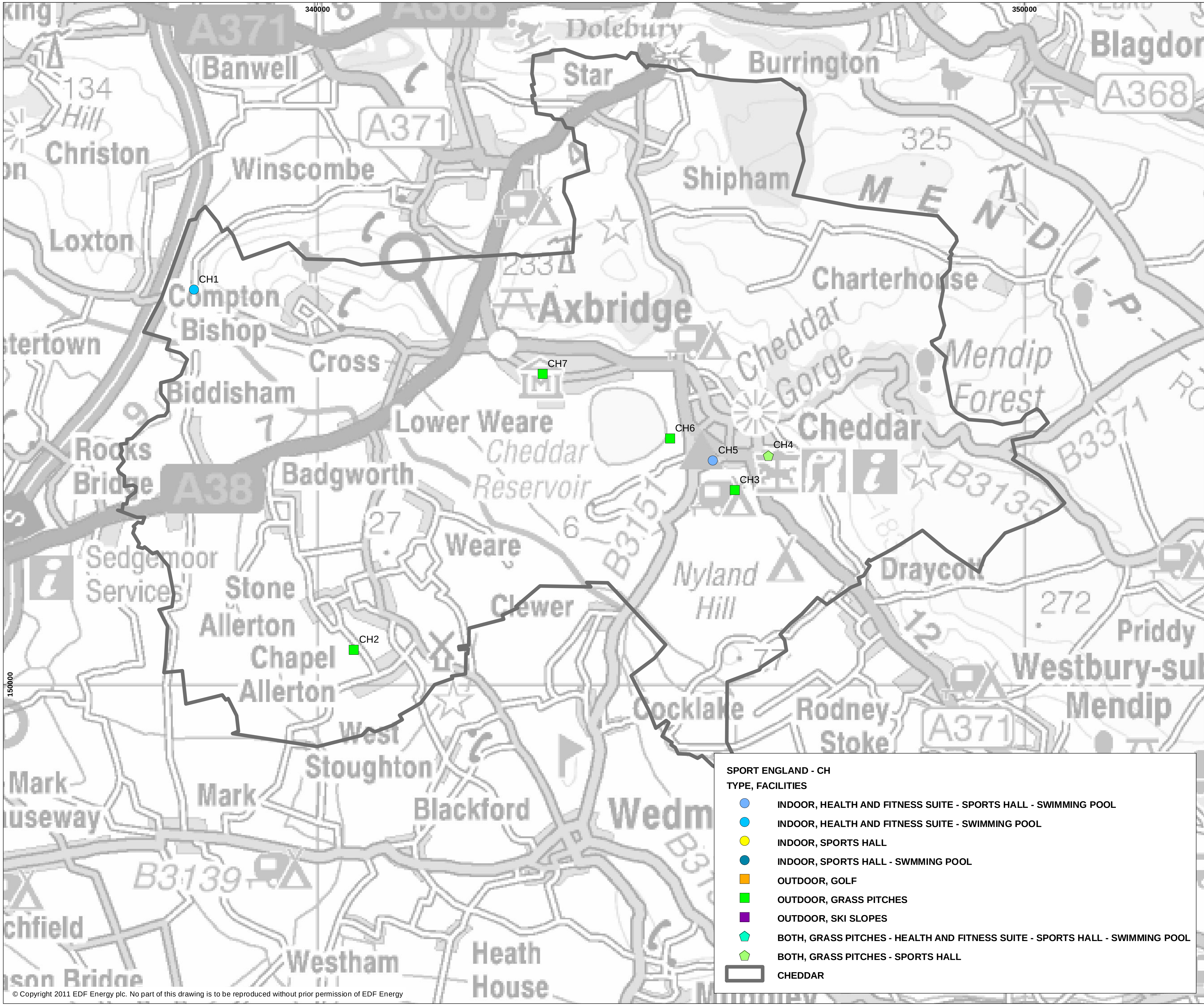
DATE: SEPT 2011	DRAWN: M.H	SCALE: 1:70,000 @ A3

SCALE BAR: 0 1 2 3Kilometres



SPORT ENGLAND - CH

TYPE, FACILITIES

- INDOOR, HEALTH AND FITNESS SUITE - SPORTS HALL - SWIMMING POOL
- INDOOR, HEALTH AND FITNESS SUITE - SWIMMING POOL
- INDOOR, SPORTS HALL
- INDOOR, SPORTS HALL - SWMMING POOL
- OUTDOOR, GOLF
- OUTDOOR, GRASS PITCHES
- OUTDOOR, SKI SLOPES
- BOTH, GRASS PITCHES - HEALTH AND FITNESS SUITE - SPORTS HALL - SWIMMING POOL
- BOTH, GRASS PITCHES - SPORTS HALL
- CHEDDAR

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DOCUMENT:
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES FACILITIES AUDIT (CHEDDAR)

FIGURE NO:		REVISION:
FIGURE 2.15		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:50,000 @ A3

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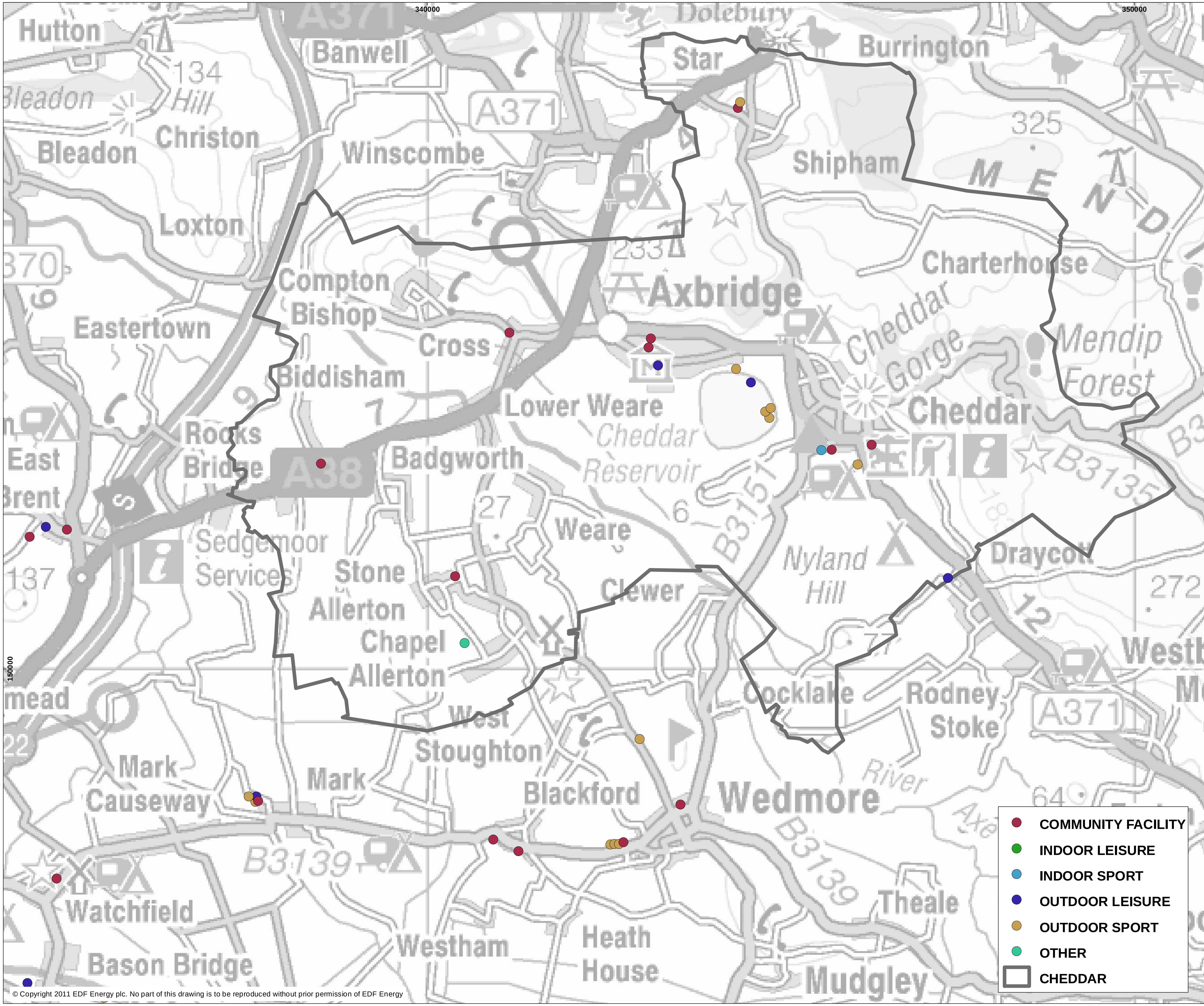

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
ARUP
FACILITIES AUDIT
(CHEDDAR)

FIGURE NO:		REVISION:
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DATE:	DRAWN:	SCALE:
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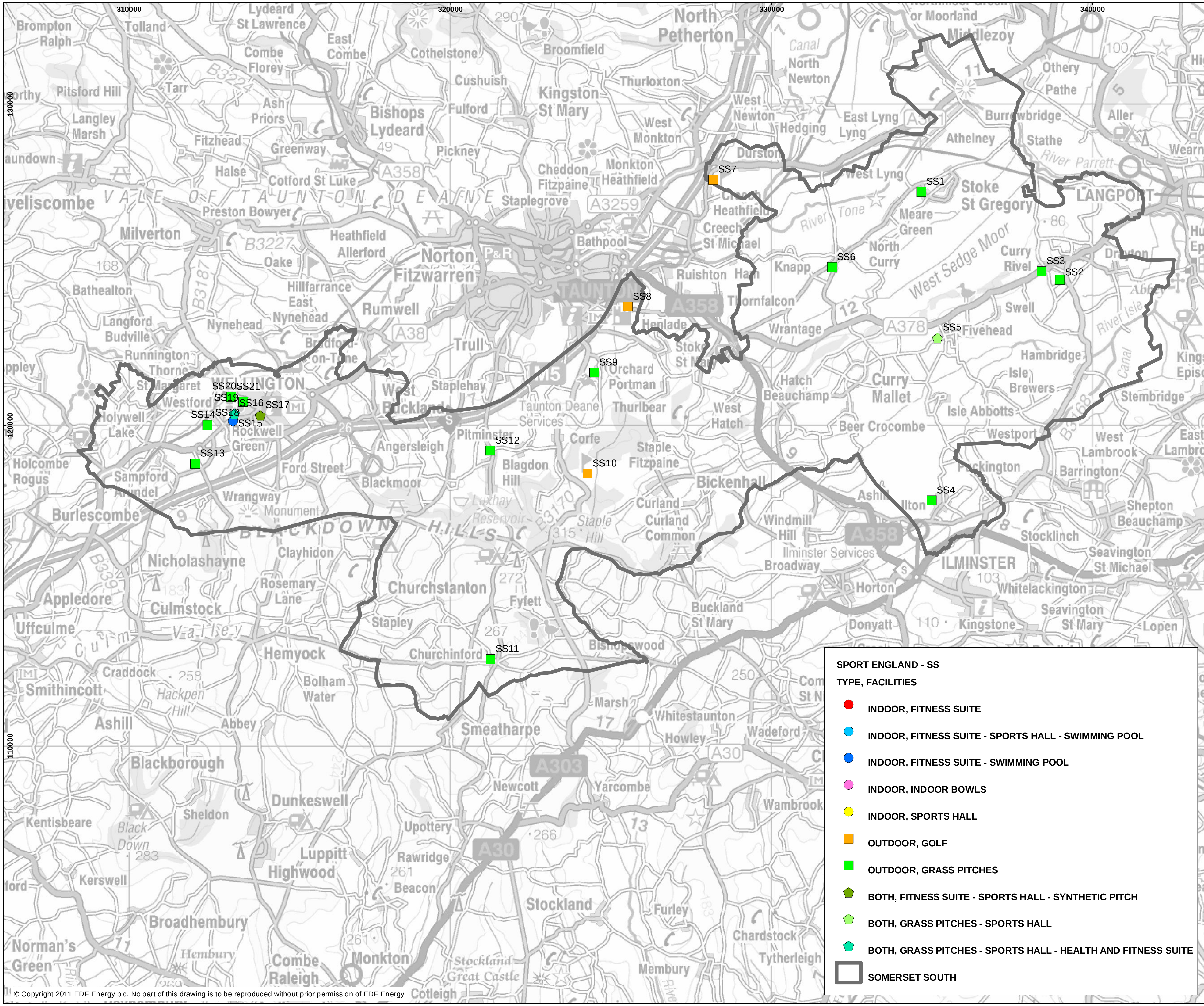

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DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES
FACILITIES AUDIT
(SOMERSET SOUTH)

FIGURE NO:		REVISION:
FIGURE 2.17		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:110,000 @ A3

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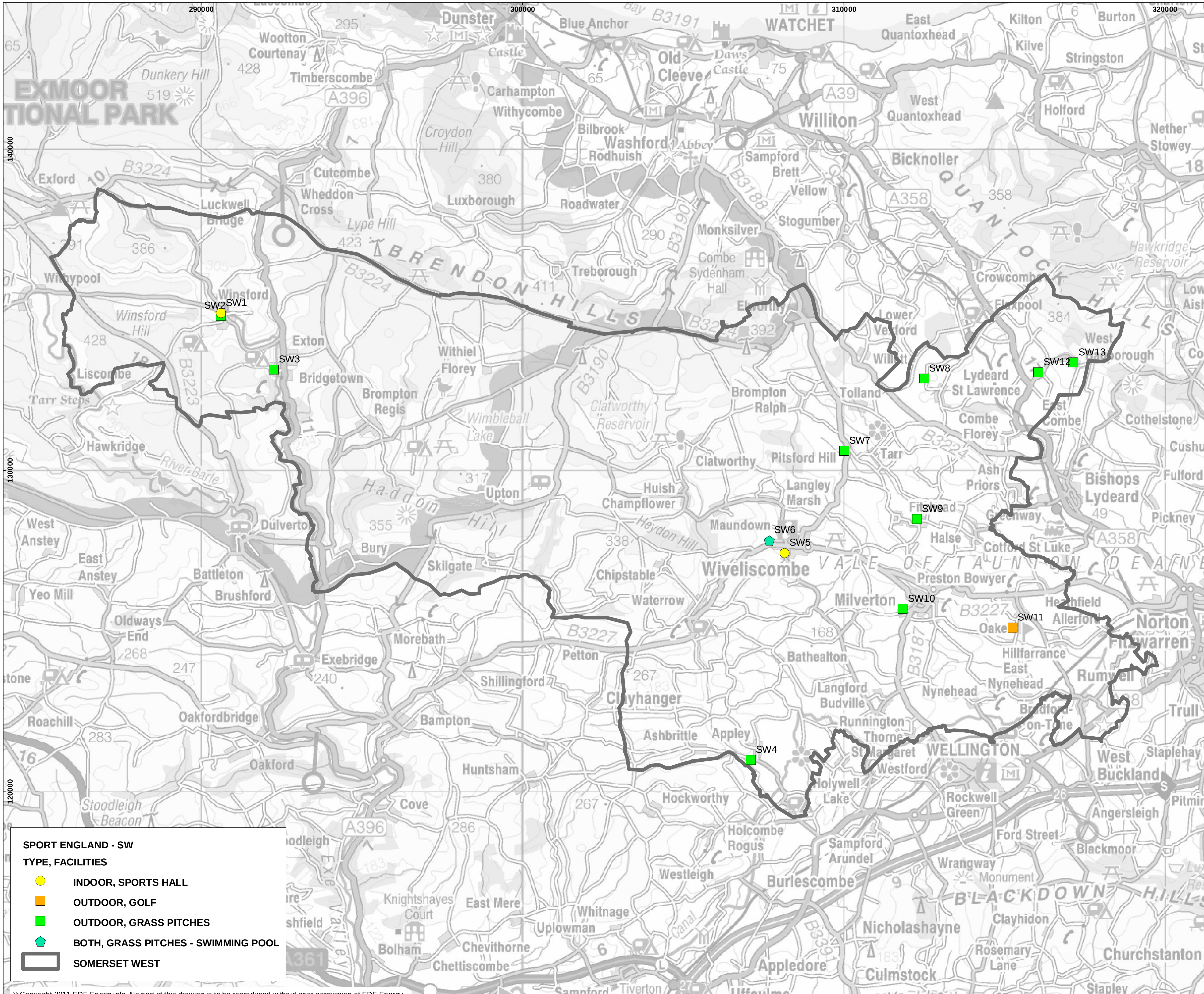

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
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FIGURE TITLE:

SPORT ENGLAND ACTIVE PLACES FACILITIES AUDIT (SOMERSET WEST)

FIGURE NO:		REVISION:
FIGURE 2.18		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:110,000 @ A3

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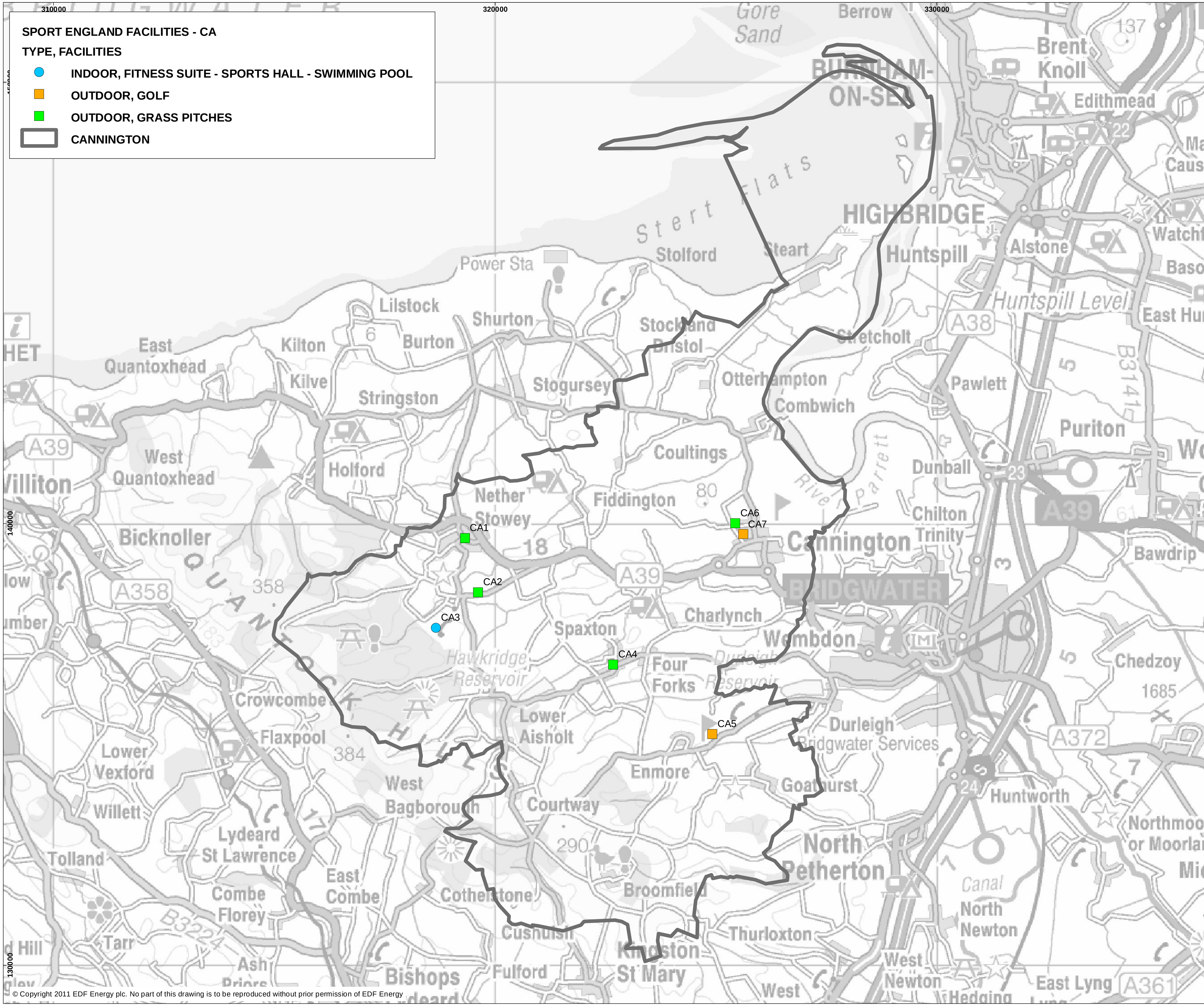

DOCUMENT:
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ENVIRONMENTAL STATEMENT
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FIGURE TITLE:
SPORT ENGLAND ACTIVE PLACES FACILITIES AUDIT (CANNINGTON)

FIGURE NO:		REVISION:
FIGURE 2.19		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:80,000 @ A3

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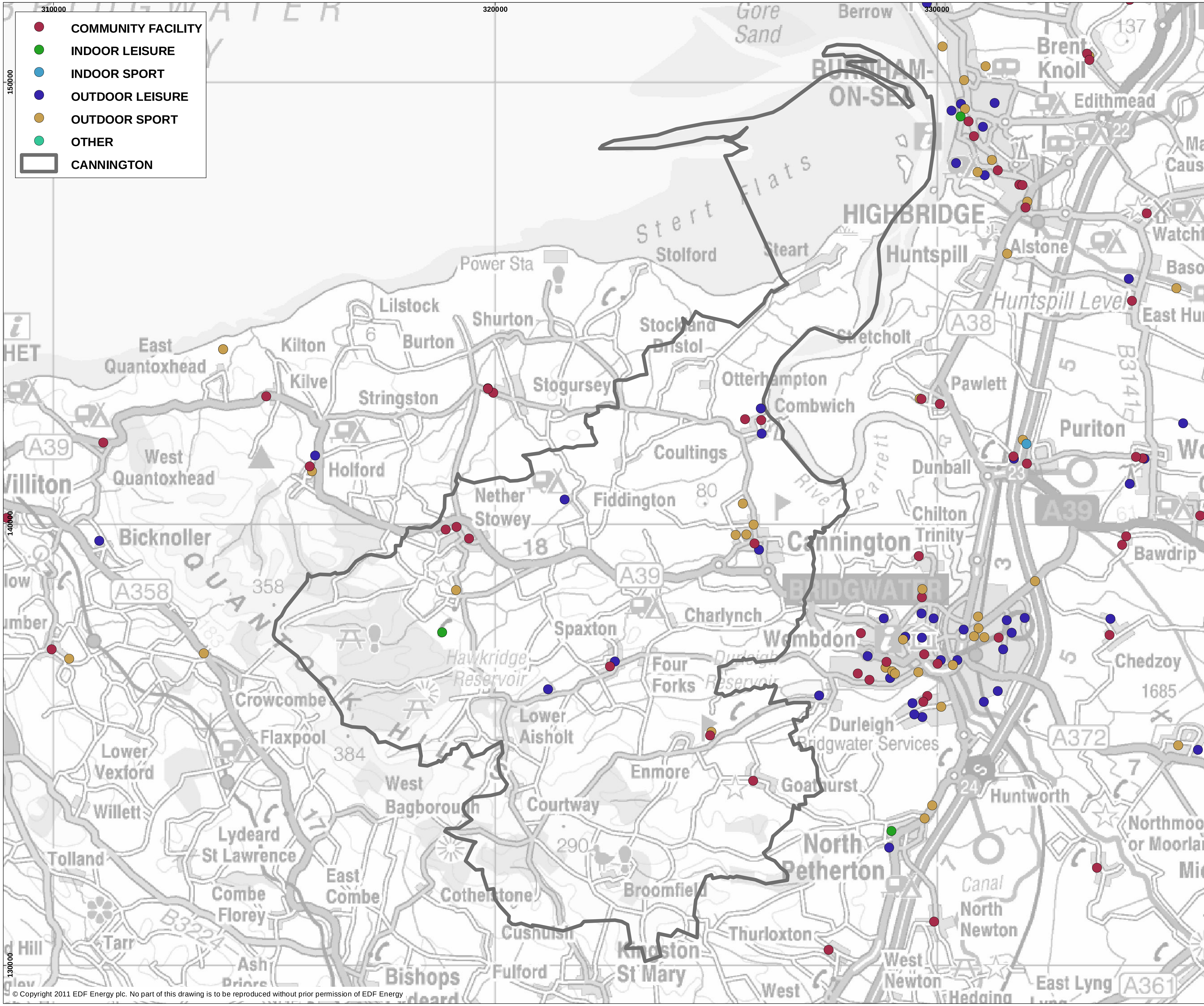

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
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FIGURE TITLE:

ARUP
FACILITIES AUDIT
(CANNINGTON)

FIGURE NO:		REVISION:
FIGURE 2.20		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.H	1:80,000 @ A3

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APPENDIX 9F: SOCIO-ECONOMIC TECHNICAL NOTE 6: COMMUNITY COHESION

FOREWORD

The National Policy Statements for Energy (EN-1) and specifically for proposed nuclear developments (EN6) identify issues which should be addressed by those proposing developments. These issues include the "significant social and economic impacts of the development" including how any significant negative impacts would be mitigated.

This note focuses on the specific dimension of "community cohesion". It identifies a working definition of community cohesion, and reviews current and recent community cohesion issues in the South West, which already has a substantial migrant workforce. It then identifies how EDF Energy will seek to deal with these issues in the context of the wider socio-economic strategy, and mitigation of development impacts.

9F. APPENDIX 9F: SOCIO-ECONOMIC TECHNICAL NOTE 6: COMMUNITY COHESION

9F.1 Context

9F.1.1 The National Policy Statements for Energy (NPS EN-1) (Ref. 9F.1) and specifically for proposed nuclear developments (NPS EN-6) (Ref. 9F.2) identify issues which should be addressed by those proposing developments.

9F.1.2 EN-1 states:

> *"While not required by the EIA Directive, the IPC will find it helpful if the applicant also sets out information on the likely significant social and economic effects of the development, and shows how any likely significant negative effects would be avoided or mitigated. This information could include matters such as employment, equality, community cohesion and well-being."*

9F.1.3 EDF Energy's evidence base for the impacts of the proposed development at Hinkley Point C is based on a technical evidence base produced by the Impact Assessment Unit at Oxford Brookes University, and a series of Technical Notes which provide more detailed assessments on specific topic areas.

9F.1.4 Technical Note 1 identifies the likely workforce required to construct Hinkley Point C and the likely labour market catchment areas. Technical Note 2 identifies the likely demographic breakdown of the workforce including, age, gender and household types. It also identifies the proportions of non-UK nationals and Black and Minority Ethnic (BAME) communities in the UK and South West workforces. Technical Note 3 sets out research findings on the Spatial Distribution of the Construction Workforce.

9F.1.5 This note focuses on the specific dimension of "*community cohesion*". It identifies a working definition of community cohesion, and reviews current and recent community cohesion issues in the South West, which already has a substantial migrant workforce. It then identifies how EDF Energy will seek to deal with these issues in the context of the wider socio-economic strategy, and mitigation of development impacts.

9F.2 Definitions of Community Cohesion

9F.2.1 The Local Government Association (LGA) first defined Community Cohesion as a starting point for councils in 2002 as part of the national response to the disturbances in Burnley, Bradford and Oldham in 2001:

"A cohesive community is one where:

- There is common vision and a sense of belonging for all communities.
- The diversity of people's different backgrounds and circumstances are appreciated and positively valued.
- Those from different backgrounds have similar life opportunities.
- Strong and positive relationships are being developed between people from different backgrounds in the workplace, in schools and within neighbourhoods." (Ref. 9F.3).

9F.2.2 As work and thinking about community cohesion has developed, there have been other definitions. The Commission for Integration and Cohesion (Ref. 9F.4) in 2007 defined an integrated and cohesive community as one with:

- "A defined and widely shared sense of the contribution of different individuals and groups to a future local or national vision.
- A strong sense of an individual's local rights and responsibilities.
- A strong sense that people with different backgrounds should experience similar life opportunities and access to services and treatment.
- A strong sense of trust in institutions locally, and trust that they will act fairly when arbitrating between different interests and be subject to public scrutiny.
- A strong recognition of the contribution of the newly arrived, and of those who have deep attachments to a particular place – focusing on what people have in common.
- Positive relationships between people from different backgrounds in the workplace, schools and other institutions."

9F.2.3 More recently, in 2008, the Department for Communities and Local Government (Ref. 9F.5) stated that:

"Community Cohesion is what must happen in all communities to enable different groups of people to get on well together. A key contributor to community cohesion is integration which is what must happen to enable new residents and existing residents to adjust to one another.

"Our vision of an integrated and cohesive community is based on three foundations:

- People from different backgrounds having similar life opportunities.
- People knowing their rights and responsibilities.
- People trusting one another and trusting local institutions to act fairly".

9F.2.4 Up until 2010 councils were required to measure if residents felt that people from different backgrounds got on well together, as part of the national audit and inspection process. Many councils have developed their own local definitions of cohesion to reflect their local issues. This is likely to evolve in the context of the Government's plans for the "Big Society" aimed at achieving greater decentralisation and participation as set out in the Localism Bill. (Ref. 9F.6).

9F.3 Migration in the South West

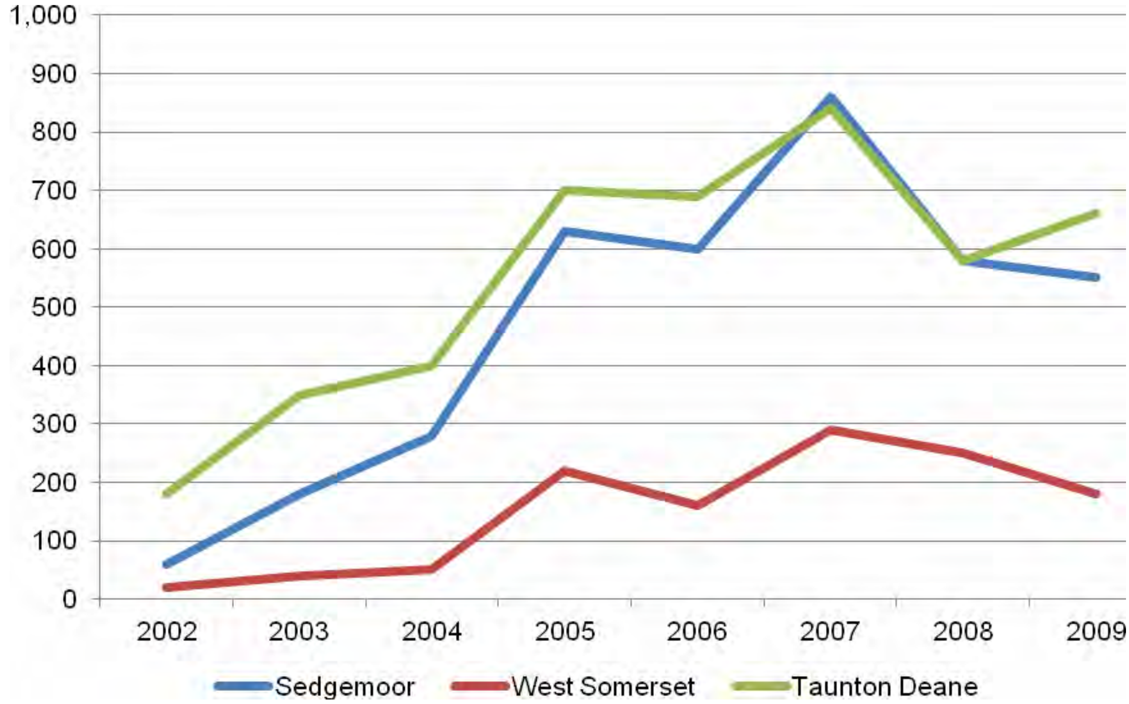
9F.3.1 The South West region sees significant annual population turnover. Like most places "internal migration", that is migration from elsewhere in the UK, significantly outweighs international migration. The most recent data shows a net gain of around 19,000 residents in 2009/10 from within the UK and a net loss of population from international migration of 3,850 in 2008/9 (Ref. 9F.7).

9F.3.2 For the most recent year for which figures are available (2008-2009) Government migration data suggests that around 12,000 people moved in to the three districts (Sedgemoor, Taunton Deane and West Somerset) and around 11,000 people moved out. The area also sees significant seasonal tourism inflows with around 5 million overnight visitors a year.

9F.3.3 The 2001 Census data suggested that the south-west had a small ethnic minority population, with 97% being classified as white British or Irish. (Ref. 9F.8) Although 2011 census data is not yet available it is clear that that figure will have increased, particularly since EU enlargement in 2004. This gave residents of the eight "accession states" (known as the A8: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia) the right to live and work in the UK.

9F.3.4 The **Plate A9F.1** below shows the number of National Insurance Number (NINO) registrations for foreign national adults in the three districts covered by the HPC assessments. (Ref. 9F.9) These numbers do not track the numbers who become permanent residents or the duration of their stay. Many will be temporary seasonal workers. They do however demonstrate a clear upward trend from the early 2000s, particularly after 2004, which appears to have fallen since the onset of the recession. However, in the context of annual migration figures described above they still form a minority of migration to the south west.

Plate A9F.1: Total Number of National Insurance Number Registrations by Foreign National Adults by Year in the Three Districts (Sedgemoor, West Somerset and Taunton Deane)



9F.3.5 Research published by the Institute of Fiscal Studies suggests that, contrary to popular perception, migrant workers from A8 Accession countries make a net fiscal contribution to the UK Exchequer. (Ref. 9F.10) This is because they are almost all in work, and have lower take up of benefits and public services, partly as they are younger and less likely to have dependents. An analysis of social housing lettings data in 2006/7, the peak year for migration, shows only 55 lettings across the entire south-west compared to over 20,000 A8 workers being registered under the NINO scheme in the region over the same period. (Ref. 9F.11).

9F.3.6 In this context it is important to bear in mind that, although the research on community cohesion has focussed on black and minority or foreign migrants, they are not the only, or even the main cause of population turnover or transience in an area. Therefore whilst some of the issues identified (e.g. language problems) are specific to an international migrant workforce, many can also be addressed by more general actions required to manage a construction workforce.

9F.4 Research on Community Cohesion in the South West

9F.4.1 One of the earliest local studies into migrant workers in the South West was conducted by **South Somerset District Council**. (Ref. 9F.12) This project was one of the first pieces of primary survey research into migrant workers by any Local Authority. The aim of this study was to examine the diversity and geographical spread of migrant worker communities in South Somerset. The aim of the project was to identify language needs and the range of information that migrant workers would find useful in their own languages to help them to settle in South Somerset. Research uncovered many migrant workers in more isolated rural areas within the District as well as urban centres. The research led to a Somerset Countywide Welcome Pack in a variety of languages (a comprehensive on-line resource), funded by the Local Strategic Partnership (South Somerset Together). (Ref. 9F.13).

9F.4.2 Further mapping work was undertaken by **Somerset County Council** (Ref. 9F.14) on particular localities and industry sectors as follows:

- Chard: Portuguese workers in food preparation and production.
- Frome: Polish workers.
- Burnham-on-Sea/Highbridge and Minehead: in tourism and care sectors.
- Yeovil: NHS.
- Wiveliscombe: pig farming.
- Taunton: care sector.
- Fruit farms and the transportation industry.

9F.4.3 **Taunton Deane Local Strategic Partnership** also conducted a study of migrant workers, employers and providers in order to gain a better understanding of the needs of migrant workers and their families. (Ref. 9F.15) The research explored both language and other possible needs so that service areas can work to meet these. Methods used included telephone interviews with employers, informal questioning of representatives from local and regional groups and government employment organisations, questioning of local English for Speakers of Other Languages (ESOL) providers, and focus groups with ESOL learners.

9F.4.4 The study identified the need for a more co-ordinated response to the majority of employers who would like information leaflets on ESOL, Literacy, Numeracy, and IT provision and the need for ‘Welcome’ or ‘Information’ packs for migrant workers, including information on: opening bank accounts, National Insurance numbers, locations of community services, help with accommodation, local transport and taxis, and cultural information.

9F.4.5 The **South West Regional Development Agency** (RDA) commissioned a Scrutiny Review (Ref. 9F.16) in 2007 to gain a greater understanding of the scale and nature of migrant working in the region and the impact on business and the economy. The study revealed that between 2003 and 2005 hard to fill vacancies in the South West fell by 44 per cent, partly because of the increased use of migrant labour. Skill shortage vacancies also fell by 14 per cent over the same period, leading to an increase in business productivity. The sectors in which there was a greatest reliance on migrant labour were identified as agriculture, hospitality, food processing and care.

9F.4.6 It was difficult to identify where migrant workers were living or to build up a picture of concentration. Low absolute numbers, dispersal and 'invisibility' were highlighted as posing particular issues for service provision. Authorities in Cornwall and Dorset had experienced some issues concerning caravan sites in relation to overcrowding or unauthorised caravans, but elsewhere this did not appear to have been an issue. Only four councils were able to identify towns with relatively high numbers of houses in multiple occupation, including Taunton, Wellington, Torridge, Exmouth, Park District, Weymouth, Penzance and Hayle. One council noted that 'Available staff resource is insufficient for the Council to be confident that all licensable HMOs have been identified'.

9F.4.7 **The top five issues facing migrants** were identified as housing, exploitation, English language needs, information, advice and guidance (IAG) and racial tensions:

a) Housing

9F.4.8 The high price of accommodation and unscrupulous landlords and houses in multiple occupancy featured as the main issue. The requirement of a large deposit up front in the private sector means that multiple occupancy is the only way in which the deposit can be found. When houses in multiple occupation are closed down, there are often re-housing issues which can be difficult to meet. Limited entitlement to benefits means that those who are not able to find work or lose their jobs unexpectedly can then become homeless. Several respondents highlighted housing as an area where new pressures would be felt as workers bring their families over and begin to look for different sorts of accommodation.

b) Exploitation:

9F.4.9 Despite the establishment of the Gangmasters Licensing Authority (GLA), migrant workers are still being exploited and examples were given of workers being tied into employer accommodation; housed in sub-standard accommodation; having money deducted from their wages for housing, union fees, registration, transport etc; working for wages below the legal minimum; and being injured through unsafe working practices. The rural nature of large parts of the region means that it is easier for unscrupulous employers to remain undetected because of their geographic isolation.

c) English language needs:

9F.4.10 The study pointed out that a key protection against exploitation is English language development, yet the study found huge unmet needs for English courses and real issues around courses being delivered at the wrong time, wrong place and wrong level. The research carried out in Taunton Deane showed a need for 'short, sharp' classes in English as well as ESOL.

d) Information, advice and guidance:

9F.4.11 This is still a key area, despite a number of innovative initiatives across the region. As more dependants arrive, migrant workers' support needs are changing, with advice sought for families, housing, children, integration into school and pre-school. Welcome packs have proved useful, but can quickly become outdated.

e) **Racial tensions:**

9F.4.12 The study concluded that the above issues can become self-perpetuating with a lack of English language leaving new arrivals vulnerable to exploitation from employers and landlords, and unable to readily understand English laws. In turn, this can give rise to complaints about recycling; driving offences; over-crowding etc. so that migrant workers come to the attention of the local community through 'issues'. Language is not needed just for economic integration but also for social integration and community cohesion. The study found that hate crimes were on the increase as were assaults on people perceived to be Eastern European.

9F.4.13 The **South West Regional Assembly Scrutiny and Review Panel** undertook a wide ranging review involving several agencies in 2009 on the impact of migration. (Ref. 9F.17) They found that Worker Registration Scheme (WRS) registrations in the South West postal region fell by 47 per cent from 3,760 between July and September 2008 to 2,040 between October and December 2008. The recession and the decline in the value of the pound were cited as the reason for this. Migration from Bulgaria and Romania has continued to increase in 2006/07 and 2007/08, although this remains small in comparison to other nationalities (particularly Poles, but also Slovaks, Czechs, Hungarians and several non-EEA communities). The most recent national data suggests that A2 migration may also be beginning to fall. In a piece of research conducted by Equality South West to inform the Review, 27% of the businesses sampled felt that a substantial decline in migrant workers could result in them going out of business.

9F.4.14 The review found that the **skills** of migrant workers in the region are often not fully utilised by **employers**. Many migrant workers in occupations regarded as 'low skilled' have experience and/or qualifications commensurate with 'higher skilled' jobs. However, issues such as lack of English language skills and difficulty getting qualifications recognised and understood may prevent many migrant workers from taking up some positions. Research conducted by Equality South West found that while over 50 per cent of the migrant workers they surveyed had professional qualifications only a minority were using these in their current job. It was however noted that some migrant workers come to the UK with the specific intention of improving their English, and are content to work in relatively low skilled jobs whilst they do so, despite being essentially 'overqualified'. Equality South West research revealed that having more opportunities to learn English, and access to jobs of an appropriate level, are important factors in encouraging migrant workers to remain with them. However, some employers are understandably reluctant to invest in training for migrant workers, because they may only remain in the region for a relatively short length of time. It was noted that 'high skilled' sectors of the South West economy like nuclear, that rely on Science, Technology, English and Maths (STEM) skills also need to employ migrant workers.

9F.4.15 The review found that, in some areas, migration has contributed to significant **community tension** including public perceptions that migrant workers are 'taking our jobs' and being given preferential access to housing and other benefits. The media was identified as posing a significant challenge to community cohesion by perpetuating myths and stereotypes. Local agencies in the region were urged to work collectively to challenge negative or inaccurate reporting, and to identify and promote case studies to exemplify the positive contribution that migrant workers are making to the region's economy and communities. The Cornwall Migrant Worker

Group is developing a multi-agency 'media strategy' to help to dispel stereotypes and directly address negative media coverage. The Group are trialling engagement strategies, like carrying out regular briefings for local editors and broadcasting station managers to develop positive working relationships and encourage balanced and accurate coverage of migration issues. A similar approach was advocated at a regional level and it was stressed that migrant workers should not be viewed in isolation but integrated into mainstream service provision.

9F.4.16 The review made 22 recommendations to promote a more strategic and co-ordinated approach around migrants, including a review of the emerging Action Plan by the Forum for Migrant Workers which includes over 50 representatives from 37 organisations across the region.

9F.4.17 The **South West Regional Development Agency** (RDA) commissioned a study by the Equality South West (ESW) Migrant Workers Project (Ref. 9F.18) from May 2008 to March 2010 focused on the impact of migration on **business, employment and skills**. The findings were fed into the Scrutiny Review described above.

9F.4.18 The study found that while inflows of migrant workers to the South West have declined over the last 2-3 years, and a significant number of A8 nationals have gone home, there are increasing signs of migrant workers settling in the region (44% of respondents said that they did not know when they would return to their country of origin). The number of pupils with English as an additional language has risen from 11,600 in 2004 to 22,690 in 2009. According to DWP figures the number of migrant workers entering the region peaked in 2006/07 at just over 41,000, but since then it has declined to under 24,000 in 2009/10. Entrants in 2009/10 came from Poland (c.4,200); Latvia (c.1000) and Lithuania (c.900). Significant numbers of migrants also come from non-European Union countries, particularly China, India and the Philippines. Due to the growth of immigration restrictions most of these migrants work in more highly skilled areas of the economy.

9F.4.19 ESW uncovered a range of good practice case studies of employers offering English classes in the workplace and also encouraging migrants to move from entry level to specialist positions e.g. Delta Form, a packaging company based in Bridgewater, who ensure that all relevant skills and experience are captured on migrants' application forms. One company even laid on Polish taster courses for other workers to support the integration of Polish workers and improve relations.

9F.4.20 The studies described above have led to the development of a multi-agency **Migrant Workers Action Plan** (Ref. 9F.19) covering four themes:

a) Regional and Local Structures:

9F.4.21 Ensuring there are appropriate decision making structures at both regional and local level. Migration is an issue which transcends a number of different policy areas, including the economy, employment, community cohesion, health, education, housing and social inclusion. As such no single agency has responsibility for all the issues affecting migrant workers so a partnership approach is required. This section sets out a number of actions to ensure effective working between agencies.

b) Economy, Skills and Employer Engagement:

9F.4.22 Migration is of crucial benefit to the region's economy. Overall the Government has estimated that migrants contributed between 8.1% and 10% of regional Gross Value Added in the South West in 2008, of which between 2.0% and 2.4% was from migrants who arrived in the region after 2004. While the benefits of migration have been substantial there is a sense that the region is not taking advantage of the full economic potential that migrants bring. This section sets out a number of actions to support skills development and employer needs.

c) Supporting Migrant Workers:

9F.4.23 Many migrants are among the most vulnerable workers in the region's labour force. Lack of health and safety advice, poor accommodation provision, bonded labour, and illegal deductions from and sometimes non-payment of wages are among some of the conditions which many migrants meet when they come to the region. In contrast many other employers in the region support their migrant workforce, offering English language training and advice on living in the UK. It is important to ensure that on the one hand migrants are made aware of their employment rights and that enforcement agencies are given appropriate support to shut down bad employers, and on the other that those incidences of employer good practice are promoted and taken up by more employers. The public's perception of migrant workers varies considerably and is often informed by myths that migrants are 'stealing jobs' (when they primarily fill hard to fill vacancies) and are 'draining the public purse' (when they are actually net contributors). Consequently there is a need to promote positive images of migrant workers and explain to the wider public the benefits of migration. This section sets out a number of priorities and actions designed to support migrant workers directly and promote their integration into the wider community.

d) Responsive Public and Voluntary Services:

9F.4.24 As direct (and invariably net) contributors to public finances, migrant workers should be able to access all the public services they are legally entitled to in the same way that established communities can. However migrants coming into the region are often unaware of the most appropriate places to go in order to obtain services. In some cases this can create community tensions and produce a strain on public services, for example, when some migrants go to A&E services when it would be more appropriate to visit a GP. The need to provide appropriate multi-lingual advice (where migrants have not been able to gain fluency in English yet) on what is available is a major challenge for service providers. Another major issue, relevant for migrants working unconventional hours, will be appropriate information on out of hours' services. Education provision is of vital importance to community cohesion with access to suitable means of interpretation a critical issue for many schools in the region. This section sets out priorities for service providers in responding to migrants' needs.

9F.5 Implications for Hinkley Point C

9F.5.1 Technical Note 1 suggests that, at peak, HPC will require around 3,700 non-home-based workers, that is people who will move to primarily Somerset temporarily to work on the development. Technical Note 2 suggests around 90% will be male, and 85% will be single person households. Reflecting the wider construction industry a proportion of the workforce are likely to be foreign nationals, although it is not possible to accurately predict how many.

9F.5.2 The evidence review described above is mainly qualitative, identifying a broad range of issues which have been raised by a (international) migrant workforce. It is therefore not possible to make a quantitative assessment of what the impacts of the HPC workforce might be. However we can identify the types of things which could arise and plan to avoid any negative effects. Some of these issues are relevant to a non-home-based workforce regardless of nationality, whilst others, in relation to language issues for example, could arise from the specific needs of foreign nationals.

9F.5.3 For the first category, covering all non-home-based workers, the key issues are:

- ***The need for the provision of information*** e.g. Welcome Packs, and on-going information, advice and guidance for workers (Accommodation Management Strategy).
- ***Housing***: The need to signpost access to housing for workers, and to manage impacts, particularly on houses in multiple occupation (Accommodation Strategy/Fund).
- ***Employment and Jobs Training***: Ensuring that current residents feel they have equal access to employment opportunities, through positive projects to provide outreach and support employment training; (Construction Workforce Development Strategy).
- ***Access to Services***: Ensuring that non-home-based workers have access to necessary public services, whilst at the same time ensuring that existing residents feel they have equal access to provision. (EDF Energy contributing towards Education, Health, Leisure and the Community Fund).
- ***Addressing Potential Community Tension***; ensuring that a pre-dominantly male non-home-based workforce behaves well in the area, preventing tensions building up through other actions (e.g. local employment training and access to services) and ensuring that the police and other services have the resources to deal with any specific problems should they arise. (Accommodation Management Strategy, Worker Code of Conduct, Strategic Relationship Protocols and CSMP and through Campus and Leisure Management/Liaison).

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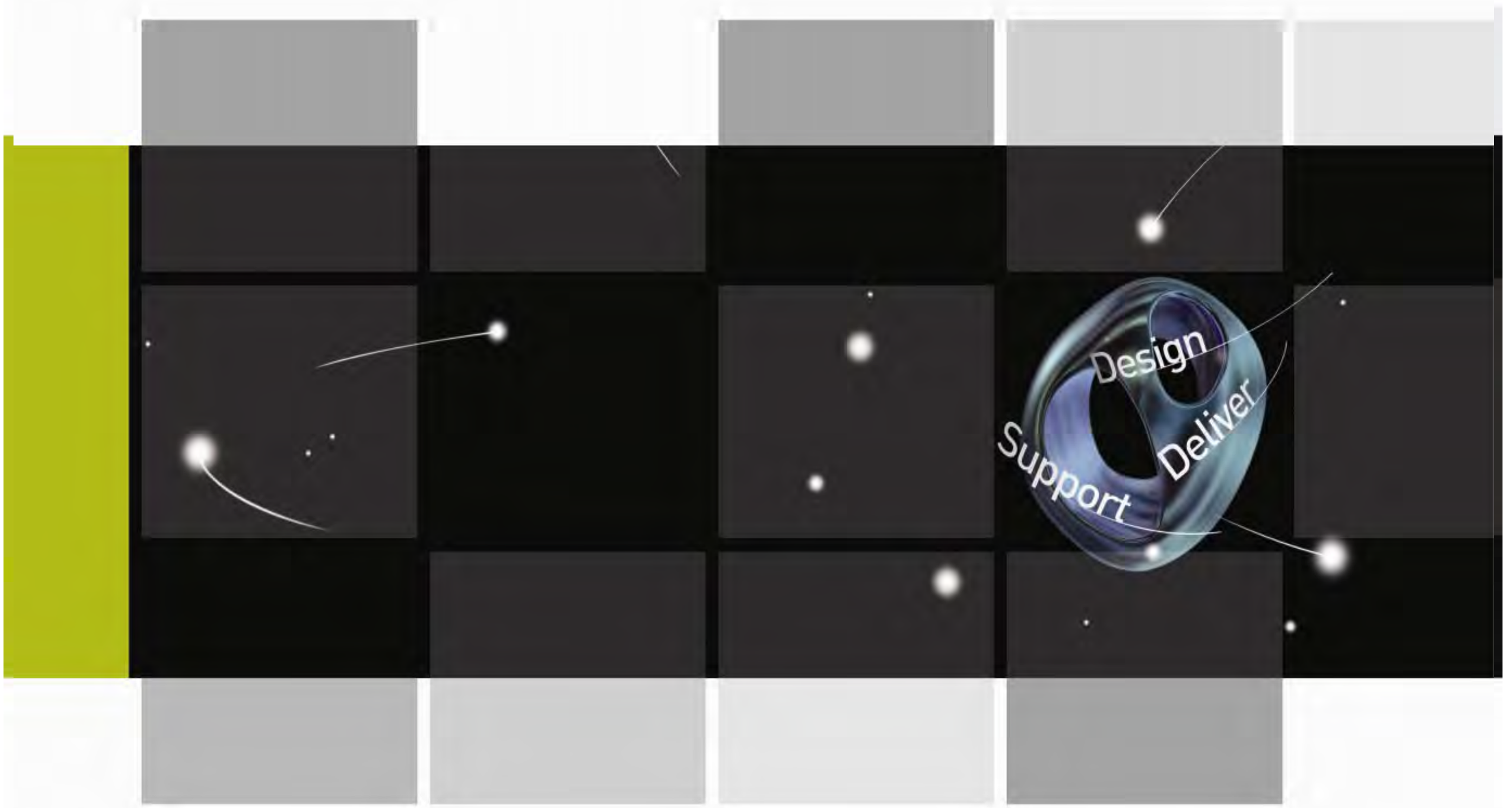
APPENDIX 11A: NOISE MONITORING FACTUAL REPORT



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GLOSSARY / ABBREVIATIONS

An explanation of the specific acoustic terminology referred to within this report is provided below.

dB	Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise i.e. whether is it high pitched, low pitched or with no distinct tonal character. These measurements are usually undertaken in octave or 1/3 octave frequency bands. If these values are logarithmically summed a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
dBL_A	The dBL_A figure is used to relate better to the loudness of the sound heard. The dBL_A figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or 1/3 octave band values, before logarithmically summing them. As a result, the single dBL_A value provides a good representation of how loud a sound is.
L_{Aeq}	As almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The L_{Aeq}, 07:00-19:00 for example, describes the equivalent continuous noise level over the 12 hour period between 7am and 7pm.
L_{Amax}	The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.
L_{An}	Another method of describing with a single value a noise level which varies over a given time period, is to consider the average amount of acoustic energy and the length of time for which a particular noise level is exceeded. If a level of x dB(A) is exceed for say 6 minutes within one hour, that level can be described as being exceeded for 10% of the measurement period. This is denoted as the $L_{A10,1hr}$ = x dB. The L_{A10} index is often used to describe road traffic noise whilst the L_{A90}, the noise level exceeded for 90% of the time, is the usual descriptor of the underlying background noise. L_{A1} in addition to L_{Amax} are common descriptors of construction noise.

EXECUTIVE SUMMARY

Electricité de France (EDF) proposes to construct and operate a new nuclear power station west of the existing Hinkley Point A (being decommissioned) and B facilities. The new station will comprise two new UK EPR type reactors and ancillary buildings.

This report details a baseline noise monitoring survey, undertaken between 27th April and 7th May 2009, as part of the Environmental Impact Assessment required for this development.

Measurements of ambient noise levels were undertaken at 10 locations to enable the assessment of potential impacts associated with both the construction and operation phases of the development.

Typical dominant noise sources identified during the survey included local road traffic, birdsong and surf movement (at a coastal monitoring location). The determined ambient noise levels were typical of a rural environment, dropping very low during the night time, and wind noise masking having an observable effect.

Operation of the Hinkley Point B power station was not typically observed, although a single significant short-term noisy event (venting) was recorded the Hinkley Point Visitors centre. Given the magnitude of the measured noise level, it is possible that this event would have been heard at neighbouring receptor locations.

1.0 INTRODUCTION

To assess properly the environmental noise impacts of the construction and operational phases of the Hinkley Point C development, it is essential that the existing ambient noise levels at the most noise sensitive locations are established prior to the commencement of the construction works.

A baseline noise survey was therefore undertaken by AMEC consultants between 27th April and 7th May 2009. All AMEC personnel involved in the monitoring programme have attained the UK Institute of Acoustics Certificate of Competence in Environmental Noise Measurements.

The scope and methodology of the survey was agreed in advance with relevant representatives from West Somerset (WSC) and Sedgemoor District (SDC) Councils. Noise monitoring locations were agreed in principle only, prior to discussions with property owners and/or residents.

This report is a factual document containing the results of the baseline noise measurements undertaken in the vicinity of the Hinkley Point site. There is no discussion regarding the implications of the results on the acoustic design of the buildings, this will be provided in a subsequent technical report that will be the basis of the EIA chapter.

The following sections of this report describe the measurement work undertaken and give a summary of the results. A glossary of acoustic terminology is provided above and the raw broadband monitoring data is provided in Appendix C.

1.1 Planning policy and guidance

The key regulations that relate to this study are set out below:

- Planning Policy Guidance 24: Planning and Noise (PPG 24).
- British Standard (BS) 7445: Parts 1-3: 1991/2003 – Description and measurement of environmental noise.
- British Standard (BS) 4142: 1997 – Method for rating industrial noise affecting mixed residential and industrial areas.
- Department of Environment, Welsh Office & HMSO, 1988, Calculation of Road Traffic Noise (CRTN).
- IPPC Horizontal Guidance for Noise H3 Parts 1 and 2 (Version 3 2004).

2.0 SITE DESCRIPTION

2.1 Site location and context

The Site is located on the north Somerset coast, east of Minehead and north of Bridgwater. Between 10 km and 20 km from the Site are the settlements of Williton, Watchet, Burnham-on-Sea, Bridgwater and Taunton and there are a number of smaller villages closer to the Site.

The Site is bounded to the north by the Bristol Channel (Bridgwater Bay) and to the south and west by agricultural fields. Land to the east is occupied by two nuclear power stations, Hinkley A and Hinkley B, which form the existing Hinkley Point power station complex. Hinkley A operated between 1965 and 2000 and is currently undergoing decommissioning. The station is now fully defueled and is being prepared for a period of aftercare and maintenance. Full site clearance is planned for 2095.

Hinkley B has operated since 1976. It is currently producing 70% of its maximum potential output of 860 MW and is scheduled to continue operating until at least 2016. Decommissioning will commence once operations have ceased.

2.2 Summary of proposed development

Electricité de France (EDF) plans to construct and operate a new nuclear power station at Hinkley Point ("Hinkley Point C) on the north Somerset coast. The site EDF has selected for the proposed development (the 'Site') is situated adjacent to the existing Hinkley A nuclear power station which is currently being decommissioned.

The principal component of the proposed power station will comprise two UK European Pressurised Reactors (UK EPRs), nominally unit C1 and C2. Each unit will have a net electrical output of up to 1630MW for export to the electricity grid.

In addition to the two UK EPRs, a range of ancillary buildings, related infrastructure and waste storage facilities will be required. In order to facilitate construction of this development, construction of a marine off-loading facility adjacent to the Site and extension to the existing sea defences may be required.

A summary of the key elements of each phase with respect to potential noise impacts on nearby receptor locations is provided below so that appropriateness of monitoring location selection is apparent.

2.2.1 Primary noise-generating activities during the construction phase

The primary noise and vibration sources during the development construction phase are those typical of an industrial construction site. Potential impacts will vary through the following major stages of the development:

- Mobilisation

- Upgrading work at Combwich Wharf
- Offloading operations at Combwich Wharf
- Earthworks and site platform construction
- Building construction
- EPR commissioning

Throughout these stages, the volume of construction traffic on local roads will vary considerably, with the potential to affect noise sensitive receptors along the main road network connecting the Site with the M5 motorway to the east.

2.2.2 Primary noise-generating activities during the operation phase

The primary noise sources of an operational EPR Unit include the following:

- The discharge stack
- Air entry and exit openings
- Ventilation openings
- Pumping stations
- Steam pipes
- Machine rooms

In addition to site plant noise, operation of the UK EPRs will generate road traffic, primarily for the transportation of the site workforce. Occasional heavy vehicular traffic will be generated for materials delivery during periods of heavy maintenance work.

2.2.3 Nearest noise sensitive receptors

Description of the nearest noise sensitive receptors to the proposed development will be provided. A table will be presented which identifies the locations of the receptors and their distances from site.

The nearest receptor locations to the Site comprise residential dwellings in the villages of Burton, Shurton and Wick to the south. Baseline noise survey locations that are representative of these locations have therefore been selected, as well as locations on the northern and southern site boundaries.

Construction and operation of the development also has the potential to impact on noise sensitive operational activities (e.g. office spaces) at the Hinkley B site immediately to the east of the Site.

Noise generated by construction and operation road traffic on the main road network will have the potential to impact on noise sensitive receptors aligning the likely transportation route corridor. Baseline monitoring has been undertaken at two locations representative of dwellings that are likely to experience the most significant impacts.

The baseline noise monitoring locations, are described in Table 1 see Appendix A for full description and plans.

Table 1 Baseline noise monitoring locations

Ref.	**Location**	**Representative of**	**Grid Ref.**	**Approximate distance (m)**	
				from the boundary of the SSA boundary	**from the nearest proposed EPR Unit**
ML1	Northern SSA boundary	Site boundary	319530, 146079	0	340
ML2	Knighton Farm (residential)	Dwellings in Burton	319380, 144548	450	1,520
ML3	Doggetts (residential)	Dwellings in Shurton	320590, 144666	30	1,130
ML 4	Wick House (residential)	Dwellings in Wick	321675, 144557	810	1,690
ML 5	Southern SSA boundary	Site boundary	320050, 144498	0	1,300
ML 6	Hinkley Point power station – visitors centre	Hinkley B power station office use	320680, 146072	500	920
ML 7	Rodway, Cannington	Properties along Rodway	325615, 140451	n/a	n/a
ML	Chad's Hill, Cannington	Properties on Chad's Hill, Park Lane and Sandy Lane	325215, 140063	n/a	n/a
ML 9	Riverside, Combwich	Properties on Riverside	326100, 142342	n/a	n/a
ML 10	Northbrook Road, Cannington	Properties on Northbrook Road, Southbrook Close and Lonsdale Road	326250, 139110	n/a	n/a

3.0 SURVEY METHODOLOGY

3.1 Measurement methodology

The scope and methodology of the monitoring survey was agreed in advance with relevant representatives from West Somerset (WSC) and Sedgemoor District (SDC) Councils. Noise monitoring locations were agreed in principle only, prior to discussions with property owners and/or residents, and assessment of appropriate siting conditions at each location.

3.1.1 Planning Policy Guidance 24 'Planning and Noise' (PPG 24)

PPG 24 was introduced by the Department of the Environment in 1994. Paragraph 1 on page 1 of PPG 24 indicates that it was issued to:

> *'…provide advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business … It outlines some of the main considerations which local planning authorities should take into account in drawing up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources'*

For new developments that will introduce noise into an area PPG 24 confirms, in Annex 3, that it is appropriate to continue using previously established assessment routines, for example when assessing 'Noise from road traffic' (Annex 3, paragraph 1), 'Noise from industrial and commercial developments' (Annex 3, paragraphs 19-20) and 'Noise from construction sites' (Annex 3, paragraph 21). The appropriate assessment routines applicable to this development are discussed in the following sections.

3.1.2 BS 7445:2003 Part 1 'Description and measurement of environmental noise – Guide to quantities and procedures'

BS 7445-1:2003 defines the verification and traceability of instrumentation and noise measurement, as well as describing the basic procedures for the determination of environmental noise levels.

BS 7445-1 defines the following criteria for selection of appropriate noise level measurement locations:

- Microphone position either:
    - at least 3.5 m from any reflecting surface (other than the ground), i.e. in 'free-field' and 1.2 – 1.5 m above the ground (acknowledgement is made to other standards with specific heights); or,

  - 1 – 2 m from the façade of a receptor building, and 1.2 – 1.5 m above each floor level of interest.

- Minimise interference due to meteorological conditions by either:
  - measurement over a range of meteorological conditions to determine the long-term average sound level; or,
  - measurement under carefully specified meteorological conditions (i.e. conditions that would result in the most stable sound propagation)

BS 7445-1 also describes procedures for equipment calibration, which is described in Section 3.4, Quality Control Procedures.

3.1.3 Calculation of Road Traffic Noise (CRTN)

Paragraphs 43 and 44 of CRTN describes its Shortened Measurement Procedure for determining $L_{10(18\text{-hour})}$ road traffic noise levels. This involves the continuous measurement of traffic noise over any three consecutive hours between 10:00 and 17:00. This generates the $L_{10(3\text{-hour})}$ which is the arithmetic average of the three $L_{10,1\text{hour}}$ levels measured. Subtraction of 1 dB from the $L_{10(3\text{-hour})}$ gives the estimated $L_{10(18\text{-hour})}$ value.

CRTN stipulates that the following physical conditions should prevail for suitable measurement:

- Dry road surface;
- Appropriate wind conditions:
  - Prevalence of wind in the direction from the road to the microphone;
  - Average wind speed no more than 2 m/s from the road to the microphone;
  - Wind speed should not exceed 10 m/s in any direction (wind shield to be used)

CRTN stipulates that the monitoring location should have a substantially unobstructed (angle of view greater than 160°) view of the road, at a distance of 4 – 15 m from the near side carriageway edge.

The microphone should be positioned at 1.2 m above the road surface with the diaphragm horizontal, and in 'free-field' conditions, where possible.

3.1.4 BS 4142: 1997 'Method for rating noise affecting mixed residential and industrial areas'

BS 4142: 1997 details a method of rating the acceptability of increases in the background noise level L_{A90} at noise-sensitive developments affected by noise from proposed fixed developments.

The ambient background noise varies throughout the day and night-time periods. For new plant that may operate on a 24-hour basis, it is appropriate to measure the reasonable minimum ambient background noise level (which would normally occur in the early hours of the morning) at nearest noise-sensitive developments (normally local residential properties) and to use this value for comparison against the predicted rating noise level from the new plant.

BS4142 stipulates that measurement locations should be representative of outside locations *"at buildings where people are likely to be affected"*. Measurements should be undertaken in 'free-field' (at least 3.5 m from any reflecting surface other than the ground), ideally at a height of 1.2 – 1.5 m above the ground. If first floor (or higher) measurements are to be undertaken, the microphone should be located 1 m from the building façade.

In order to minimise the influences of external interference, noise measurements should not be undertaken:

- during excessive wind speeds (a wind shield should be used, BS4241 states that a wind shield is likely to be effective up to wind speeds of 5 m/s);
- during periods of heavy rainfall; and,
- close to high voltage power lines or radio transmitters

BS4142 stipulates two distinct reference time intervals to be assessed:

- 1 hour during the day
- 5 minutes during the night

The document does not define day and night, only expressing that night should refer to the period "when the general adult population are preparing for sleep or are actually sleeping". PPG 24, which recommends the use of BS4142, defines day and night-time periods as 07:00 – 23:00 and 23:00 – 07:00, respectively.

3.2 Monitoring period, duration and frequency

A combination of short-term attended and medium-term unattended measurements were undertaken. A summary of the monitoring regime and details of the microphone position, as well as a commentary of the significant noise sources at each location, is provided below:

3.2.1 ML1 Northern SSA boundary

The monitoring location was next to the coastal path, approximately 40 m south of the cliff edge. For all measurements, the sound level meter was positioned 1.5m above ground level, in free-field conditions.

For health and safety purposes, attended measurements were not undertaken during periods of darkness. The sound level meter was therefore deployed unattended overnight at this location.

The main daytime noise sources at this location include birdsong and surf. The movement of foliage in the wind also contributed to the ambient noise levels. Although not observed during the measurement period, intermittent noisy events are also likely to occur at this location, including: farming activities and nuclear plant operations (such as gas venting).

3.2.2 ML2 Knighton Farm

The monitoring location was approximately 30 m north of the nearest residential farm building, at Knighton Farm. For all measurements, the microphone was positioned 1.5 m above ground level, in free-field conditions.

Continuous monitoring was undertaken between Monday 27th and Thursday 30th April 2009.

During the measurement period, the main daytime noise sources at this location were mobile farming equipment and birdsong. The movement of foliage in the wind also contributed to the ambient noise levels. During the night-time, very low background noise levels, as low as 20 dB $L_{A90,15min}$, were recorded.

3.2.3 ML3 Doggetts

The monitoring location was approximately 7 m from the western façade of the residential dwelling ‘Doggetts’. For all measurements, the microphone was positioned 1.5 m above ground level, in free-field conditions.

Continuous monitoring was undertaken between Monday 27th and Tuesday 28th April 2009, and again between Thursday 30th April and Tuesday 5th May 2009. It was observed that, during the bank holiday week-end the resident had erected a decking platform approximately 5 m from the measurement position. Noise generated during this construction work (electric drill, screwdriver, hammering) is likely to have adversely affected measurements during the afternoon periods of the 2nd and 3rd May.

The main noise sources at this location during typical periods include the movement of foliage in the wind and birdsong. Distant road traffic on the A39 was also observed during the survey visit.

3.2.4 ML4 Wick House

The monitoring location was approximately 35 m northeast of the nearest residential dwelling at Wick House, and approximately 95 m south east of Wick Farm. For all measurements, the microphone was positioned 1.5 m above ground level, in free-field conditions.

Continuous monitoring was undertaken between Thursday 30th April and Sunday 3rd May 2009. Higher noise levels were recorded during the afternoon period of Saturday 2nd May which is likely to be due to children playing near to the sound level meter, notably using a trampoline which had been positioned approximately 12 m away.

The main noise sources at this location during typical periods include the movement of foliage in the wind; birdsong; and road traffic on the A39.

3.2.5 ML5 Southern SSA boundary

The monitoring location was close to a field border hedgerow, in any area of open, undulating countryside, approximately 180 m north of the nearest residential receptor location (Bishops Farm House). For all measurements, the microphone was positioned 1.5 m above ground level, in free-field conditions.

Short-term attended measurements were undertaken during the afternoon of the 28th April, and the morning of the 6th May 2009. Continuous unattended monitoring was undertaken during the evening and overnight between 6th and 7th May 2009.

The main noise sources at this location during typical periods include the movement of foliage in the wind and birdsong. Although not observed during the measurement period, intermittent noisy events associated with farming activities are also likely to occur at this location.

3.2.6 ML6 Hinkley Point Power Station (visitors centre)

The monitoring location was approximately 80 m north of the Hinkley Point power station Visitors Centre, at the northeast corner of the car park, approximately 160 m south of the coastline. For all measurements, the microphone was positioned 1.5 m above ground level, in free-field conditions.

Short-term measurements (two samples of 15-min duration) were undertaken during each of the daytime (07.00-17.00 hours), evening (17.00-23.00 hours) and night-time (23.00-07.00 hours) periods.

Continuous unattended monitoring was undertaken between Wednesday 6th and Thursday 7th May 2009. An operative cutting the grassland (using a strimmer) north of the measurement period on the afternoon of the 6th May contributed to the measured ambient noise levels. The background acoustic climate at this location was dominated by industrial noise from the Hinkley Point A and B sites, and therefore the L_{A90} did not drop below 45 dB throughout the monitoring period. Between the hours of 04:45 and 05:00 on the 7th May 2009, a significant event occurred, which generated a level of 86 dB $L_{Amax(fast)}$. Analysis of the 1/3rd octave spectral L_{max} data shows the noise emission contained significant high frequency sound (above 1 kHz). This, as well as analysis of the statistical data, indicates that the source was likely to be short-term gas venting at the existing Hinkley Point B site.

Other noise sources at this location include: surf, birdsong and occasional vehicle movements in the visitors centre car park.

3.2.7 ML7 Short-term attended monitoring (Rodway)

The monitoring location was 4 m east of the carriageway edge of Rodway road, north of Cannington, at the entrance to the Cannington community football pitch. This location was representative of residential dwellings in north Cannington, and between Cannington and Combwich.

The microphone was positioned 1.5 m above the road surface, in free-field conditions. At this location Rodway has a speed limit of 40 mph, with a good surface (dry during the measurement period) and there is a significant upward gradient from the south. The microphone position had a 180º view of the road, and there were no opposite reflections.

The existing Baseline Noise Level (BNL) was determined in accordance with the CRTN Shortened Measurement Procedure. An attended measurement was carried out over three consecutive daytime hours (13:00 – 16:00).

The daytime acoustic climate at this location was dominated by road traffic on Rodway. Other, less significant noise sources included birdsong and intermittent tractor-mower movements on the football pitch.

3.2.8 ML8 Short-term attended monitoring (Chad's Hill)

The monitoring location was 3 m east of the carriageway edge of Chad's Hill, 40 m north of its junction with Park Lane and Sandy Lane. This location was representative of residential dwellings on Park Lane, Sandy Lane and Chad's Hill.

The microphone was positioned 1.2 m above the road surface, in free-field conditions. At this location Chad's Hill has a speed limit of 30 mph, and is a reasonably level single lane track, used primarily for access to and from Castle Hill Quarry to the north, and by farm vehicles. The road surface was dry during the measurement period, and the microphone position had a 150º view of the road, with no opposite reflections.

The existing Baseline Noise Level (BNL) was determined in accordance with the CRTN Shortened Measurement Procedure. An attended measurement was carried out over three consecutive daytime hours (10:00 – 13:00). A vehicle count during the measurement period shows a significant number of HGVs (34%) which were primarily quarry trucks, and farm vehicles (10%), with cars and light vans making up the remainder.

Throughout the measurement survey, significant noise from Castle Hill Quarry was observed. Notable sources included an aggregate crusher plant (repetitive clunks) and quarry vehicle reversing bleepers.

Other noise sources identified during the survey included: birdsong; foliage moving in the wind; sheep bleating; and distant road traffic in Cannington.

3.2.9 ML9 Short-term attended monitoring (Combwich)

The monitoring location was approximately 22 m southeast of the nearest residential property on Riverside, Combwich, and approximately 43 m north of the existing Combwich Wharf facility. The microphone was positioned 1.2 m above ground level, in free-field conditions.

Short-term attended measurements were undertaken for a period of 1 hour during the morning of Wednesday 29th April 2009.

During the survey, noise sources that contributed to the acoustic climate at this location included birdsong, occasional vehicle movements on Riverside and in the car park at the BE laboratory to the south.

3.2.10 ML10 Short-term attended monitoring (Northbrook Road)

The monitoring location was approximately 10 m southwest of the nearest residential property on Northbrook Road, and 240 m northeast of the carriageway edge of the A39 roundabout, which is the dominant noise source in the area. This location was representative of residential dwellings on Northbrook Road, Lonsdale Road and Southbrook Close. The microphone was positioned 1.2 m above the road surface, in free-field conditions.

The existing Baseline Noise Level (BNL) for the A39 was determined in accordance with the CRTN Shortened Measurement Procedure. An attended measurement was carried out over three consecutive daytime hours (14:00 – 17:00). At this location the A39 has a speed limit of 40 mph, with a good surface (dry during the measurement period). The microphone position had a limited angle of view of the road (35º), and there were no opposite reflections.

Other noise sources identified at this location included birdsong and intermittent roofing work at a property 180 m to the south.

3.3 Equipment

Equipment used during this measurement survey included:

Rion NL-31	Class 1 Sound Level Meter	s/n 672900
Rion NA-28	Class 1 Sound Level Meter	s/n 00370312
Rion UC-53A	Microphone	s/n 312092
Rion UC-59	Microphone	s/n 00405
Rion NC-74	Class 1 Sound Level Calibrator	s/n 34712641

3.4 Quality control procedures

All AMEC personnel involved in the monitoring programme have attained the UK Institute of Acoustics Certificate of Competence in Environmental Noise Measurements.

All equipment specified in Section 3.3 above (sound level meters, microphones, preamplifiers and field calibrators) had been fully calibrated within the 12 months preceding the survey. Calibration certificates for all monitoring equipment used are provided in Appendix D.

As stipulated in BS7445-1: 2003, field calibrations were carried out in accordance with the manufacturer's specifications before and after each series of measurements. A class 1 field calibrator in accordance BS EN 60942: 2003 was used to set the sensitivity of the entire sound measurement system at the start of each series of measurements, or each medium-term monitoring period, and to check that no significant sensitivity drift had occurred upon completion.

3.5 Constraints and variations

Two additional noise monitoring locations were included that were not previously included in the Noise Monitoring Plan to account for changes to the emerging development construction programme and transportation options studies. These included a short-term measurement at the nearest residential receptor location to Combwich Wharf to enable an assessment of the potential upgrade and use of this facility. A further road traffic noise survey was included in Cannington to assess the potential impacts of a possible new bypass.

There were no other deviations from the Noise Monitoring Plan.

3.6 Meteorological conditions

A record was kept of the prevailing weather conditions during the monitoring period. A summary of observations as well as intermittent measurements of wind speed and ambient temperature is provided in Table 2.

In addition, meteorological data was recorded continuously at a temporary weather station on the Hinkley Point site (Grid Ref. 320790,145525). The output data for the entire baseline noise survey period from this site is summarised in Figures 1 and 2 below, and the full data is provided in Appendix E.

Despite occasional light rain, the overall meteorological conditions throughout the measurement period were conducive to obtaining suitable baseline monitoring data.

Table 2 Summary of meteorological conditions during the baseline noise survey

Date	Time	Ambient Temp. (°C)	Average Wind Speed (m/s)	Prevailing Wind Direction (from)	Observations
27/04/09	13:15	10	1 – 3	NW	Overcast, light rain
27/04/09	16:35	15	4 – 5	NW	3/8 cloud, dry
27/04/09	18:30*	14	4 – 5	NW	2/8 cloud, dry
27/04/09	20:00	11	4 – 5	NW	2/8 cloud, dry
28/04/09	08:00	13	1 – 2	NNW	4/8 cloud, dry
28/04/09	10:12	19	2 – 3	NNW	2/8 cloud, dry
28/04/09	11:00	22	< 1	NW	1/8 cloud, dry
28/04/09	14:00*	17	4 – 5	NNW	4/8 cloud, dry
28/04/09	15:00	14	1 – 2	NW	1/8 cloud, dry
29/04/09	08:25	19	< 1	W	1/8 cloud, dry
29/04/09	16:10	22	2 – 3	W	4/8 cloud, dry
30/04/09	10:00	19	2 – 4	SSW	Overcast, light rain
05/05/09	12:15	16	4 – 5	W	7/8 cloud, dry
05/05/09	14:00	17	1 – 2	NW	7/8 cloud, dry
06/05/09	08:45	12	1 – 2	NW	4/8 cloud, dry
06/05/09	12:00	18	1 – 2	NW	2/8 cloud, dry
06/05/09	14:00	20	< 1	W	1/8 cloud, dry
06/05/09	17:45*	15	4 – 5	NW	6/8 cloud, dry
07/05/09	09:45*	14	1 – 3	NW	6/8 cloud, dry

Note: * observations at ML1 (coast) where stronger winds persisted.

Figure 1 Measured wind speed and temperature data (27th April – 7th May 2009)

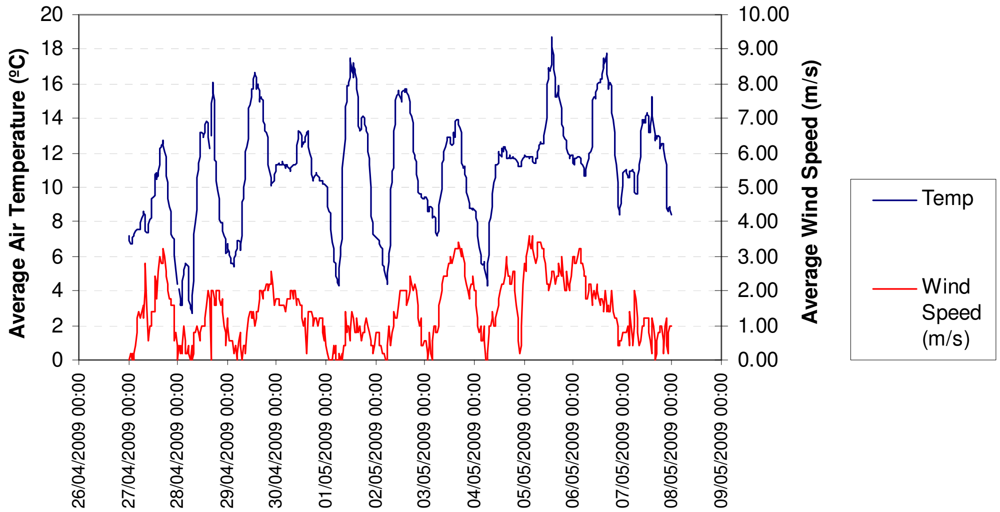
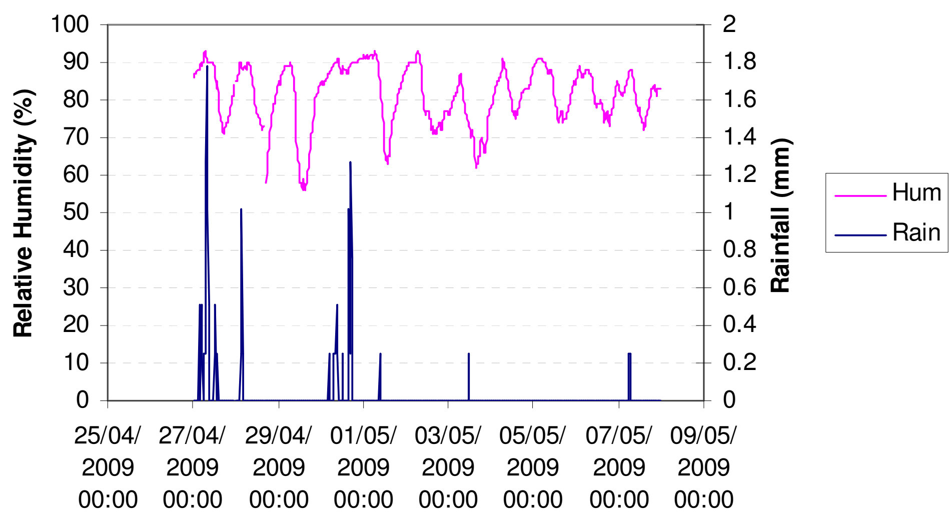


Figure 2 Measured rainfall data (27th April – 7th May 2009)



4.0 SUMMARY OF MEASUREMENT RESULTS

4.1 Monitoring data

A summary of the results of the baseline noise measurements are tabulated below. Full broadband datasets are provided in Appendix C. One third octave data was obtained at four monitoring locations (ML1, ML2, ML4 and ML6). This data will be used in the analysis of potential impacts, and presented in the technical assessment report where applicable.

For each monitoring period: 'Day' represents 07:00 – 23:00; 'Evening' represents 19:00 – 23:00; and, 'Night' represents 23:00 – 07:00.

Table 3 Monitoring location 1 – Northern SSA boundary

Monitoring Period (start date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{A10,T}$ *	$L_{Amax,T}$
Day (29/04/09)	16:25	2 hour	44.7	36.0	48.0	60.6
Day (07/05/09)	07:00	3 hour	41.9	36.8	43.6	64.0
Evening (06/05/09)	19:00	4 hour	45.2	41.1	45.9	61.5
Night (06/05/09)	23:00	8 hour	46.5	41.6	46.0	64.5

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* L_{A90} and L_{A10} values are arithmetic averages of individual 15-minute measurements

Table 4 Monitoring location 2 – Knighton Farm

Monitoring Period (start date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{A10,T}$ *	$L_{Amax,T}$
Day + (27/04/09)	14:15	8.75 hour	44.1	33.3	42.2	74.4
Evening (27/04/09)	19:00	4 hour	41.0	26.8	35.5	64.9
Night (27/04/09)	23:00	8 hour	45.7	31.0	39.1	77.0
Day (28/04/09)	07:00	16 hour	45.3	30.4	44.3	74.4
Evening (28/04/09)	19:00	4 hour	37.4	26.4	33.9	74.4
Night (28/04/09)	23:00	8 hour	42.7	26.1	34.2	69.9
Day (29/04/09)	07:00	16 hour	47.5	32.9	46.5	79.0
Evening (29/04/09)	19:00	4 hour	40.7	30.9	39.0	71.8
Night (29/04/09)	23:00	8 hour	42.8	26.3	36.8	77.5

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* L_{A90} and L_{A10} values are arithmetic averages of individual 15-minute measurements.

+ Incomplete daytime period.

Table 5 Monitoring location 3 – Doggetts

Monitoring Period (start date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{A10,T}$ *	$L_{Amax,T}$
Day + (27/04/09)	14:15	8.75 hour	59.4	37.5	45.8	91.9
Evening (27/04/09)	19:00	4 hour	62.8	32.9	42.4	55.3
Night (27/04/09)	23:00	8 hour	43.2	36.1	42.1	62.1
Day + (28/04/09)	07:00	7.75 hour	44.6	33.9	44.5	75.0
Day + (30/04/09)	10:00	13 hour	40.2	32.3	40.4	70.5
Evening (30/04/09)	19:00	4 hour	34.5	29.8	36.2	49.2
Night (30/04/09)	23:00	8 hour	39.7	29.5	35.5	66.2
Day (01/05/09)	07:00	16 hour	46.1	31.9	41.2	85.3
Evening (01/05/09)	19:00	4 hour	50.6	32.0	40.4	58.3
Night (01/05/09)	23:00	8 hour	35.5	29.2	33.8	63.5
Day (02/05/09)	07:00	16 hour	54.7	38.3	46.0	100.1

Evening (02/05/09)	19:00	4 hour	35.6	31.2	36.8	47.3
Night (02/05/09)	23:00	8 hour	35.0	27.3	32.6	68.4
Day (03/05/09)	07:00	16 hour	57.1	43.0	52.2	103.8
Evening (03/05/09)	19:00	4 hour	43.0	37.3	45.6	55.3
Night (03/05/09)	23:00	8 hour	39.3	31.8	38.2	64.7
Day (04/05/099)	07:00	16 hour	42.0	34.3	42.5	69.3
Evening (04/05/09)	19:00	4 hour	39.1	33.1	39.1	51.3
Night (04/05/09)	23:00	8 hour	51.7	45.2	53.9	66.4
Day (05/05/09)	07:00	5.5 hour	51.5	44.8	53.0	75.2

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* L_{A90} and L_{A10} values are arithmetic averages of individual 15-minute measurements.

$^{+}$ Incomplete daytime period.

Table 6 Monitoring location 4 – Wick House

Monitoring Period (start date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{A10,T}$ *	$L_{Amax,T}$
Day $^{+}$ (30/04/09)	10:30	12.5 hour	45.6	38.1	46.2	82.8
Evening (30/04/09)	19:00	4 hour	42.9	35.4	42.3	68.0
Night (30/04/09)	23:00	8 hour	44.3	37.3	42.9	78.0
Day (01/05/09)	07:00	16 hour	45.7	37.3	46.7	73.5
Evening (01/05/09)	19:00	4 hour	41.3	35.7	42.7	66.7
Night (01/05/09)	23:00	8 hour	44.6	37.9	42.9	72.1
Day (02/05/09)	07:00	16 hour	55.9	43.4	52.7	82.7
Evening (02/05/09)	19:00	4 hour	42.2	36.8	43.4	68.5
Night (02/05/09)	23:00	8 hour	47.2	35.7	42.1	69.3
Day (03/05/09)	07:00	16 hour	59.8	46.1	53.5	91.5
Evening (03/05/09)	19:00	4 hour	45.1	40.7	46.8	63.6

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* L_{A90} and L_{A10} values are arithmetic averages of individual 15-minute measurements.

$^{+}$ Incomplete daytime period.

Table 7 Monitoring location 5 – Southern SSA boundary

Monitoring Period (date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{A10,T}$ *	$L_{Amax,T}$
Day + (28/04/09)	15:18	1 hour	40.4	35.3	42.8	60.4
Day (06/05/09)	08:45	30 min	49.8	34.7	45.3	84.8
Evening (06/05/09)	19:00	4 hour	36.8	28.5	36.7	72.8
Night (06/05/09)	23:00	8 hour	39.0	29.4	36.2	73.5
Day + (07/05/09)	07:00	3.5 hour	41.2	31.7	40.5	71.3

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* L_{A90} and L_{A10} values are arithmetic averages of individual 15-minute measurements.

+ Incomplete daytime period.

Table 8 Monitoring location 6 – Hinkley Point visitors centre

Monitoring Period (date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{A10,T}$ *	$L_{Amax,T}$
Day + (05/05/09)	12:30	10.5 hour	50.0	47.9	51.2	71.9
Evening (05/05/09)	19:00	4 hour	50.0	48.4	51.1	67.9
Night (05/05/09)	23:00	8 hour	56.3	50.4	53.9	85.7
Day + (06/05/09)	07:00	6.25 hour	48.9	46.1	50.2	73.8

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* L_{A90} and L_{A10} values are arithmetic averages of individual 15-minute measurements.

+ Incomplete daytime period.

Table 9 CRTN Shortened measurement procedure at monitoring location 7 – Rodway, Cannington

Start Time (05/05/09)	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)				
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{A10,T}$	$L_{Amax,T}$	$L_{A10(18hour)}$*
13:00	1 hour	68.5	46.3	73.2	89.1	72.6
14:00	1 hour	68.2	46.7	73	86.2	
15:00	1 hour	69.9	48.5	74.6	88.7	

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.
* Derived using CRTN shortened measurement methodology.

Table 10 CRTN Shortened measurement procedure at monitoring location 8 – Chad's Hill, Cannington

Start Time (06/05/09)	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)				
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{A10,T}$	$L_{Amax,T}$	$L_{A10(18hour)}$*
10:00	1 hour	56.2	39.5	49.3	81.4	43.4
11:00	1 hour	59	40.4	48.6	84.8	
12:00	1 hour	55.6	36.2	47.3	82.4	

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.
* Derived using CRTN shortened measurement methodology.

Table 11 Monitoring location 9 – Riverside, Combwich

Monitoring Period (date)	Start Time	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)			
			$L_{Aeq,T}$	$L_{A90,T}$	$L_{A10,T}$	$L_{Amax,T}$
Day (05/05/09)	09:47	15 min	42.8	35.2	45.8	59.8
	10:02	15 min	46.8	37	45.1	80.8
	10:17	15 min	44.5	37.8	44.8	76.3
	10:32	15 min	41.9	37.1	44.6	58.4

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

Table 12 CRTN Shortened measurement procedure at monitoring location 10 – Northbrook Road, Cannington

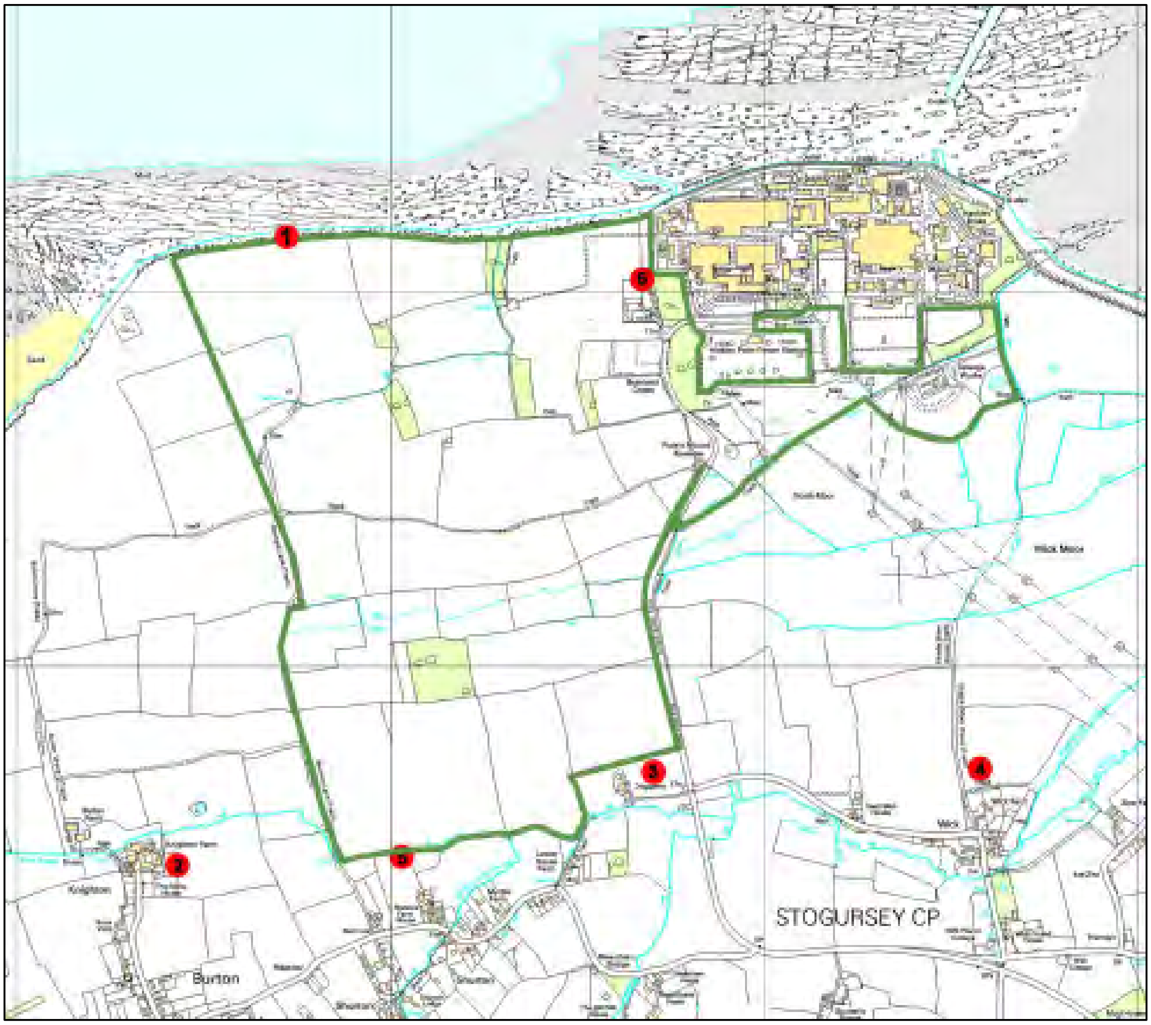
Start Time (06/05/09)	Measurement Duration (T)	Sound Pressure Level, dB (fast time-weighting)				
		$L_{Aeq,T}$	$L_{A90,T}$	$L_{A10,T}$	$L_{Amax,T}$	$L_{A10(18hour)}$*
14:00	1 hour	51.6	46.9	52.4	83.9	51.7
15:00	1 hour	51.6	47.8	53	74.3	
16:00	1 hour	51.1	47.8	52.8	73	

Notes: All values are in dB re $2x10^{-5}$Pa, Free-field.

* Derived using CRTN shortened measurement methodology.

Appendix A. Map of monitoring locations

A1.1 Monitoring Locations ML1 – ML6



Appendix B. Photographic record of monitoring locations

Table B.1 Baseline noise monitoring locations

Ref.	Location	Plate
ML1	Northern SSA boundary	
ML2	Knighton Farm (residential)	

ML3	Doggetts (residential)	
ML 4	Wick House (residential)	
ML 5	Southern SSA boundary	

ML 6	Hinkley Point power station – visitors centre	 
ML 7	Rodway, Cannington	

		
ML	Chad's Hill, Cannington	

ML 9	Riverside, Combwich	 
ML 10	Northbrook Road, Cannington	

		06/05/2009 12:59

Appendix C. Raw monitoring data

Raw broadband monitoring data are provided in the following tables. One third octave monitoring data were also obtained at four locations (ML1, ML2, ML 4 and ML6); this data will be used in the analysis of potential impacts, and presented in the technical assessment report where applicable.

All sound pressure level data presented are expressed in dB re: 20 µPa. Start times are British Summer Time (BST).

Table C1.1 ML1 (29/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
08:23	44.2	39.5	46.9	63
08:38	44.3	40	47	52.7
08:53	42.9	38.3	45.8	53.7
16:25	44.7	34.9	48.7	57.5
16:40	41.5	32.8	45.4	54.5
16:55	40.8	33.1	44.1	55.1
17:10	46	37.8	49.7	59.3
17:25	44.8	37.7	47.9	59.2
17:40	44.7	36.3	48.4	55
17:55	45.8	38	49	60.6
18:10	46.7	38.3	50.5	58.8

Table C1.2 ML1 (06/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
19:00	47.5	45.2	49.3	53.4
19:15	46.2	43.6	48.1	53.8
19:30	45.4	42.5	46.1	61.5
19:45	44.5	41.9	46.5	52
20:00	43.1	40.8	44.9	50.2
20:15	49.1	43.3	52.4	60
20:30	50.4	43.2	53.9	59.9
20:45	45.2	41.3	47.8	53.9
21:00	44.7	40.8	47.5	55.4
21:15	42.1	39.8	44.2	48.9
21:30	41.9	40	43.3	51
21:45	41.2	39.5	42.5	50.2
22:00	40.8	38.9	42.2	48.5
22:15	40.3	38.6	41.5	49.5
22:30	40.8	39.3	41.9	46.5
22:45	41	39.5	42.1	45.8
23:00	38.9	37.3	40.1	45.4
23:15	39	37.6	40.3	44.2
23:30	38.1	36.5	39.5	45.5

Table C1.3 ML1 (07/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	37.3	35.3	39	44.5
00:15	37.5	36	38.8	46.7
00:30	39	37.4	40.4	43.6
00:45	40.6	39.3	41.8	45.1
01:00	41.6	39.8	42.9	47.6
01:15	42.7	40.6	44.5	49.1
01:30	43.2	41.6	44.7	49.1
01:45	43.4	41.3	45	50
02:00	44.4	41.4	46.3	53.4
02:15	41.7	39.5	43.4	46.9
02:30	41.8	39.1	43.7	49.5
02:45	43.6	41.9	45	48.9
03:00	46	43.4	47.5	57.2
03:15	46.3	42.7	48.9	56.6
03:30	46	43.2	48.1	54.2
03:45	45.7	43.4	47.5	53.9
04:00	45	43.1	46.4	51.4
04:15	47.3	44.1	49.6	54.9
04:30	46.9	43.4	49.2	58.6
04:45	45.4	42.8	47.5	55.8
05:00	44.1	42.3	45.6	59.2
05:15	52.1	44.7	55.2	60.3
05:30	52.8	49.5	55.1	60.1
05:45	53	49.1	55.5	64.5
06:00	50	47.2	52	59.5
06:15	50.6	47.4	53	57.7
06:30	46.3	43.3	48.4	53.2
06:45	45.6	42.4	46.9	62.5
07:00	45.1	41.5	47.7	55.5
07:15	45.7	42.3	47.9	56.6
07:30	43.2	40.5	45.1	55
07:45	41.9	37.4	42.8	60.6
08:00	40.4	37.5	41.9	51.5
08:15	41.8	37.2	45.3	59.4
08:30	40.4	32.5	43.6	64
08:45	40.6	33.7	44.2	57.7
09:00	37.5	33.5	40.1	52.9
09:15	36.7	33.3	38.5	49.9
09:30	41.3	35.5	44.9	54.8
09:45	39.2	36.6	40.7	55.6

Table C2.1 ML2 (27/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
14:15	42.5	37.6	45.6	58.3
14:30	46.1	40.3	49.3	58.4
14:45	46.7	38.9	48.5	63.4
15:00	45.8	38.1	48.6	61.1
15:15	45.1	38.7	48.3	59.6
15:30	46.2	40.3	49.2	59.3
15:45	44.6	39.2	47.3	63.2
16:00	45	39.9	48.1	53.5
16:15	47.8	42.4	50.7	57
16:30	47.5	42.6	50	61.5
16:45	47.3	41.7	50.3	61.3
17:00	45.9	39	48.4	65
17:15	47.1	39.6	48.6	74.4
17:30	44.9	39.3	48	58.9
17:45	44.7	38.1	47.9	59.9
18:00	47.3	37.5	49.8	64
18:15	42.3	35.6	45.8	56.2
18:30	41.5	36	44.3	58.6
18:45	40.3	33.4	41.4	58.2
19:00	38.5	32.7	40.2	58.1
19:15	48	31.5	49.2	64.9
19:30	42.5	32.4	46.2	64.4
19:45	47.8	30.3	50.9	63.5
20:00	46	27.6	46.4	62.8
20:15	31.4	25.8	33.6	54.3
20:30	28.5	24.2	29.1	45.3
20:45	32.4	23.4	30.9	52.2
21:00	25.9	23.4	28	37.6
21:15	24.8	23.5	26.2	30.5
21:30	32.4	24.3	30.4	52.7
21:45	34.2	26.4	36.2	51.5
22:00	27.3	25.7	28.8	37.3
22:15	27.9	25.3	29.8	42.1
22:30	28.7	25.6	29.2	46.9
22:45	30.5	25.9	33.3	41.7
23:00	31.4	29.8	32.6	37.9
23:15	29.5	27.8	31	38
23:30	29.8	27.6	32	40.9
23:45	27.7	26.3	29	32.1

Table C2.2 ML2 (28/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	27	25.9	28.1	34.1
00:15	26.8	25.7	27.9	39
00:30	26.8	25.9	27.9	31.7
00:45	27.1	26	28.1	32.8
01:00	25.9	24.6	27.1	31.5
01:15	25.5	24.2	26.5	40.9
01:30	26.9	24.2	28.9	41
01:45	27.6	24.1	30.2	35.4
02:00	27.2	23.9	29.7	33.1
02:15	40.9	31.5	43.9	47.4
02:30	42.8	38.7	46.1	47.9
02:45	37.6	33.8	40.1	47
03:00	34.8	28	38.8	44
03:15	39.1	33.4	41.1	44.9
03:30	36.4	31.4	38.9	43.7
03:45	32.5	28.8	34.9	43.3
04:00	30.4	25.7	33	38.3
04:15	33.4	27.7	37.3	44.3
04:30	34.6	32.3	36.7	42.7
04:45	35.2	32.6	37.2	52.2
05:00	42.8	35.5	46	59.3
05:15	50.3	39.9	54.9	61.3
05:30	54.7	40.4	59.8	65.5
05:45	51.7	40.7	57.7	64.4
06:00	50.7	40	56.4	64.2
06:15	49.5	38.1	54.8	66.5
06:30	53	36.7	58.2	77
06:45	51.8	39.6	56.9	68.1
07:00	49.2	40.1	54.8	61.6
07:15	52.4	36.6	57.4	68.3
07:30	50.5	34.5	56	65.6
07:45	49.2	33.6	53.2	67.6
08:00	45.2	33.2	47.2	63.2
08:15	51.7	32.8	56.5	67.7
08:30	47.6	30.8	48.9	66
08:45	52.3	32.3	58.4	68.2
09:00	51.3	30	56	68.7
09:15	47.5	30.9	50.5	64.9
09:30	47.4	29.7	49.6	72.9
09:45	48.4	30.3	48.1	72.5
10:00	44.3	29.9	47.9	62.7
10:15	47.8	31.6	47.2	74.1
10:30	-	-	-	-
10:45	-	-	-	-
11:00	43.4	27.9	48	57.7
11:15	45.6	27.1	49.1	63.8
11:30	45.2	28.2	46.8	63.9
11:45	41.8	29.1	46.2	55.3
12:00	43.2	29.5	47.5	58.7
12:15	42.6	28.1	46.9	58
12:30	44	31.4	48.4	59.1
12:45	48.3	28.9	49.8	73.7

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	43.5	28.9	47.1	65.7
13:15	40.5	29.3	44.1	58.3
13:30	43.6	29.8	41.7	60.3
13:45	41.3	32.6	43.5	58.8
14:00	42.1	32.8	44.3	60.6
14:15	40.9	32.7	44.7	58
14:30	44	31.5	44.2	62.8
14:45	42.9	31.2	43.8	59.7
15:00	41	32.9	44.7	60.3
15:15	37.7	30.3	39.9	61.9
15:30	36	30.4	37.8	56.7
15:45	43.6	32.8	46.5	59.9
16:00	46.1	33.6	49.7	62.6
16:15	40	32.8	42.4	60.8
16:30	46.3	34.8	50.5	61.4
16:45	40	34.1	43.2	51.2
17:00	41.5	32	45.2	56.5
17:15	42.4	32.3	45.6	68.2
17:30	43.2	30.5	46.5	61.5
17:45	44.1	33.9	48.2	61.9
18:00	46.4	31.3	50.8	62.4
18:15	42.4	33.3	46.1	59.6
18:30	44.7	35.7	48	60.9
18:45	46.1	35.6	50.4	64.8
19:00	45.6	34.9	48.6	74.4
19:15	43.4	32.6	47.9	59.9
19:30	40.3	30.5	42.9	60.4
19:45	36.2	29.6	38.9	52.4
20:00	35.2	28.4	36.1	53.7
20:15	30.6	27.2	33.3	42.1
20:30	32.2	27	35	45.7
20:45	32.9	26.7	33.4	53.1
21:00	34.5	27	33	55.7
21:15	34.5	25.9	31.2	54.4
21:30	28.3	25.2	29.7	49.3
21:45	26.2	22.2	29	38.7
22:00	24	21.1	26.5	35.8
22:15	22.7	20.5	24.8	32.9
22:30	23.8	20	26.1	39
22:45	24.4	22.8	25.8	31.3
23:00	28.2	24.8	30.1	45.3
23:15	29.9	25.8	33.2	40.2
23:30	27.8	24.5	30.1	38.9
23:45	26.8	23.1	27.3	50.1

Table C2.3 ML2 (29/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	23	21.1	24.6	31
00:15	26.9	23.2	29.2	36.7
00:30	31.9	27.1	34.6	39.1
00:45	32.1	28.3	34.5	39.9
01:00	30.7	25.1	34.3	42.7
01:15	29.6	26.2	31.8	38.1
01:30	31.3	23.6	35.3	42.9
01:45	23.9	22.3	25.4	28.6
02:00	25.8	24.2	27.2	34.2
02:15	24.1	22.5	25.8	31.1
02:30	23.4	22.3	24.5	28.6
02:45	25	22	25	44.1
03:00	22.7	21.8	23.6	27
03:15	21.5	20.3	22.7	28.1
03:30	23.2	22.1	24.3	29
03:45	23.3	21.9	24.1	42.5
04:00	27.8	22.4	24.9	50.7
04:15	24.2	22.6	25.5	32.3
04:30	26.4	25.1	27.6	39.5
04:45	30.1	28.1	31.8	35.6
05:00	45.2	31.7	50	60.5
05:15	50.1	33.6	55.3	61.8
05:30	50	33.9	55.2	64.5
05:45	49.5	34.8	52.7	66
06:00	47.7	33.5	52.7	61.1
06:15	45.3	33.3	46	67.2
06:30	49.6	33.2	51.5	69.9
06:45	48.3	31.1	52	69.8
07:00	42	30.7	45.5	61.8
07:15	47.5	29.8	49	68.2
07:30	47.7	29.9	49.5	63.7
07:45	48.7	31	53.7	64.4
08:00	44.9	27.4	47.5	66.8
08:15	49.3	29.9	54.9	65.5
08:30	48.8	27.7	52.2	67.5
08:45	46.7	30.5	50	64.2
09:00	46.1	28.8	49.1	63.5
09:15	53	42	56.3	69.9
09:30	52	48	54.7	77.5
09:45	54.8	49	58.1	77.3
10:00	54.9	46.1	58.3	74.4
10:15	52.6	34.2	57.4	66.6
10:30	52.1	35.4	55.5	67.9
10:45	53	36	57.5	67.3
11:00	51.6	34.7	56.5	66
11:15	50	33.6	55	66.4
11:30				
11:45				
12:00	45.2	34.6	47.7	62.6
12:15	46.1	32.7	46.1	67
12:30	52.2	32	49.1	77.5
12:45	41.6	32.3	42.9	63.4

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	49.6	31.9	53.9	70.6
13:15	43.4	29.7	44.5	62.6
13:30	44	31.1	45.8	65.6
13:45	44.5	30.3	45.3	62
14:00	37.5	30.9	40.2	62
14:15	45.6	34.3	50.6	62.4
14:30	39.6	32.6	42.4	54.9
14:45	38.5	33	41.7	51.4
15:00	39.1	31.9	42	56.4
15:15	37.1	31.1	39.5	52.1
15:30	41.1	33.5	43.6	59.4
15:45	45.2	33.5	48.9	60.9
16:00	48.4	33.3	53.4	63.4
16:15	44.4	35.4	47.2	61.1
16:30	43.7	33.7	47.2	63
16:45	39.6	32.1	43.1	58
17:00	44.5	34.9	48.6	60.5
17:15	41.2	34.6	44.1	58.7
17:30	44.3	35.4	48.4	60.3
17:45	43.9	34.1	47.9	59.3
18:00	42.5	34	46.3	59.3
18:15	47.5	33	52.3	64.6
18:30	43.8	33.3	48.3	57.3
18:45	45.9	33.9	49.8	62.8
19:00	45	35.2	48.7	60.5
19:15	45.9	36.5	49.9	62.4
19:30	43.4	32.9	47.6	59.9
19:45	40.5	31.4	41.2	65.6
20:00	40	32.8	42.7	61.4
20:15	42.6	34.7	39.9	70.8
20:30	43.5	35.9	41.9	71.8
20:45	41.2	37.1	42.4	60.9
21:00	38.4	34.7	40.7	48.6
21:15	37.9	33.6	40.7	52.4
21:30	35	29.4	37.6	52.6
21:45	30.4	26.7	33	39.4
22:00	26.7	23.3	29.2	38.9
22:15	26.9	23.5	29.1	39.7
22:30	26.5	22.9	29.3	40.4
22:45	27.7	23.3	30.3	50.4
23:00	28.2	23.2	31.6	47.7
23:15	28.6	24.8	30.9	37.3
23:30	28.2	23.6	31.7	38.6
23:45	29.4	24.6	32.6	47.5

Table C2.4 ML2 (30/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	32.4	25	35.7	46.9
00:15	29.3	23.5	32.2	40.7
00:30	31.6	26.2	34.8	45.5
00:45	35.7	26.6	38.7	49.7
01:00	33.2	25.3	36.6	55.6
01:15	32.3	24.4	35.2	45.8
01:30	31.1	25.4	34.3	46.2
01:45	28.6	23	32	43.4
02:00	34.4	27.2	37.7	47.4
02:15	29.6	22.9	33.1	44.7
02:30	30	23.9	33.4	40.1
02:45	29.5	24.5	31.3	45.4
03:00	30.8	24.1	34.5	46.8
03:15	32.2	25.5	35.7	44.3
03:30	23.8	21	25.8	38.7
03:45	26.5	20.4	30.2	39.1
04:00	25.9	21.2	28.6	39.4
04:15	23.3	20.4	25.7	37.2
04:30	26.9	22.6	29.6	41.7
04:45	25	22.2	26.9	38.8
05:00	36.7	25.4	37.6	63.7
05:15	50.8	33.3	55.9	65
05:30	51.1	36.5	55.8	65.1
05:45	51.9	36.1	55.2	79
06:00	45	34.3	48.2	62.1
06:15	47.2	33.4	46.5	65.7
06:30	48.2	35.3	50.2	77.2
06:45	44.7	36.4	48.5	63.2
07:00	48.3	37.5	50.2	76.5
07:15	47.5	38.1	51.2	62.3
07:30	51.5	39.8	56.1	65.7
07:45	52.7	39.5	56	72.6
08:00	46.1	36.9	46.7	68.5
08:15	44.7	37.3	47.3	65.8
08:30	46.3	40.6	48.8	60.2
08:45	48	38.4	51.4	63.9
09:00	47.6	38.8	51.3	62.7
09:15	52.4	36.4	55.3	80.8

Table C3.1 ML3 (27/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
14:15	48.3	40.1	47.6	80
14:30	47.6	42.3	50.2	60.3
14:45	47.7	42.4	50.5	60.3
15:00	46.4	40.6	49.4	60.7
15:15	45.6	40.6	48.8	55.7
15:30	46.8	41.8	49.6	58.6
15:45	46	41.5	48.8	58.6
16:00	46.9	42.4	49.7	55.7
16:15	49.7	45.2	52.2	62.3
16:30	48.6	44.3	51.4	61.4
16:45	48.7	43.7	51.6	60.8
17:00	50.6	42.9	50	81.7
17:15	50.6	41.7	49.1	78.6
17:30	44.4	39.5	47.3	57.5
17:45	44.7	40.7	47.2	54.8
18:00	44	39.2	47	53.6
18:15	42.1	37.9	44.1	62.6
18:30	48.7	38.7	45	81.2
18:45	55.5	36.5	43	91.9
19:00	39.8	35.8	42.4	49.8
19:15	74.3	36.1	74.4	91.3
19:30	-	-	-	-
19:45	61.6	36	66.4	75.4
20:00	36.7	34.1	38.6	45.9
20:15	36.8	33.5	38.8	55.3
20:30	35.6	31.9	37.8	52.4
20:45	34.1	30.5	35.5	59.7
21:00	33.3	29.9	34.9	52
21:15	33.7	29.9	35.9	48.4
21:30	35.2	28.8	36	64.5
21:45	36.4	31.7	39.5	52
22:00	35.9	33.2	37.9	48
22:15	36.6	33.5	38.6	46.8
22:30	35.9	33.2	38.1	43.1
22:45	38.6	35.2	41.2	45.6
23:00	39.9	35.3	42.6	47.5
23:15	38	34.8	40.4	45.9
23:30	37.7	35	39.4	47
23:45	39.3	37.4	40.8	47.1

Table C3.2 ML3 (28/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	41.9	36.1	44.6	50.1
00:15	37.8	34.3	40.5	43.8
00:30	34.9	31	37.2	42.7
00:45	31.6	29.9	32.9	38.1
01:00	31.4	29.2	32.9	37.3
01:15	34.7	29.4	36.9	50
01:30	37	33.7	39.2	45.1
01:45	37.1	34.2	39.1	44.1
02:00	36.9	34.4	38.6	43.5
02:15	36	32.6	38.3	42.7
02:30	34.9	32.8	37.1	46.4
02:45	32.9	29.7	35.1	49.3
03:00	34.6	30.2	37.4	40.6
03:15	40.6	30.8	44	49.1
03:30	41.4	38.7	42.8	46
03:45	38.4	35.1	40.6	45.1
04:00	36.6	31.6	39	47.7
04:15	38.7	32.6	43.2	53.2
04:30	40.4	37.1	42.9	53.1
04:45	39.8	35.7	42.4	45.9
05:00	45.5	43.3	47.1	56.6
05:15	45.7	43.2	47.3	59.6
05:30	45.8	42.4	47.6	55.2
05:45	46.5	44.3	48	58.9
06:00	47.1	44.5	48.9	56.3
06:15	49.7	43.4	53.6	62.1
06:30	49.7	44.8	52.5	58.1
06:45	50.9	46.7	53.5	61.7
07:00	51.7	48	54.1	61.1
07:15	50.3	45.9	53	58.3
07:30	49.4	43.2	52.7	61.7
07:45	47	39.9	50.3	57.6
08:00	45.5	39.8	48.4	63.1
08:15	41.2	35.6	44	53.1
08:30	40.5	33.7	43.4	56.5
08:45	41	34.9	43.7	60.6
09:00	47.5	35	50.4	64.7
09:15	42.7	34.8	46.4	57.4
09:30	43.1	32.1	46.9	57.6
09:45	41.6	31.7	41.4	62.3
10:00	36.2	31.9	38.5	51.5
10:15	38.6	32.2	40.9	57.9
10:30	37.9	31.1	40.6	62
10:45	-	-	-	-
11:00	43.3	29.7	42.4	75
11:15	37.8	30.9	39	57.2
11:30	34.2	28.9	36.5	55.5
11:45	37.4	29.4	41	52
12:00	40.6	29.4	44.7	54.6
12:15	42.1	29	44.8	61.6
12:30	43	30.2	47.7	62.2
12:45	49.7	28.6	46.5	74.4

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	39.4	29.9	42	57.2
13:15	38	31.2	41.9	52.8
13:30	36.3	31.4	38.5	62.8
13:45	38.7	34.7	41.4	47.6
14:00	40.1	35.2	42.7	55
14:15	40.9	34.1	44.4	62.3
14:30	46.5	34.6	45.8	72.3

Table C3.3 ML3 (30/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
10:15	52.1	36.6	49.7	70.5
10:30	42.5	35.1	45.3	65.5
10:45	40.8	34.7	43.4	56.5
11:00	40.6	33.7	43.8	56
11:15	41.1	33.9	44.3	56.4
11:30	40.3	34.9	42.8	55.7
11:45	41.9	34.7	45.5	55.9
12:00	42	33.7	45	59.3
12:15	40.9	33.7	43.8	57.5
12:30	42.2	33.4	46.2	55.8
12:45	41.8	32.9	45.5	58.5
13:00	39.9	32.7	42.9	55.1
13:15	40.8	31.2	44	57.2
13:30	37.3	29.5	39.9	56.7
13:45	39.1	32.2	42.2	55.9
14:00	44.6	34	48.9	59.3
14:15	37.5	31.2	40.7	50.6
14:30	38.3	30.6	40.7	58.4
14:45	40.3	34.2	43	54.6
15:00	36.8	33.1	39.1	47.8
15:15	35.1	32.3	36.9	49.5
15:30	37	32.6	39.1	49.5
15:45	39.6	35.3	41.4	49.4
16:00	39	34.2	42.3	50.9
16:15	36.7	31.8	38.9	51.1
16:30	39.6	36.6	41.4	55.7
16:45	40.9	38.6	42.1	56.4
17:00	40.1	37.9	41.7	51.8
17:15	37.3	34	39.4	53
17:30	35.9	32.2	38.2	46.7
17:45	36.7	31.2	40	50.1
18:00	38.4	32.7	41.7	52.3
18:15	38.6	32.7	41.8	50.9
18:30	37.9	30.9	41	55.2
18:45	36	32.2	38.1	54.9
19:00	35.8	31.5	38.1	51.9
19:15	36	32	38.3	52.7
19:30	35.1	31.7	37.5	48.3
19:45	38.6	31.5	42.2	52.5
20:00	37.1	30.4	40.7	52.1
20:15	36.4	29.8	40	50.6

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
20:30	34.4	30.2	36.5	51.4
20:45	32.3	29.3	34.6	45.9
21:00	32.3	29.2	34	53.8
21:15	31.6	29.2	33.5	44.3
21:30	31.1	27.8	32.7	57.8
21:45	31.5	27.7	34	44.2
22:00	30.1	27.7	32.2	40
22:15	31	28.5	32.9	40.9
22:30	33.5	29.9	35.8	54
22:45	33.6	30.1	36.1	46.5
23:00	31.7	29.3	33.5	39.3
23:15	30.3	27.4	32.3	39.9
23:30	27.6	22	30.8	40.3
23:45	33.4	23.9	35.5	51.5

Table C3.4 ML3 (01/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	24.7	21.6	26.7	35.5
00:15	22.1	20.1	23.6	31.3
00:30	28.3	22.3	30.1	45.3
00:45	29	23.1	27.2	48.3
01:00	24.8	22.7	26.7	36
01:15	24.5	22.8	26.3	29.8
01:30	24.4	22.1	24.9	48.1
01:45	24.8	23.4	25.5	41.1
02:00	24.9	23.7	25.9	36.5
02:15	29.9	26.8	31.7	36.6
02:30	33.6	31	35.3	41.7
02:45	34.7	32.9	36.4	39.6
03:00	34.3	29.8	37.6	40.3
03:15	32.1	29.1	34.9	48.1
03:30	34.8	33.1	36	46.1
03:45	34.8	32.6	36.4	46.3
04:00	32.2	28.9	34.9	45
04:15	33.2	30.7	34.6	46.6
04:30	36.8	31	39	52.6
04:45	36.3	31.7	38.2	50.2
05:00	41.9	36.2	44.9	55.6
05:15	41.3	38	43.3	56.1
05:30	41.8	36.7	43.1	63.1
05:45	43.9	37.2	43.7	66.2
06:00	42.4	35.1	45.2	56.6
06:15	47.1	38.2	49.3	64.3
06:30	48.3	40.3	51.8	60.4
06:45	47.7	40.7	51.4	60.5
07:00	47.7	41.8	51.1	59.4
07:15	46.4	39.5	50.4	57.3
07:30	46.7	39.5	49.6	60.3

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
07:45	43.5	36.2	46.8	57.1
08:00	39.6	33.7	42.9	49.9
08:15	37.2	31.1	40.6	49.1
08:30	37.1	30.7	40.2	48.8
08:45	36.9	30.4	40	49.4
09:00	36.7	30.1	40	52.9
09:15	34.7	29.4	37.5	50.2
09:30	36.2	29.6	39.5	52.6
09:45	34.8	28.6	37.7	50.5
10:00	35.5	28.9	37.7	53
10:15	34	28.8	37.1	46
10:30	41.4	28.4	39.8	64.3
10:45	33.7	28.7	36.5	51.1
11:00	36.1	29.6	38.3	58.6
11:15	38	31.6	41	54.7
11:30	37.3	32	40.5	49.8
11:45	36.7	31	39.6	51.8
12:00	36.9	31.8	39.4	50.5
12:15	37.2	32.5	39.9	52
12:30	37.5	32.5	40.5	53.5
12:45	36.3	32.1	38.8	51.5
13:00	38.9	33.6	41.8	54.6
13:15	37.4	32.2	40.5	49
13:30	41.6	30.6	42	62.3
13:45	37	30	39.9	57.9
14:00	39.1	32	42.2	49.3
14:15	40.7	29.9	44.7	58.4
14:30	36.8	29.8	39.7	55.2
14:45	37.7	31.2	40.5	57
15:00	40.8	32.8	43.1	58.9
15:15	40.3	32.1	40.8	67.4
15:30	37.6	32.1	40.5	50.1
15:45	40.4	34.2	44.1	51.9
16:00	38.8	34	41.6	51.1
16:15	35.6	30.6	38.8	47.7
16:30	37	30	40.5	51.1
16:45	38.7	30.9	41.7	61.3
17:00	37.3	31.7	40.3	53.7
17:15	36	30.9	38.9	47.6
17:30	41.5	33.3	44.8	59.6
17:45	44.2	34.7	48.2	59.6
18:00	37.7	31.7	40.7	52.2
18:15	36.4	31.1	38.8	60.4
18:30	34.8	29.9	37.6	53.2
18:45	54.7	30.8	50.5	84.4
19:00	60.1	43	52.8	85.3
19:15	56.3	33	49.4	84.1
19:30	40.4	31.5	42.8	58.9
19:45	52.4	32.1	50.8	70.1
20:00	52.1	31.7	53.9	71.2
20:15	34.9	30.9	37.5	54.3
20:30	36.4	31.9	37.7	53.6
20:45	39.3	34.4	38.2	69.6
21:00	36	30.8	37.5	55.2

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
21:15	32	29.9	33.4	46
21:30	32	29	33.6	44.6
21:45	35.4	29.9	35.6	50.4
22:00	36.4	30.4	39.8	50.2
22:15	33.4	31.7	34.8	46.4
22:30	34.2	31.1	35.2	49.1
22:45	32.1	30.3	33.1	43
23:00	35.8	31.7	35.3	63.5
23:15	32.2	29.3	32.6	50.2
23:30	31.2	29.3	32.1	54.1
23:45	31.6	29.1	33.3	47.1

Table C3.5 ML3 (02/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	30	28.1	31.4	46.1
00:15	28.9	26.9	30.3	37
00:30	28.8	26.9	30.1	38.6
00:45	29	27.1	30.7	35.2
01:00	28.6	26.6	30.2	34.7
01:15	29.3	26	29.9	48.8
01:30	28.5	26.7	30	34
01:45	29	27.4	30.3	35.4
02:00	29.4	27.3	30.8	40.5
02:15	28.9	26.5	30.3	43.2
02:30	28.5	27.1	29.8	38
02:45	29.6	26	30.3	48.6
03:00	27.4	25.9	28.7	39.7
03:15	29.1	26	29	47.6
03:30	28.2	25.5	28.4	44.7
03:45	28.4	25	29.2	45.3
04:00	28.8	24.9	27.3	48.4
04:15	29.3	25.2	31.6	47.2
04:30	31.4	26	34.6	48.5
04:45	34.9	30.3	37.1	50.7
05:00	40.8	34.3	41.1	63.1
05:15	38.1	34.8	39.6	57.7
05:30	39.8	35.5	41.5	58.2
05:45	39.8	36.1	41.9	56.1
06:00	41.7	37	43.8	61.9
06:15	39.2	34.6	41.7	56.2
06:30	40.9	36.1	43.7	52.4
06:45	41.7	34.9	45	54.6
07:00	41.8	36.4	44.9	52.6
07:15	39.3	34	42.3	51.6
07:30	37.8	31.7	41.1	51.3
07:45	37.4	31	40.9	50.2
08:00	39.3	31.4	42.8	53.8
08:15	37.4	31.5	40.1	51.3

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
08:30	35.6	29.9	39.1	51.4
08:45	36.1	30	38.7	56.3
09:00	34.2	29.2	36.5	53.7
09:15	33.7	28.8	36.5	48.2
09:30	35.9	29.8	38.9	55.1
09:45	35.7	29.6	38.1	59.9
10:00	34.2	28.9	36.9	48.5
10:15	35.5	28.4	38.7	61.6
10:30	37.5	32.1	39.7	50.9
10:45	37.3	30.6	37.8	61.4
11:00	38.6	31.7	39	66.4
11:15	37	32.5	39.9	49.1
11:30	38.8	34.5	41.4	54.2
11:45	42.2	35.3	42.7	64.8
12:00	40.5	36	42	61.6
12:15	38.6	35.2	41.1	47
12:30	46	34.8	43.3	63.2
12:45	47.3	36.4	48.7	62.6
13:00	52.8	40.4	56.5	67.2
13:15	59.3	52.4	59.7	85.3
13:30	67.8	54.4	65.5	100.1
13:45	59.5	54.5	61.5	78.1
14:00	60.8	55	63.5	77.1
14:15	64.6	57.8	66.5	81
14:30	59.6	54.2	62.6	78.8
14:45	57.3	53.2	59.8	73.9
15:00	57.3	52.7	60	74.8
15:15	56.8	52	59.7	68
15:30	56.6	51.6	59.4	70.4
15:45	55.3	50.3	58.4	66.9
16:00	54.7	50	57.4	67.1
16:15	54.2	49.7	57.3	62.8
16:30	54.5	50.1	57.2	66.9
16:45	55.4	50.2	58.1	67.5
17:00	56.4	51.3	59.2	72.6
17:15	56.5	50.8	59.5	69
17:30	56.6	51.2	59.5	70.6
17:45	57.3	52.1	60.3	69
18:00	54.6	38.7	59	69.6
18:15	39.7	36.5	41.9	49.2
18:30	39.6	36.4	42.1	49.4
18:45	39.9	36.8	42.2	57.4
19:00	38.7	35.7	40.8	54
19:15	38.2	35.1	40.3	51.7
19:30	37.4	34.6	39.6	51.9
19:45	38.9	33.4	40.2	59.4
20:00	34.2	31.4	36.5	43.5
20:15	33.3	31.2	35	41
20:30	35	31.1	37.7	47.2
20:45	35.9	30.7	39.2	49.7
21:00	37.8	30.6	39.5	54.6
21:15	31.2	29	32.7	42.4
21:30	30.3	27.9	31.7	41.4
21:45	33.2	27.2	35.8	50.2

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
22:00	32.4	28.8	34.1	43.2
22:15	35.6	33.3	37.1	41.7
22:30	32.4	29.3	34.5	43
22:45	32	29.7	33.5	41.6
23:00	32.6	29.8	34.1	45.6
23:15	30.8	28.1	33.1	41.9
23:30	29.5	27.7	30.4	41.8
23:45	31.1	27.6	33	42.7

Table C3.6 ML3 (03/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	28.8	26.2	30.2	44
00:15	30.4	25	34.5	43.3
00:30	27.2	24.2	28.6	41.2
00:45	27.3	24.6	28.9	48.4
01:00	26.7	24.1	28.7	35
01:15	25.8	23.4	27.8	34.8
01:30	26.4	22.8	27.8	40
01:45	26	22.7	26.5	41.5
02:00	28.2	22.7	31.9	42.9
02:15	27.6	22.7	27	44.6
02:30	25.3	23.6	26.8	30.2
02:45	29.1	24.9	28.5	47.6
03:00	26.9	25.1	28.2	37.1
03:15	26	25.1	26.9	31.6
03:30	28.6	24.8	26.9	52.9
03:45	27.7	24.1	25.6	50.7
04:00	27.9	23.2	24.9	48.9
04:15	30.2	23.4	26.8	51.4
04:30	31.6	25.5	33.9	49.6
04:45	35	28.5	38.1	52.3
05:00	40.9	34	41.6	67.2
05:15	41.9	34.4	42.5	68.4
05:30	36.1	32.7	38.3	49.9
05:45	37.9	32.7	40	57.3
06:00	36	31.8	38.8	50.9
06:15	39.6	32.9	42.9	52.5
06:30	42.5	37.4	45.6	55.6
06:45	40.9	37.2	43.4	50.9
07:00	41.1	37.2	43.5	59.4
07:15	39.8	36.3	42.4	50.5
07:30	39.5	36.6	41.9	48.7
07:45	41	37.4	43.4	52.6
08:00	42.2	38.4	44.6	52.2
08:15	42.9	38.2	45.7	53.5
08:30	44.1	39.9	46.6	56.9
08:45	44.7	40.2	47.3	58.4
09:00	67.8	39.9	48.7	103.8

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
09:15	61	42.5	52.7	85.1
09:30	60.1	45.8	56.3	90.7
09:45	64.9	47.8	56.6	92.1
10:00	64.1	47.3	55.6	89.2
10:15	63.2	46.9	59.1	88.2
10:30	63.5	45.5	61.6	89.5
10:45	63.8	44.5	61.1	90
11:00	60.6	44.6	58.1	90.2
11:15	59.2	45.4	62.3	82.1
11:30	57.7	45.4	59.8	80.6
11:45	58.2	47.8	59.3	79.6
12:00	58.9	48.4	58.3	82.8
12:15	55.5	48.7	56	81.5
12:30	56.8	45.5	59	79.2
12:45	55.6	45	55.4	78.7
13:00	56.5	46.1	55.6	79
13:15	55.9	47	58.7	74
13:30	58.5	47.9	60.4	88.2
13:45	59.4	47.2	58	92.6
14:00	51.7	46.4	54.6	65.1
14:15	56.8	48.2	58.7	78.7
14:30	56.5	50	58.7	78.2
14:45	55.3	49.9	58.1	73.3
15:00	56.9	50.4	59	79.1
15:15	54.2	49	57.3	70.6
15:30	52.4	46.7	55	69.8
15:45	52.8	45.6	55.5	76.9
16:00	52.3	47.1	54.9	64.8
16:15	52.3	46.3	55.2	64.3
16:30	51.5	45.4	54.7	64.6
16:45	52.8	47.4	55.5	67.2
17:00	51.8	46.6	54.6	63.4
17:15	50.2	45.1	52.8	62.9
17:30	51.2	45.7	54.1	64.1
17:45	49.7	44.9	52.3	61.9
18:00	50.1	43.5	53.2	64.7
18:15	49.5	43.6	52.5	64.5
18:30	51.1	44.5	54.1	65.1
18:45	48.7	42.6	51.7	61.1
19:00	44.8	39	48.2	57.1
19:15	46.3	40.2	49.5	57.8
19:30	43.9	38.5	47.2	56.1
19:45	43.5	38.7	46.2	64.9
20:00	42.1	37.8	45	53.9
20:15	41.7	36.7	45.1	53.3
20:30	43.1	38.1	46.2	56.6
20:45	39.4	35.6	42.2	51.8
21:00	38.8	34.5	41.7	53.4
21:15	37.7	34	40.4	48.5
21:30	40.2	34.9	43.4	54.7
21:45	41.4	35.9	44.9	52.6
22:00	43.5	37.4	46.6	55
22:15	44.3	38.5	47.4	56.3
22:30	44.2	38.3	47.7	56.7

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
22:45	44.5	39.1	47.4	55.5
23:00	44.7	38.8	47.7	58.6
23:15	46.1	41.1	49	57.8
23:30	45.5	39.9	48.7	56.1
23:45	41.5	37.1	44.3	53.8

Table C3.7 ML3 (04/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	42.3	37.7	45.3	51.8
00:15	41.3	37.1	44.2	52.1
00:30	39.4	34.5	42.3	51.8
00:45	36.5	32.6	38.5	55
01:00	32.5	29.2	34.5	50.7
01:15	30.7	28.8	32.1	43.5
01:30	30.7	28.7	32.1	40.6
01:45	31.4	30	32.7	37
02:00	31.8	30.1	33.5	40.6
02:15	33.9	31.1	35.9	45.1
02:30	30.8	28.8	32.1	41.3
02:45	33.2	30.3	35.3	41.8
03:00	31	28.5	33.4	39.4
03:15	30.4	26	32.7	50.1
03:30	26.1	25.1	27.1	35.9
03:45	28.6	25.7	29.2	48
04:00	31.1	26.9	32.2	48.1
04:15	29.8	27.2	31.4	43.5
04:30	33.6	27.2	37.4	50.1
04:45	37.8	29.3	39.7	57.7
05:00	39.2	34.6	40.7	63.2
05:15	37.5	33.8	39.3	54.9
05:30	36.6	33.1	37.6	58.4
05:45	37.1	32.9	38.9	54.2
06:00	41	32.6	38.9	64.7
06:15	42.9	33.2	46	61.5
06:30	43.1	32.8	47.2	59.1
06:45	38.3	33.5	40.9	56.3
07:00	36.2	32	38.6	52.3
07:15	36.9	32.1	39.6	48.1
07:30	39.7	30.9	42.8	54.4
07:45	38.4	34.5	40.8	56.2
08:00	36.1	31.6	38.6	50.3
08:15	36.3	30.5	38.2	54.8
08:30	41.7	29.8	38.5	69.3
08:45	37.6	29.9	39.4	59.3
09:00	36.9	28.8	39.9	55.2
09:15	35.2	29.2	37.9	54.6
09:30	39.7	28.8	43.3	57.1
09:45	35.1	28.1	37.9	50.9

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
10:00	36.6	29.1	37.5	56.3
10:15	38.8	30.9	41.7	58.3
10:30	35.2	30.9	37.9	46.5
10:45	35.4	30.9	37.9	59
11:00	37.9	30.8	38.2	56.5
11:15	40	33.4	43.1	61.4
11:30	42.5	35.7	45.4	59.6
11:45	38.5	32.9	41.2	58.6
12:00	39.6	34.6	42.1	56.7
12:15	38.7	33.9	40.3	61.8
12:30	41.6	36.3	44.3	57.5
12:45	42.1	36.8	45.1	56.7
13:00	39.6	33.9	42.2	57.6
13:15	39.9	35	42.2	58
13:30	42	35	44.9	60.4
13:45	41.7	36.1	44.9	55.3
14:00	43.1	37.1	46.1	62.4
14:15	44.9	39.3	47.8	61.5
14:30	42.3	37.2	45.3	56
14:45	46	38.5	49.3	56
15:00	46.4	39.9	49.5	62.7
15:15	49	43.1	52.1	61.5
15:30	49.2	41.8	52.5	61.5
15:45	44.5	38.5	47.9	56.7
16:00	41.1	35.7	44.2	52.7
16:15	42.3	35.9	45.6	61.7
16:30	42.4	37	45.3	56
16:45	46.1	39.6	49.3	61.5
17:00	40.7	35.1	43.8	53.7
17:15	40.9	35.2	44.3	52.6
17:30	41.7	36.7	44.6	52.2
17:45	42	37.1	44.8	54
18:00	46.3	38.9	49.9	58
18:15	48.5	41.1	51.7	62.9
18:30	45.8	38.6	48.8	61.9
18:45	44.1	37.9	47.5	56.9
19:00	43	36.4	46.5	54
19:15	45.1	36.5	49.1	57.1
19:30	44.5	35.3	48.8	58.9
19:45	39.2	34	42.3	51.6
20:00	37	32.1	38.8	63.7
20:15	35.5	30.9	38	53.3
20:30	34	30.5	36.1	49.7
20:45	33.1	30.3	35.4	46.5
21:00	33.7	30	34.7	52.4
21:15	32.4	30.3	33.6	53.7
21:30	33.6	31.7	35.1	41.8
21:45	35.2	33.1	36.7	47.2
22:00	36.4	35	37.6	44.2
22:15	36	34.9	36.9	43.6
22:30	36.6	34.8	37.7	53.1
22:45	37	33.8	38.7	50.5
23:00	39.8	35.8	41.9	54.6
23:15	47.1	40.6	50.3	59.2

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
23:30	48	41.1	51.7	60.1
23:45	50.5	42.6	53.7	64

Table C3.8 ML3 (05/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	49	43.7	52.1	62.5
00:15	47.3	37.9	51	61.3
00:30	50	44.4	52.8	62.9
00:45	47.9	41.6	51.2	59.1
01:00	47.4	41.6	50.8	58.3
01:15	51.6	45.6	54.3	66.3
01:30	53.3	46.9	56.5	65.4
01:45	52.8	47.9	55.7	65.7
02:00	52.9	47.4	56	66.4
02:15	54.5	48.1	58	65.5
02:30	54.4	49.5	57.2	66.2
02:45	51.6	45.5	54.5	64.3
03:00	52.2	46.9	55	64.5
03:15	53.7	48.9	56.4	65.2
03:30	54.1	49.1	57.3	65.6
03:45	54.8	49.7	57.8	65.7
04:00	52.4	47.7	55.1	64.8
04:15	52.6	47.2	55.5	63.7
04:30	51.9	46.7	54.7	62.5
04:45	51.4	45.5	54.4	64.1
05:00	48.5	42.5	51.8	59.4
05:15	49.3	43.8	52	63.5
05:30	50.3	44.8	53.2	63.3
05:45	50.7	44.6	53.7	64.6
06:00	49.3	43.9	52.3	61.8
06:15	50.8	45.8	53.3	64.4
06:30	53.9	49	56.8	65.5
06:45	54.8	50.4	57.4	65.6
07:00	54.7	49.9	57.8	64.7
07:15	55.3	50.5	58.3	65.4
07:30	54.4	49.7	57.2	68.3
07:45	55.2	50.9	58.4	66.9
08:00	52.8	48.7	55.6	65
08:15	54.8	49.5	58	65.7
08:30	52.2	47.8	54.7	64.7
08:45	51.6	46.7	54.1	63.7
09:00	50.9	46.6	53.5	63.4
09:15	51.7	47	54.5	64.5
09:30	51.3	46.4	54.1	64.3
09:45	50.5	45.2	53.4	64.4
10:00	49.6	44	52.3	64.7
10:15	49.7	45.3	52.4	60.1
10:30	46.6	41.6	49.7	55.8

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
10:45	44.6	39.2	47.8	56.1
11:00	47	41.8	50.2	56.8
11:15	44.5	40.2	47.6	57.3
11:30	45.4	39.8	48.7	56.8
11:45	45	39.4	48.4	57.6
12:00	47.2	38.4	50.8	63
12:15	47.6	37.4	48.9	75.2

Table C4.1 ML4 (30/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
10:30	47	38.3	48.7	66.8
10:45	44.9	38.5	47.8	61.4
11:00	44.4	37.3	47.1	63.6
11:15	46.5	40.6	49.6	60.3
11:30	48.6	39	51.9	65.9
11:45	44.1	37	46.2	60.5
12:00	49.1	39.2	48.5	69
12:15	44.4	38.5	47.1	60.6
12:30	46.4	39.6	49.1	65.2
12:45	46	39.2	49.2	61.4
13:00	47.4	38.7	49.4	66.5
13:15	46.4	38.2	48.3	67
13:30	51.9	36.6	49.1	82.8
13:45	48.2	38.2	52.5	63.4
14:00	44.7	37.2	47.8	60.6
14:15	44.9	37.2	46.4	65.6
14:30	44.2	37.3	47.1	61.2
14:45	44.8	39.3	48	60.6
15:00	43.4	37.7	46.4	57.6
15:15	44.9	38.5	47.8	60.4
15:30	43.6	38.7	45.7	61.2
15:45	49.1	40.1	52.3	59.5
16:00	44.5	41.1	47.1	55.1
16:15	46.1	42	46.1	68.9
16:30	45.8	43.3	47.5	55.2
16:45	48.2	46.1	50.1	54.5
17:00	47.4	44.5	49.1	54.1
17:15	44.6	41.8	46.7	53.8
17:30	44.8	41.3	47.1	58.5
17:45	46.4	41.4	49.2	58.5
18:00	45.7	39.4	49.2	60.1
18:15	44.7	37.6	46.2	64.2
18:30	42	37.2	44	64.2
18:45	46	37.9	45.3	71.8
19:00	50.3	39	53.6	67.4
19:15	42.6	37.5	45	62.9
19:30	47.3	36.6	48.8	65.9
19:45	41.3	37	43.7	59.4
20:00	43.3	36.4	46.9	58.6
20:15	42.8	35.9	44.8	61.1
20:30	40.3	35.7	43.3	58.3
20:45	40.7	34.9	42.4	60.5
21:00	44.1	34.2	40.3	68
21:15	36.5	34.4	38.2	46.1
21:30	36.1	33.8	37.8	49.1
21:45	37.6	33.9	38.5	57.2
22:00	36.4	34.2	38.3	43.9
22:15	36.5	34.5	38.2	43.1
22:30	36.7	34.2	38.6	48.6
22:45	36.6	34	38.8	45.3

Table C4.2 ML4 (01/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	35.1	30.8	37.6	40.9
00:15	30.8	28.8	32.4	48.5
00:30	36.5	32.2	39.9	47.5
00:45	38.5	35.3	40.4	50.5
01:00	38.9	36.9	40.9	44
01:15	38	35.8	39.8	43.5
01:30	37.1	35.2	38.8	41.9
01:45	38	36	39.7	55.6
02:00	39.9	36.6	41.3	57.4
02:15	39.6	37.7	41.3	49.6
02:30	40.9	39	42.7	45.5
02:45	41.5	38.4	43.6	49.3
03:00	39.3	37.4	41.1	44.1
03:15	39.1	37.8	40.5	43.4
03:30	39.4	38	40.6	50.2
03:45	39.3	37.6	40.8	47.9
04:00	38.3	36.5	39.7	51.8
04:15	38.1	36.7	39.4	44.3
04:30	39.2	37.2	40.3	55
04:45	45.5	38.3	48.9	61.6
05:00	48.3	42.7	51.6	62
05:15	52.3	43.2	54.3	70.9
05:30	49.8	42.2	52	70.3
05:45	48.6	42	51.8	63.7
06:00	47.2	41.2	49.8	68.7
06:15	47.5	41.8	50.2	61.9
06:30	48.5	43.8	51.2	63.7
06:45	49.6	42.1	51.5	78
07:00	48.4	43.3	50.8	62.7
07:15	48.1	42	51.3	64
07:30	53.3	41.7	52.1	70.2
07:45	49.3	38.8	48.7	70.5
08:00	45.7	38.4	49	61.7
08:15	49.5	38.5	50.4	69.6
08:30	46.9	37	49.6	68.3
08:45	42.7	36.5	45.3	61.7
09:00	44.3	35.1	45.8	62.5
09:15	44.7	36.5	48.2	62
09:30	46.5	36.8	50.6	60.4
09:45	42	34.9	45.6	55.9
10:00	43.4	34.4	46.7	60.5
10:15	43.4	37	46.5	59.7
10:30	49.6	34.5	49.8	71.7
10:45	52.7	33.7	51.9	73.5
11:00	45.3	36.4	47.7	63.3
11:15	46.6	36	48.3	67.6
11:30	47.3	37.5	47.3	68.9
11:45	45.5	39.7	47.9	59.5
12:00	43.3	37	46.1	62.8
12:15	44.2	39.6	47	58.4
12:30	44.4	39.2	47.5	59.9
12:45	43.1	37.9	46.1	57.3

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	45.4	40.9	48.2	56.2
13:15	45.1	40	47.4	63.9
13:30	46.2	38.8	47.8	65
13:45	44.4	38.1	46.2	63.8
14:00	46.2	41.7	49.1	60.6
14:15	47.2	40.3	48.7	65.5
14:30	45.6	39.3	49.2	60.2
14:45	47.2	38.7	49.1	68.2
15:00	46.7	41.4	48.7	58.6
15:15	46	38.6	49.3	59.5
15:30	45.5	37.9	47.6	61.9
15:45	45.1	39.5	47.6	61.8
16:00	44.2	39	46.9	59.6
16:15	44.7	37.7	47.8	59.3
16:30	40.7	33.6	44.1	53.8
16:45	43.4	36.6	46.8	60.6
17:00	44.8	37.7	48.4	57.6
17:15	45.3	36.5	47.5	67.3
17:30	44.7	36.1	47.1	59.4
17:45	45.2	36	47.9	62.9
18:00	45.8	37.3	49.2	64.7
18:15	44.4	37.5	47.5	60.4
18:30	44.8	36.5	46.9	65
18:45	42.6	35.7	45.6	59.9
19:00	40.5	35.6	43.6	51.6
19:15	40.5	35.6	43.4	55.7
19:30	44.7	37.4	48.4	59.4
19:45	42.4	35.2	45.2	59.4
20:00	42.5	35.8	45.6	58.3
20:15	42.7	35.7	43.1	66.4
20:30	45	36.9	46.7	62.4
20:45	40.3	36.7	42.8	57.5
21:00	39.6	35.1	42.3	55.9
21:15	41.9	32.5	40.7	66.6
21:30	36.8	33.2	38.8	55.4
21:45	40	35.6	40.7	66.7
22:00	39.1	35.4	40.6	51.2
22:15	38.6	37.1	39.9	46.7
22:30	38.7	36.6	40.5	51.1
22:45	38.8	36.4	41.2	45.8
23:00	40.3	38.4	41.8	57
23:15	39.2	37.6	40.6	45.2
23:30	38.4	36.6	40.1	46.9
23:45	39.3	37.4	40.7	53.6

Table C4.3 ML4 (02/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	37.9	35.8	39.5	50.5
00:15	37.8	36	39.3	46.3
00:30	37.6	35.9	38.9	51
00:45	37.3	35.8	38.6	43.2
01:00	37.2	35.3	38.8	41.9
01:15	35.1	33.5	36.4	43.1
01:30	36.3	34.4	38	42.7
01:45	36.8	35.1	38.4	43.4
02:00	37.3	35.3	39.2	46.2
02:15	38.2	36.4	39.8	43.7
02:30	39.6	38	41.1	44.5
02:45	38.8	36.8	40.5	44.3
03:00	38.7	36.8	40.2	42.7
03:15	37.1	35.6	38.5	42.5
03:30	37	35.3	38.4	41.6
03:45	34.8	32.9	36	48.7
04:00	35.8	33.2	37.9	42.4
04:15	37.5	35.9	38.8	45.5
04:30	40.7	36.4	42.3	56.9
04:45	46.8	40.5	50.4	61.3
05:00	49.4	43.9	52.8	58.5
05:15	50.3	44.7	53.4	72.1
05:30	50.9	45.2	54	64.9
05:45	49.1	43.6	52.2	63.2
06:00	49.5	43.2	52.6	63.5
06:15	51.6	42.7	53	70.8
06:30	46.7	42.6	49.5	55.6
06:45	47.3	42	50.1	62.9
07:00	47.7	40.6	51.5	59.5
07:15	47.6	41.5	51	60.2
07:30	46.8	38.5	50.8	60.8
07:45	46.9	38.1	49.5	69.8
08:00	47.9	39.1	50.8	64.6
08:15	44.8	37.8	48.3	60.3
08:30	48	38	51.1	65.9
08:45	46.6	38.7	50.3	60
09:00	45.3	38.7	48.5	60.7
09:15	46.5	38.5	50.1	62.6
09:30	46	36.7	50.1	59.4
09:45	43.9	36.1	47.4	60.2
10:00	43.4	37.4	46.6	63
10:15	43.1	36.3	46.3	60
10:30	43.7	37	47	58.9
10:45	45.3	37	48.1	61.9
11:00	45.5	38.7	49	59.2
11:15	47.8	39.2	49.6	76.6
11:30	43.2	39	45.7	56.6
11:45	44.1	40.4	46.5	61
12:00	56.1	42.2	59.9	82.7
12:15	46.8	42.8	49.1	61.3
12:30	58.9	43.4	63.4	77.3
12:45	61.4	51.6	64.3	80.1

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	59.6	49.9	63.9	72.7
13:15	61.6	54.9	65.1	73.1
13:30	61.3	55.2	64.6	75.3
13:45	61.6	55.6	64.8	77.4
14:00	61.7	56	64.6	77.5
14:15	61.6	55	64.7	75.8
14:30	61	54.7	64	77
14:45	61.3	54.7	64.7	75
15:00	60.1	53.4	63.2	76.5
15:15	58.5	53	61.5	72.2
15:30	58.6	52.8	61.7	73.6
15:45	57.9	52.7	60.8	74.2
16:00	59.9	52.8	63.5	75.1
16:15	60.4	53.6	63.6	76.7
16:30	60.4	53.3	63.8	73.5
16:45	60	53.6	63.1	75.3
17:00	59	53	62.2	73.3
17:15	57	52.2	59.8	68.7
17:30	57.5	52.4	60.3	70.9
17:45	60.4	52.9	62.3	76.1
18:00	55.5	44.2	59.3	71.4
18:15	47.4	44	49.8	54.9
18:30	45.2	41	48	58
18:45	44	40.2	46.2	60.5
19:00	45.4	40.5	48.2	58.4
19:15	43.6	39.9	46	58.4
19:30	44.1	39.5	46.6	60.3
19:45	45.5	37.6	44.9	65.9
20:00	42.5	37.8	44.9	59.3
20:15	41.8	37.6	44.3	61.2
20:30	42.7	36.4	43.9	68.5
20:45	42.2	36.9	45.6	57.3
21:00	42.7	37.2	45.3	61.7
21:15	38.5	35.9	40.5	49.9
21:30	37.2	35.3	38.8	43.2
21:45	43.5	35.2	44.2	68.4
22:00	37.8	35.2	39.8	46.5
22:15	39	36.7	40.8	46.9
22:30	38.4	33.6	41.5	57
22:45	36.8	33.9	39	42.3
23:00	36.4	33.2	38.5	47.2
23:15	38.3	36.3	39.9	44.6
23:30	39.2	37.2	41	45.4
23:45	38.6	36.4	40.3	49.6

Table C4.4 ML4 (03/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	36.9	34.7	38.7	46.2
00:15	36.6	34.4	38.3	45.1
00:30	35.4	32.8	37.7	46
00:45	31.8	26.7	35.2	41.1
01:00	27.6	26.4	28.8	32.8
01:15	31.6	29.1	33.9	41
01:30	31.7	28.6	33.3	45.9
01:45	34.4	31.3	35.9	47.5
02:00	35	32.5	37.2	44.6
02:15	35.2	32.7	36.9	47.6
02:30	34.4	32.5	36	41.1
02:45	35.2	32.1	37.4	41.6
03:00	36.4	34.4	38.2	43.4
03:15	36.6	34.9	38.1	44.6
03:30	37.8	35.8	39.5	50
03:45	38.2	35.7	40	49.7
04:00	37.5	35.8	39	43.6
04:15	35.6	33.8	37.2	40.8
04:30	35.6	33.8	37.2	42.8
04:45	46.8	37.9	50.7	60.3
05:00	56.4	43.7	61.9	68
05:15	56.9	47.1	60.6	69.3
05:30	54.5	44.9	59.1	67.4
05:45	49.4	43	52.6	63.7
06:00	47.2	42.2	50.5	57.7
06:15	48.9	42.2	52.5	64.4
06:30	50.2	41.3	55.4	61.2
06:45	44.2	40.2	46.7	56.6
07:00	47.6	42.5	50.4	61.8
07:15	45.8	41.2	48.1	60.8
07:30	44.7	41.2	47	61.9
07:45	47.1	42.6	49.5	61.3
08:00	48	44.3	50.9	58.2
08:15	48.9	45.1	51.5	61.1
08:30	47.6	44.2	49.8	62
08:45	49.2	45.8	51.9	60.9
09:00	49.4	44.6	52.2	59
09:15	50.1	46.3	52.7	62.2
09:30	50.2	47.1	52.5	62.7
09:45	67.8	46.2	68	91.5
10:00	65.1	57.1	68.6	72.8
10:15	76	47	78.2	91.5
10:30	49.4	45.6	51.9	59.9
10:45	49.4	44.7	51.1	63
11:00	50.6	46.8	52.8	60.5
11:15	50.2	46.5	52.8	60.3
11:30	50.5	46.5	53.2	57.8
11:45	51.1	47	53.6	60.5
12:00	62.8	49.8	66.7	76.7
12:15	56.6	49.1	58.9	69.2
12:30	52.6	47.9	54.7	68.7
12:45	51.5	48.6	53.9	60.2

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	51.8	47.4	53.4	81.6
13:15	52.2	46.1	54.5	65.1
13:30	50.2	46.8	52.8	56.6
13:45	57	49.7	59.1	72.2
14:00	60.5	51.2	59.5	77.1
14:15	55.4	52	57.5	70.6
14:30	57.2	54.1	59.4	66.5
14:45	57.6	53.8	60.2	65.2
15:00	54.1	50.6	56.5	61.5
15:15	55.7	51.2	57.8	65.8
15:30	52.9	47.9	55.8	65.4
15:45	53.9	51.1	56	63.7
16:00	54.6	51	56.7	77
16:15	54.1	50.6	56.4	63.5
16:30	53.6	49.9	56	60.1
16:45	54	50.1	56.6	61.8
17:00	61.1	49.6	64	74.9
17:15	53.1	48.7	55.8	62.6
17:30	51.9	48	54.1	70.2
17:45	53.3	49	55.8	61.3
18:00	51.9	49.1	53.9	58.1
18:15	51.6	47.6	54.3	58.9
18:30	51.7	48	54	68.2
18:45	48.9	45.1	51.5	55.4
19:00	47.9	42.4	50.5	60.4
19:15	48.4	44.2	51.1	59.7
19:30	45.2	41.8	48	56.8
19:45	45.7	40.8	46.9	63.6
20:00	45.4	40.1	46.3	63.3
20:15	44	40.9	46.2	54.6
20:30	44.8	40.5	47.3	59.6
20:45	45	38.4	47.8	62.2
21:00	42.4	38.7	43.9	62.7
21:15	41.2	37.7	42.6	57.7
21:30	40.6	37	43.4	53.7
21:45	44.4	41.8	46.4	49.7
22:00	45.7	43	47.8	51.4
22:15	43.4	41.1	45.2	50.4
22:30	44.7	41.3	47.4	52.2
22:45	45.3	42.1	47.5	52.2
23:00	46.7	42	48.2	68.1
23:15	46	42.3	48.9	52.6

Table C5.1 ML5 (28/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
08:23	38.6	33.6	41.3	50.7
08:38	38	32.8	41.5	50.3
08:53	41.5	37.1	44	60.4
16:25	42.2	37.7	44.5	55.1

Table C5.2 ML5 (06/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
08:44	43.1	33.9	47	58.9
08:59	52.3	35.5	43.5	84.8
18:15	51.5	36.9	45.4	88.6
18:30	39.8	35.1	43.1	51.3
18:45	38.3	33.6	41	56.5
19:00	37.1	33.2	39.7	55.8
19:15	38.2	31.9	40.6	62.5
19:30	37.1	32.1	39.9	52.8
19:45	36.2	32.1	38.6	48.8
20:00	37.6	32.1	40.4	61
20:15	40.6	32.6	43.8	63
20:30	37.8	30.4	41.6	52.4
20:45	36.2	29.2	39.1	59.7
21:00	37.6	28.5	41.5	51.8
21:15	42.7	24.7	40.9	72.8
21:30	25.7	23.3	27	40.4
21:45	30.4	24	33.7	47.3
22:00	30.1	24.8	32.8	47
22:15	28.7	26.2	30.5	42
22:30	27.7	25.5	29.1	38.2
22:45	26.4	25	27.5	39
23:00	26.8	24.6	27.6	47.5
23:15	28.6	26.2	29.1	43.1
23:30	29.3	25.2	31.1	47.8
23:45	26.4	23.5	28	41.3

Table C5.3 ML5 (07/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	27.3	23.2	30.3	38.3
00:15	28.2	25	30.5	38.9
00:30	30.9	27.6	33.3	41.2
00:45	31.6	28.1	33.7	44.5
01:00	32.1	29.1	34.5	39
01:15	33.6	29.9	35.9	45.6
01:30	29.2	27.4	30.6	36.1
01:45	29.9	27.2	31.7	40.5
02:00	32	28.6	34.3	49.7
02:15	45.2	27.3	31.6	73.5
02:30	29.7	28	31.1	34.7
02:45	34	30.8	36.6	43.2
03:00	37.4	32.9	40.3	45.8
03:15	35.7	30.7	38.9	44.7
03:30	33.6	29	36.9	49.5
03:45	31.7	27.4	34.1	44.3
04:00	31	27.3	33.2	47.6
04:15	30.9	27.9	33.3	43.8
04:30	31.2	27.3	33.6	45.2
04:45	41.8	30.6	44.8	64.2
05:00	47.2	35.7	51.7	68.9
05:15	47.9	35.9	45.5	72.1
05:30	42.7	36	44.9	68.6
05:45	40.4	34.8	43.8	53.8
06:00	39.1	33.1	41.9	60
06:15	37.9	32.8	40.9	50.5
06:30	38.3	33.6	41.2	50
06:45	39.8	34.5	42.5	55.3
07:00	39.4	34	42.2	57.1
07:15	43	34.6	44	65.1
07:30	39.7	34.3	42	60.1
07:45	36.4	32.1	38.9	53.9
08:00	42	33.6	43.1	70.9
08:15	38.1	31.3	41.1	54.4
08:30	38.1	30.7	39.8	59.3
08:45	36.5	30.9	39.6	51.4
09:00	36.6	31.6	39.4	51.1
09:15	37.4	31.8	40.6	52.1
09:30	36.9	32.2	39.7	47.3
09:45	34.7	30.2	37.3	48.9
10:00	44	28.6	40.9	68
10:15	48.3	27.7	38.1	71.3

Table C6.1 ML6 (05/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
12:30	49.2	47	50.5	62
12:45	49	46.5	49.3	68.1
13:00	50.3	46.3	49.8	71.9
13:15	48.5	46.4	49.7	62.6
13:30	49.1	46.1	50.7	70.2
13:45	49.1	47.3	50	64.3
14:00	50.4	48.4	52.1	58.3
14:15	51.5	49.1	53.3	58.8
14:30	49.2	47	51	59.6
14:45	48.2	46.3	49.4	60.2
15:00	50.1	47.5	52.4	61.4
15:15	49.6	47.9	50.8	59.4
15:30	49	47	50.9	56.9
15:45	49.6	47	50.8	67.3
16:00	48.9	46.7	50.7	59.8
16:15	48.9	46.4	50.9	58.9
16:30	50.3	48.4	52	61.3
16:45	51.3	49.4	52.9	61.4
17:00	51.5	49.8	53.1	59.3
17:15	50.9	49.1	52.4	59.6
17:30	50.6	48.8	52.1	59.3
17:45	50.4	48.4	52	60.3
18:00	50.1	48.2	51.5	60.7
18:15	50	48.4	51.5	58.4
18:30	50.4	48.5	51.8	62.8
18:45	49.4	47.8	50.6	61.7
19:00	48.7	47.1	50.1	58.6
19:15	48.2	46.7	49.4	58.1
19:30	48.9	46.9	49.7	67.9
19:45	48.5	46.7	49.8	60.9
20:00	49	47.1	50.3	62.2
20:15	49.7	48	51.1	57.2
20:30	49.7	48.2	51	56.8
20:45	50.4	48.4	52.1	59.1
21:00	51.2	49.5	52.7	60.8
21:15	51	49.5	52.3	62.1
21:30	51.1	49.5	52.5	60.6
21:45	51.3	50.2	52.3	56.8
22:00	50.8	49.5	51.8	57
22:15	50.2	49.2	51.2	57.8
22:30	49.8	48.7	50.7	56.4
22:45	49.9	48.8	50.9	56.7
23:00	50.7	49.3	52	58.5
23:15	50.5	49.4	51.6	59.7
23:30	51.2	49.9	52.3	58.9
23:45	52.1	50.8	53.1	64.1

Table C6.2 ML6 (06/05/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
00:00	52.8	51.5	53.8	62.5
00:15	52.6	51.6	53.6	58.6
00:30	52.6	51.6	53.6	56.8
00:45	53	51.8	53.9	58.1
01:00	53.6	52.5	54.7	57.8
01:15	54	52.8	55.1	59.2
01:30	53.9	52.7	55.1	59.3
01:45	53.1	51.9	54.2	58.8
02:00	52.8	51.4	54	59.9
02:15	52.6	51.2	53.9	59.1
02:30	52.9	51.5	54.2	60.3
02:45	53.4	51.4	55.1	62.7
03:00	52.7	51.1	54.2	63.4
03:15	52.7	51.1	54	60.3
03:30	52.8	51.3	54.1	60.1
03:45	52.2	50.8	53.6	58
04:00	52.2	50.7	53.5	61.9
04:15	51.6	50.2	53.1	57.5
04:30	51.1	49.4	52.5	57.2
04:45	69.3	50.1	73.4	85.7
05:00	54.4	50.4	57.3	66
05:15	52.7	49.5	55.3	65.7
05:30	50.1	48.5	51.6	56.9
05:45	49.9	48.2	51.4	60.8
06:00	49.8	48.3	51.1	56.5
06:15	48.8	47.2	50.2	58.7
06:30	49.4	47.1	50.4	66.7
06:45	48.3	46.6	49.7	59
07:00	48.1	46.3	49.3	61.1
07:15	47.6	46.2	48.9	57.2
07:30	47.9	46.1	49.4	59.5
07:45	47.6	46	49.1	60.3
08:00	47.4	45.1	48.1	65.5
08:15	48.2	45.9	49.7	62.3
08:30	47.9	46.2	49.3	58.1
08:45	48.5	45.6	51.2	60.4
09:00	49.6	46.1	52.7	67
09:15	48.3	45.9	50.8	63.2
09:30	48.4	46.5	49.7	60.6
09:45	48.3	46.3	49.3	65
10:00	48.7	46.8	50.2	60.9
10:15	49.1	47	50.7	63.5
10:30	48.8	47.1	49.3	67.4
10:45	49.5	46.9	51.7	64.9
11:00	52.5	47.1	52.4	73.8
11:15	48.4	46.7	49.9	61.7
11:30	49.4	46.9	51.3	69.9
11:45	48.3	46	50.5	61.1
12:00	52.4	44.2	53.1	69.2
12:15	46.5	44.5	47.3	63.9
12:30	47.5	45.2	49	62.8
12:45	48.6	45.8	50.8	60.9

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	49.5	46.3	52.2	62.5

Table C7.1 ML7 (05/05/09)

Start Time	1-hour Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
13:00	68.5	46.3	73.2	89.1
14:00	68.2	46.7	73	86.2
15:00	69.9	48.5	74.6	88.7

Table C8.1 ML8 (06/05/09)

Start Time	1-hour Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
10:00	56.2	39.5	49.3	81.4
11:00	59	40.4	48.6	84.8
12:00	55.6	36.2	47.3	82.4

Table C9.1 ML9 (29/04/09)

Start Time	15-minute Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
09:47	42.8	35.2	45.8	59.8
10:02	46.8	37	45.1	80.8
10:17	44.5	37.8	44.8	76.3
10:32	41.9	37.1	44.6	58.4

Table C10.1 ML10 (06/05/09)

Start Time	1-hour Sound Pressure Level, dBA (fast), Free-field			
	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}
14:00	51.6	46.9	52.4	83.9
15:00	51.6	47.8	53	74.3
16:00	51.1	47.8	52.8	73

Appendix D. Calibration certificates

D1.1 Rion NL-31 (s/n 00672900)

Reviewed by
RC
16/12/2008.

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number CAL110802
Date of Issue 04/11/2008

Customer AMEC Earth & Environmental Ltd.

Description of Instrument

Sound Level Meter
Rion NL-31 Sound Level Analyser [Serial No. 00672900] with
Rion UC-53A Microphone [Serial No.312092] and
Rion NH-21 Preamplifier [Serial No.23077]
Fitted with a WS-10 foam windshield.

The instrument successfully completed the Class 1 Periodic Tests of BS EN 61672.

Associated Calibrator
Rion NC-74 [Serial No. 34973224] with ½" adaptor type NC-74-002 fitted. This calibrator was calibrated by ANV Measurement Systems on 04/11/08 [Certificate No.110801].

Date of Calibration 04/11/2008.

Test Procedure
ANV/CAL/SLM/002a
Calibration Results currently at Issue 3
Test procedures in accordance with BS EN 61672-3:2006.
NOTE: Test 10.1 (Self Generated Noise with Microphone Installed) omitted.

Test Engineer Amrat Patel

APPROVED SIGNATORY..........................
Les Jephson ☑ / Mike Breslin ☐

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D1.2 Rion NA-28 (s/n 00370312)

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL030920**
Date of Issue	**24/03/2009**
Customer	**ANV Measurement Systems**
	Description of Instrument Including Manufacturer / Supplier
Sound Level Meter	Rion NA-28 Sound Level Analyser [Serial No. 00370312] with Rion UC-59 Microphone [Serial No. 00405] and Rion NH-23 preamplier [Serial No. 60321] Fitted with a WS-10 foam windshield.
	The instrument conforms to Class 1 of BS EN 61672-1:2003
	The instrument was running Version 1.7 Firmware
Associated Calibrator	B&K 4226 S/N 2590976
Date of Calibration	24/03/2009
Test Procedure	..\..\Calibration Results Sheets\Current Approved Results Sheets\NA-28 Master 61672-Approved Issue 3 (BK 2590976).xls
	Test procedures in accordance with BS EN 61672-3:2006 NOTE: Test 10.1 (Self Generated Noise with Microphone Installed) omitted.
Test Engineer	Amrat Patel

APPROVED SIGNATORY ....
Les Jephson ☐ / Mike Breslin ☐

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
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ACOUSTICS NOISE AND VIBRATION LIMITED. REGISTERED IN ENGLAND NO. 3549028. REGISTERED OFFICE AS ABOVE.

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D1.3 Rion NC-74 (s/n 34712641)

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	CAL040902
Date of Issue	03/04/2009
Customer	ANV Measurement Systems

Description of Instrument

Calibrator	Rion NC-74 [Serial No. 34712641] With ½" adaptor type NC-74-002 fitted.
Date of Calibration	03/04/2009.
Test Procedure	..\..\Calibration Procedures\Current Approved Procedures\NC_74_Cal Procedure Approved Isue 1.xls ..\..\Calibration Results Sheets\Current Approved Results Sheets\NC-74 Master 60942 Approved Issue 2 (BK 2590976).xls Test procedures in accordance with BS EN 60942: 2003 (Annex B)
Test Engineer	Amrat Patel

APPROVED SIGNATORY ....
Les Jephson ☐ / Mike Breslin ☑

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Appendix E. Meteorological data

Table E1.1 On-site weather station data (27/04/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00					
00:30	0	E	7.2	86	0
01:00	0.4	E	6.7	87	0
01:30	0	E	6.7	87	0
02:00	0.4	E	6.9	87	0
02:30	0	E	7.2	88	0
03:00	0.4	N	7.3	88	0
03:30	0.9	N	7.5	88	0.51
04:00	1.8	N	7.6	89	0
04:30	2.7	N	7.6	90	0.51
05:00	3.1	NNW	7.6	89	0.25
05:30	2.7	NNW	7.6	90	0.25
06:00	2.7	NNW	7.8	90	0
06:30	3.1	N	8.2	92	0.25
07:00	3.6	N	8.6	93	0.25
07:30	2.7	E	8.6	92	1.27
08:00	4.5	SE	8.4	91	1.78
08:30	6.3	SE	7.7	90	1.02
09:00	3.6	ESE	7.4	90	0.51
09:30	1.3	E	7.4	90	0
10:00	1.3	E	7.6	90	0
10:30	2.2	E	8.1	90	0
11:00	2.2	E	8.4	90	0
11:30	3.1	E	9.2	90	0
12:00	3.1	E	9.4	89	0.25
12:30	3.1	E	9.6	89	0.51
13:00	5.4	ESE	10.7	83	0
13:30	4.9	ESE	10.8	83	0
14:00	4	ESE	10.5	85	0.25
14:30	5.8	ESE	10.7	82	0
15:00	6.7	SE	12	79	0
15:30	6.7	SE	12.2	75	0
16:00	6.3	SE	12.3	75	0
16:30	6.3	SE	12.7	74	0
17:00	7.2	SE	12.4	72	0
17:30	6.7	SE	12.1	71	0
18:00	5.8	SE	11.5	72	0
18:30	5.4	SE	10.9	73	0
19:00	4.9	SE	10.3	74	0
19:30	4.5	SE	9.7	74	0
20:00	4	SE	8.9	75	0
20:30	4	SE	8.3	76	0
21:00	3.6	SE	7.5	77	0
21:30	3.6	SE	7.1	79	0
22:00	3.6	ESE	6.8	81	0
22:30	1.3	E	6.1	81	0
23:00	1.8	ESE	5.2	83	0
23:30	0.9	E	4.4	84	0

Table E1.2 On-site weather station data (28/04/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00					
00:30	0.9	ESE	4.1	85	0
01:00	0.4	E	3.2	85	0
01:30	0.9	E	3.3	86	0
02:00	0.4	ENE	3.2	87	0
02:30	0.9	E	3.9	90	0
03:00	2.2	SE	5.2	90	0.25
03:30	1.3	ENE	5.6	89	1.02
04:00	0.4	WNW	5.6	88	0.25
04:30	0.4	E	5.5	88	0
05:00	0.9	ESE	5.3	89	0
05:30	0.4	WNW	4.1	89	0
06:00	0	WNW	3	88	0
06:30	0.9	E	2.7	90	0
07:00	0	E	3.1	90	0
07:30	0.4	ENE	4.6	90	0
08:00	1.8	WSW	6.5	90	0
08:30	1.8	W	7.9	89	0
09:00	2.2	WSW	9.3	88	0
09:30	2.2	WSW	10.1	86	0
10:00	1.8	WSW	11	85	0
10:30	1.3	SW	12.4	83	0
11:00	1.8	W	13.2	80	0
11:30	2.2	S	13.2	78	0
12:00	2.2	S	13	77	0
12:30	2.2	S	12.9	76	0
13:00	2.2	SSE	13.2	76	0
13:30	2.7	S	13.5	75	0
14:00	3.6	SSE	13.8	74	0
14:30	4.5	SSE	13.5	73	0
15:00	4.5	SSE	12.9	72	0
15:30	4	SSE	12.2	73	0
16:00					
16:30	4.5	SE	13	38	0
17:00	4.5	SE	16.1	53	0
17:30	4	SE	13.5	58	0
18:00	3.6	SE	11.8	63	0
18:30	3.6	SE	11.5	65	0
19:00	4.5	SE	10.9	67	0
19:30	4.5	SE	9.8	70	0
20:00	4.5	SE	8.9	73	0
20:30	4	SE	8.4	75	0
21:00	3.6	ESE	7.9	77	0
21:30	4	SE	7.9	79	0
22:00	3.1	SE	7.8	79	0
22:30	2.2	SE	7.2	80	0
23:00	1.8	SE	6.8	82	0
23:30	0.9	ESE	6.2	82	0

Table E1.3 On-site weather station data (29/04/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	2.7	SE	6.3	85	0
00:30	2.2	SSE	6.7	84	0
01:00	1.3	ESE	6.1	84	0
01:30	1.3	ESE	5.7	85	0
02:00	1.3	ESE	5.6	86	0
02:30	1.3	E	5.6	87	0
03:00	0.4	E	5.4	87	0
03:30	0.4	E	5.5	88	0
04:00	0.9	E	6.3	89	0
04:30	0	E	6.6	89	0
05:00	0.4	E	6.8	89	0
05:30	1.3	E	6.9	89	0
06:00	1.8	E	6.7	89	0
06:30	0.9	ENE	6.4	89	0
07:00	0	ENE	7.2	90	0
07:30	0	ENE	8.7	89	0
08:00	0.9	ENE	9.6	88	0
08:30	0.9	N	11.2	86	0
09:00	0.4	N	11.9	83	0
09:30	1.8	NW	12.3	82	0
10:00	2.7	NNW	13.3	79	0
10:30	2.7	N	14.3	72	0
11:00	3.1	N	14.8	67	0
11:30	3.1	N	15.2	65	0
12:00	2.7	N	15.7	63	0
12:30	2.7	N	15.7	58	0
13:00	3.1	N	15.8	58	0
13:30	2.2	N	16.6	58	0
14:00	2.7	N	16	56	0
14:30	3.1	N	15.7	59	0
15:00	3.1	N	16	57	0
15:30	4	N	15.1	56	0
16:00	4.5	N	15	58	0
16:30	4.5	N	15.2	60	0
17:00	4	N	14.7	62	0
17:30	4.5	N	14.1	64	0
18:00	4.5	N	13.6	67	0
18:30	4.5	N	13.3	70	0
19:00	4.9	N	13.2	70	0
19:30	4.9	N	12.5	72	0
20:00	4.5	N	11.8	72	0
20:30	4.9	N	10.9	76	0
21:00	4.9	N	10.3	80	0
21:30	5.8	N	10.1	81	0
22:00	4.9	NNW	10.3	81	0
22:30	3.6	NNW	10.4	82	0
23:00	3.6	N	10.6	83	0
23:30	4	NNW	10.9	84	0

Table E1.4 On-site weather station data (30/04/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	4	N	11.2	84	0
00:30	4	N	11.3	85	0
01:00	4	NNW	11.4	84	0
01:30	3.6	NNW	11.4	84	0
02:00	3.6	NNW	11.3	85	0
02:30	3.6	NNW	11.4	85	0
03:00	3.6	NNW	11.5	85	0
03:30	3.6	NNW	11.3	86	0
04:00	3.1	NNW	11.1	86	0
04:30	3.1	NNW	11.2	87	0
05:00	4	NNW	11.3	87	0.25
05:30	4	NNW	11.3	87	0
06:00	4	NNW	11.1	88	0
06:30	4	N	10.9	88	0
07:00	4.5	N	11.1	89	0
07:30	4.5	N	11.2	89	0.25
08:00	4	N	11.3	90	0.25
08:30	4.5	N	11.3	90	0.25
09:00	4.5	N	11.3	90	0.51
09:30	3.6	N	11.5	91	0.25
10:00	4	N	12.1	91	0
10:30	4	N	12.8	90	0
11:00	4	N	13.3	88	0
11:30	3.6	N	13.2	87	0
12:00	3.6	N	12.7	87	0
12:30	2.7	N	12.3	88	0.25
13:00	2.2	N	12.6	89	0
13:30	2.7	N	12.6	88	0
14:00	2.2	N	12.6	88	0
14:30	0.4	NNE	13.2	88	0
15:00	3.1	SE	13.3	87	0
15:30	3.1	SE	12.7	87	0
16:00	3.1	SE	12	88	1.02
16:30	3.1	SE	11.5	89	0.25
17:00	3.1	ESE	11	89	1.27
17:30	2.7	SE	10.5	90	0.76
18:00	2.2	SE	10.4	90	0
18:30	2.7	SE	10.7	90	0
19:00	2.7	SE	10.8	90	0
19:30	2.7	SE	10.8	90	0
20:00	2.2	SE	10.7	90	0
20:30	2.7	SE	10.6	90	0
21:00	2.7	SE	10.4	90	0
21:30	2.7	SE	10.4	90	0
22:00	2.7	SE	10.4	91	0
22:30	1.8	SE	10.3	91	0
23:00	1.3	SE	10.2	91	0
23:30	2.2	SE	10.2	91	0

Table E1.5 On-site weather station data (01/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	0.9	ESE	10.1	91	0
00:30	0.4	ESE	9.8	92	0
01:00	0.4	ESE	9.2	91	0
01:30	0	E	8.6	91	0
02:00	0	E	8.4	92	0
02:30	0	E	7.6	91	0
03:00	0	E	6.8	91	0
03:30	0.9	ESE	6.1	91	0
04:00	0.4	ESE	5.7	92	0
04:30	0.9	ESE	5.6	92	0
05:00	0	ESE	5.2	92	0
05:30	0	---	4.5	91	0
06:00	0	ESE	4.3	92	0
06:30	0.4	ESE	4.9	93	0
07:00	0	ESE	6.1	93	0
07:30	0.4	ESE	8.1	92	0
08:00	0	E	10.2	92	0
08:30	0.9	SE	12	90	0
09:00	0.9	SE	13.5	88	0
09:30	3.1	ESE	14.1	85	0.25
10:00	1.8	SE	15.2	82	0
10:30	2.2	SSE	15.9	79	0
11:00	2.2	SSE	15.9	77	0
11:30	1.3	ENE	16.9	74	0
12:00	1.8	ENE	17.5	70	0
12:30	3.1	E	16.9	64	0
13:00	2.7	E	16.4	65	0
13:30	2.7	ENE	17.2	63	0
14:00	1.8	ENE	16.6	64	0
14:30	1.8	ENE	16.3	66	0
15:00	2.7	E	16.1	65	0
15:30	1.8	E	15.2	68	0
16:00	1.8	ENE	14.1	71	0
16:30	2.2	ENE	13.3	74	0
17:00	1.3	ENE	13.6	75	0
17:30	1.3	ENE	13.8	76	0
18:00	1.8	ENE	14.1	77	0
18:30	1.8	E	13.9	78	0
19:00	2.2	E	13.9	79	0
19:30	2.7	ESE	13.3	81	0
20:00	2.2	E	12.9	82	0
20:30	2.2	ESE	12.7	83	0
21:00	1.8	SE	11.3	83	0
21:30	1.3	ESE	10	84	0
22:00	0.9	ESE	8.7	85	0
22:30	0.9	ESE	7.9	86	0
23:00	0.4	ESE	7.4	87	0
23:30	0.9	E	7.2	87	0

Table E1.6 On-site weather station data (02/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	1.8	E	7.1	88	0
00:30	1.8	ESE	7.1	89	0
01:00	1.8	E	7	89	0
01:30	1.8	E	6.8	89	0
02:00	0.9	E	6.8	90	0
02:30	0.9	E	6.5	90	0
03:00	0.4	E	6.3	90	0
03:30	0.4	E	5.7	90	0
04:00	0.4	ESE	5.4	90	0
04:30	0.4	ESE	5.2	90	0
05:00	0	ESE	4.9	90	0
05:30	0	ENE	4.4	90	0
06:00	0.9	ENE	4.6	91	0
06:30	2.2	E	5.7	93	0
07:00	0.9	ENE	7.6	93	0
07:30	0.9	E	9.1	92	0
08:00	1.8	E	10.7	91	0
08:30	2.2	ESE	11.5	89	0
09:00	3.1	ESE	12.8	86	0
09:30	2.7	ESE	13.6	84	0
10:00	2.7	SE	14.6	81	0
10:30	2.7	SE	15.3	79	0
11:00	3.6	ESE	15.4	76	0
11:30	3.6	SE	15.6	77	0
12:00	4.5	SSE	15.2	77	0
12:30	4.5	SSE	15	77	0
13:00	4.5	SE	15.3	77	0
13:30	4.5	SE	15.6	75	0
14:00	4.5	SE	15.5	75	0
14:30	4.5	SE	15.7	72	0
15:00	4.5	SE	15.7	73	0
15:30	3.6	SE	15.7	71	0
16:00	4	SE	15.3	72	0
16:30	4.5	SE	15	71	0
17:00	5.4	SE	14.5	71	0
17:30	4.9	SE	14.1	71	0
18:00	4.5	SE	13.3	72	0
18:30	4.5	SE	12.5	73	0
19:00	4.9	SE	11.7	74	0
19:30	4.5	SE	11.4	74	0
20:00	4.5	SE	11.1	72	0
20:30	3.6	ESE	10.4	72	0
21:00	2.7	ESE	9.9	74	0
21:30	2.2	ESE	9.6	75	0
22:00	2.7	ESE	9.6	77	0
22:30	0.9	ESE	9.4	77	0
23:00	0.9	E	9.3	77	0
23:30	1.3	E	9.4	77	0

Table E1.7 On-site weather station data (03/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	1.3	E	9.4	76	0
00:30	1.3	E	9.4	76	0
01:00	0.4	E	9.1	77	0
01:30	0	E	8.7	78	0
02:00	0.9	E	8.6	79	0
02:30	1.8	ESE	8.9	80	0
03:00	0.4	E	8.9	80	0
03:30	0	ENE	8.6	81	0
04:00	1.3	E	8.2	81	0
04:30	2.2	E	8.3	82	0
05:00	2.2	E	8.1	82	0
05:30	1.8	E	7.7	83	0
06:00	1.8	E	7.2	84	0
06:30	2.2	E	7.9	86	0
07:00	3.6	SE	8.6	87	0
07:30	4	SE	9.4	86	0
08:00	4.5	SE	10.4	83	0
08:30	4.9	SE	11.1	81	0
09:00	5.4	SE	11.6	79	0
09:30	5.4	SE	11.9	77	0
10:00	5.4	SE	12.3	76	0
10:30	5.4	SE	12.7	76	0
11:00	5.8	SE	12.9	74	0
11:30	6.3	SE	12.9	73	0.25
12:00	6.3	ESE	12.9	74	0
12:30	6.7	ESE	12.7	72	0
13:00	6.3	ESE	12.4	70	0
13:30	6.7	ESE	12.6	72	0
14:00	6.7	ESE	13.2	71	0
14:30	7.2	ESE	12.9	70	0
15:00	7.2	ESE	13.6	68	0
15:30	7.2	ESE	13.9	62	0
16:00	7.2	SE	13.9	63	0
16:30	7.6	ESE	13.7	63	0
17:00	7.2	ESE	13.5	65	0
17:30	6.7	ESE	12.8	65	0
18:00	7.2	ESE	11.9	68	0
18:30	6.7	ESE	11.1	70	0
19:00	6.3	ESE	11.2	70	0
19:30	5.4	ESE	10.8	68	0
20:00	4.9	SE	10.6	67	0
20:30	4.9	SE	10	66	0
21:00	4.5	SE	9.4	66	0
21:30	4	SE	9.1	66	0
22:00	4.5	SE	8.8	71	0
22:30	4.9	SE	8.8	75	0
23:00	4.9	SE	8.7	76	0
23:30	5.4	SE	8.8	77	0

Table E1.8 On-site weather station data (04/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	4.5	SE	8.7	78	0
00:30	4.5	SE	8.6	78	0
01:00	3.6	SE	8.4	79	0
01:30	2.7	ESE	7.9	80	0
02:00	2.2	ESE	7.2	82	0
02:30	1.8	ESE	6.5	83	0
03:00	2.2	E	6.1	84	0
03:30	1.3	E	5.8	85	0
04:00	1.3	ENE	5.5	85	0
04:30	2.2	E	5.7	86	0
05:00	1.3	E	5.7	86	0
05:30	0	ENE	5	86	0
06:00	0	ENE	4.3	86	0
06:30	0.4	ENE	4.8	88	0
07:00	1.8	E	6.5	91	0
07:30	2.2	E	7.6	90	0
08:00	2.2	E	8.2	89	0
08:30	2.7	ESE	8.9	88	0
09:00	3.1	ESE	9.6	87	0
09:30	2.2	E	10.3	85	0
10:00	2.2	E	10.8	84	0
10:30	2.7	ESE	11.2	82	0
11:00	3.1	ESE	11.3	82	0
11:30	3.6	ESE	11.5	80	0
12:00	4	ESE	12.1	78	0
12:30	4.5	ESE	11.9	76	0
13:00	4.9	ESE	11.8	77	0
13:30	4.9	ESE	12.2	75	0
14:00	4.9	ESE	12.1	77	0
14:30	4.9	E	12.2	76	0
15:00	5.4	ESE	12.3	76	0
15:30	6.7	ESE	11.8	77	0
16:00	6.3	ESE	11.7	78	0
16:30	5.4	ESE	11.7	78	0
17:00	5.4	ESE	11.9	81	0
17:30	4.9	ESE	11.7	82	0
18:00	4.9	ESE	11.7	82	0
18:30	5.8	ESE	11.8	82	0
19:00	5.8	E	11.7	83	0
19:30	5.8	ESE	11.7	83	0
20:00	4.5	E	11.7	83	0
20:30	3.6	E	11.6	83	0
21:00	2.7	E	11.3	83	0
21:30	1.3	E	11.3	84	0
22:00	0.4	E	11.2	84	0
22:30	0.9	E	11.3	85	0
23:00	2.2	E	11.4	85	0
23:30	4.9	ESE	11.7	87	0

Table E1.9 On-site weather station data (05/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	6.3	ESE	11.9	88	0
00:30	6.3	ESE	11.9	89	0
01:00	5.8	ESE	11.8	89	0
01:30	6.7	ESE	11.8	90	0
02:00	7.2	ESE	11.8	90	0
02:30	8	ESE	11.8	91	0
03:00	7.6	ESE	11.7	91	0
03:30	7.2	ESE	11.8	91	0
04:00	8	ESE	11.7	91	0
04:30	7.2	E	11.7	91	0
05:00	6.7	E	11.4	91	0
05:30	6.3	E	11.5	90	0
06:00	6.3	E	11.6	90	0
06:30	6.7	E	11.7	90	0
07:00	7.6	E	11.8	90	0
07:30	7.6	E	12.4	88	0
08:00	7.6	E	12.6	87	0
08:30	7.6	E	12.5	87	0
09:00	7.2	E	12.5	87	0
09:30	7.2	E	12.5	88	0
10:00	6.7	E	12.7	88	0
10:30	6.3	E	13.5	88	0
11:00	4.9	E	14.7	86	0
11:30	4.9	E	15.7	83	0
12:00	4.9	E	16.3	80	0
12:30	4.5	E	16.9	79	0
13:00	4.9	E	16.7	78	0
13:30	5.4	E	17.6	76	0
14:00	5.8	E	18.7	74	0
14:30	5.8	E	17.2	74	0
15:00	4.9	E	15.7	76	0
15:30	4.9	E	15.3	77	0
16:00	5.4	E	15.2	77	0
16:30	5.4	E	15.9	75	0
17:00	6.3	E	15.6	74	0
17:30	5.8	E	15	75	0
18:00	5.4	E	14.3	75	0
18:30	6.7	E	13.8	75	0
19:00	5.4	E	13.5	76	0
19:30	5.4	E	13.2	77	0
20:00	4.5	ENE	12.8	78	0
20:30	4.5	E	12.6	79	0
21:00	5.8	E	12.4	81	0
21:30	4.9	ENE	12	82	0
22:00	4.5	ENE	11.8	83	0
22:30	4.9	E	11.7	84	0
23:00	5.4	E	11.9	85	0
23:30	6.7	E	11.8	84	0

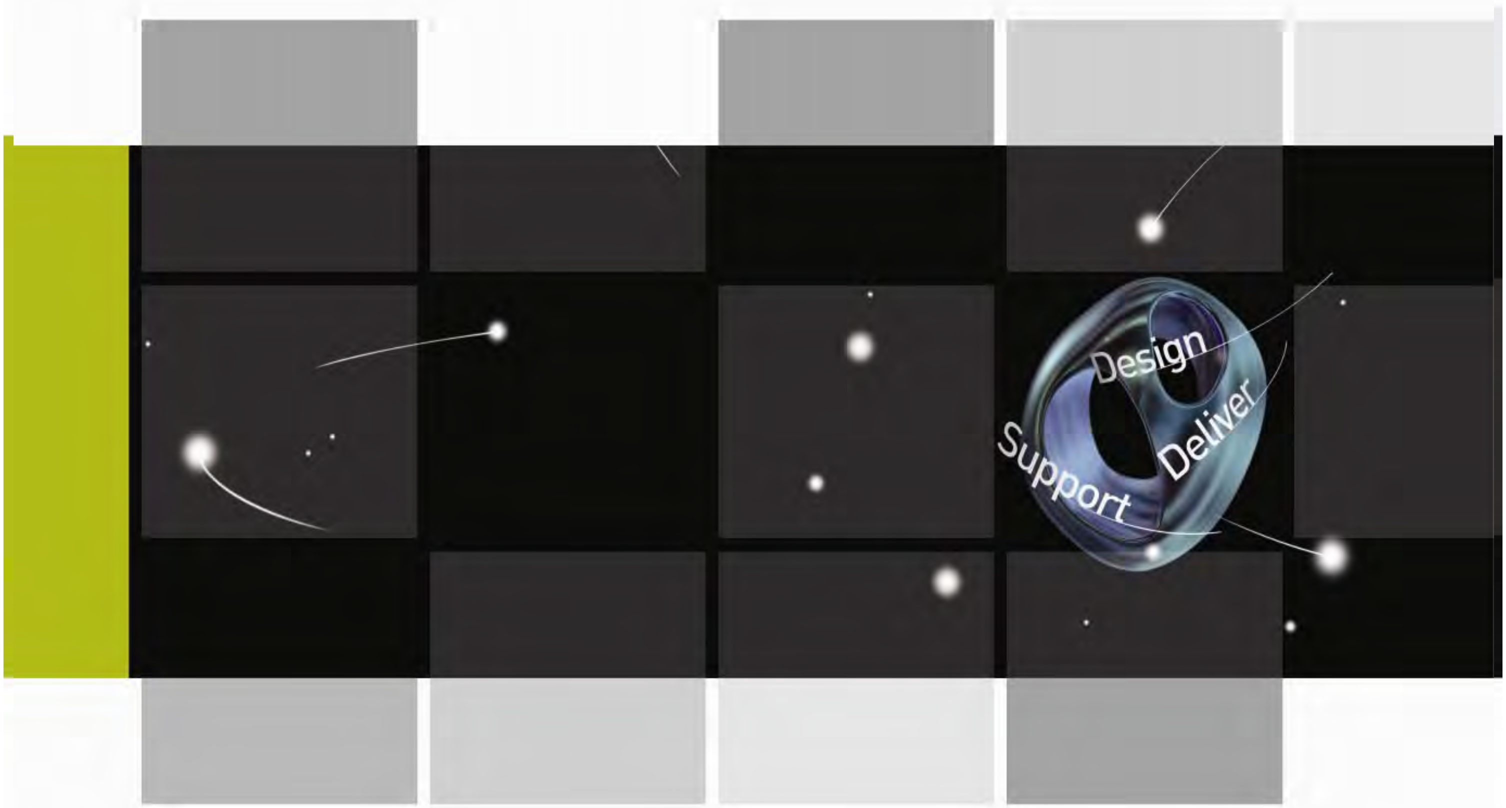
Table E1.10 On-site weather station data (06/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	6.7	E	11.6	85	0
00:30	6.7	E	11.3	86	0
01:00	6.3	E	11.6	86	0
01:30	6.3	E	11.7	88	0
02:00	6.7	E	11.8	88	0
02:30	6.7	E	11.8	89	0
03:00	7.2	E	11.8	87	0
03:30	7.2	E	11.7	86	0
04:00	6.3	E	11.5	86	0
04:30	6.3	E	11.3	87	0
05:00	5.8	E	10.8	87	0
05:30	5.4	E	10.7	88	0
06:00	5.4	ENE	10.7	88	0
06:30	4	ENE	11	88	0
07:00	4	ENE	11.4	88	0
07:30	4.5	ENE	11.7	87	0
08:00	4.9	ENE	11.9	87	0
08:30	4.9	E	12.1	87	0
09:00	3.6	E	12.8	86	0
09:30	4	E	14.7	85	0
10:00	4.5	E	15.2	80	0
10:30	4	E	15.1	79	0
11:00	4	E	15.2	81	0
11:30	4.9	E	15.8	78	0
12:00	4.5	E	15.8	79	0
12:30	4	E	16.1	79	0
13:00	3.6	ENE	16.1	79	0
13:30	4	ENE	16.3	79	0
14:00	4	ENE	16.3	80	0
14:30	3.6	ENE	17.5	79	0
15:00	3.1	ESE	16.9	78	0
15:30	4.5	ENE	17.4	77	0
16:00	3.6	E	17.8	74	0
16:30	3.1	ESE	16.9	75	0
17:00	3.6	E	16.2	76	0
17:30	3.1	E	15.7	77	0
18:00	3.1	ENE	16.1	76	0
18:30	4.5	ENE	15.6	73	0
19:00	4.5	ENE	14.7	74	0
19:30	3.1	ENE	13.9	76	0
20:00	2.7	ENE	13.2	76	0
20:30	2.7	NE	12.3	77	0
21:00	2.7	NE	11.3	78	0
21:30	2.2	NE	10.3	80	0
22:00	0.9	ENE	9.3	81	0
22:30	0.9	NE	8.6	83	0
23:00	1.3	ENE	8.4	84	0
23:30	1.3	ENE	9.3	85	0

Table E1.11 On-site weather station data (07/05/09)

Start Time	Wind Speed (m/s)	Wind Direction (from)	Average Air Temperature (ºC)	Relative Humidity	Rainfall (mm)
00:00	1.8	NE	10.1	84	0
00:30	1.8	NNE	10.7	83	0
01:00	1.8	NE	10.9	82	0
01:30	1.8	NE	11	82	0
02:00	1.8	NE	11	81	0
02:30	2.2	NNE	10.6	82	0
03:00	0.9	NNE	10.6	82	0
03:30	3.1	NNE	10.8	83	0
04:00	2.2	NNE	10.9	83	0
04:30	1.3	NNE	11	84	0
05:00	0.9	NNW	10.9	84	0
05:30	2.2	E	10.8	86	0
06:00	4.5	E	9.9	87	0.25
06:30	4	E	9.6	88	0.25
07:00	2.7	ENE	9.6	88	0
07:30	1.8	ENE	10.1	88	0
08:00	0.9	NE	11.3	88	0
08:30	1.3	ENE	12.1	85	0
09:00	1.3	NE	12.5	84	0
09:30	2.2	NE	13.9	81	0
10:00	2.2	ENE	13.7	80	0
10:30	2.7	E	13.9	78	0
11:00	2.7	E	13.7	77	0
11:30	2.7	ESE	13.8	77	0
12:00	2.7	E	14.3	78	0
12:30	2.7	E	13.7	74	0
13:00	1.8	E	13.2	74	0
13:30	1.3	E	13.2	74	0
14:00	0.4	NE	15.1	74	0
14:30	2.7	SE	14.7	72	0
15:00	2.2	SE	13.6	73	0
15:30	1.3	ESE	12.7	75	0
16:00	0	ESE	12.8	76	0
16:30	0.4	E	13	76	0
17:00	1.3	NNE	12.8	78	0
17:30	1.8	NW	13	79	0
18:00	1.8	NW	12.7	81	0
18:30	2.2	NW	12.2	83	0
19:00	2.2	NW	12.5	83	0
19:30	1.3	NNE	12.5	83	0
20:00	0.4	NNE	12.2	84	0
20:30	2.2	ENE	11.7	83	0
21:00	2.7	ENE	10.8	82	0
21:30	0.9	NE	9.1	81	0
22:00	0.4	NNW	8.6	83	0
22:30	1.8	NW	8.7	83	0
23:00	2.2	NW	8.9	83	0
23:30	2.2	NW	8.4	83	0

APPENDIX 11B: TRIAL BLAST NOISE AND VIBRATION REPORT



Blasting Tests
Noise and Vibration Monitoring Factual Report

Work Order CIDEN 002

15011/TR/00155
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FIGURES

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GLOSSARY / ABBREVIATIONS

An explanation of the specific acoustic terminology referred to within this report is provided below.

dB	Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise i.e. whether is it high pitched, low pitched or with no distinct tonal character. These measurements are usually undertaken in octave or 1/3 octave frequency bands. If these values are logarithmically summed a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
dBL_A	The dBL_A figure is used to relate better to the loudness of the sound heard. The dBL_A figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or 1/3 octave band values, before logarithmically summing them. As a result, the single dBL_A value provides a good representation of how loud a sound is.
L_{Aeq}	As almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The L_{Aeq}, 07:00-19:00 for example, describes the equivalent continuous noise level over the 12 hour period between 7am and 7pm.
L_{Amax}	The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.
L_{An}	Another method of describing with a single value a noise level which varies over a given time period, is to consider the average amount of acoustic energy and the length of time for which a particular noise level is exceeded. If a level of x dB(A) is exceed for say 6 minutes within one hour, that level can be described as being exceeded for 10% of the measurement period. This is denoted as the $L_{A10,1hr}$ = x dB. The L_{A10} index is often used to describe road traffic noise whilst the L_{A90}, the noise level exceeded for 90% of the time, is the usual descriptor of the underlying background noise. L_{A1} in addition to L_{Amax} are common descriptors of construction noise.
PPV	The Peak Particle Velocity is the maximum velocity which is recorded during a particular event and can refer to a particular orientation (vertical or horizontal) or to the maximum (units: mm/s).

EXECUTIVE SUMMARY

Electricité de France (EDF) proposes to construct and operate a new nuclear power station west of the existing Hinkley Point A (being decommissioned) and B facilities. The new station will comprise two UK EPR type reactors and ancillary buildings.

This report details a noise and vibration monitoring survey, undertaken between 20th and 29th April 2010, during earthworks blasting tests as part of the site investigative works. The monitoring regime enabled the determination of existing background noise and vibration levels, as well as measurement during blasting events.

Measurements of both environmental noise and vibration levels were undertaken at two locations, including: a residential property in Shurton and between the blasting site and Hinkley Point A.

The measurement results indicate that the vibration magnitude of blast events, although possibly perceptible to alerted residents, was determined to be Very Low in relation to nuisance impact criteria. Cosmetic damage to buildings is highly unlikely as threshold values for buildings are much higher than those for perception and disturbance used in this study.

The maximum noise levels generated by blasting events were very low and are not considered significant in terms of nuisance disturbance.

1.0 INTRODUCTION

As part of the earthworks programme for the construction the Hinkley Point C nuclear power station, blasting of the bedrock may be required. These operations have the potential to generate noise and vibration at the nearest sensitive receptors, including private residential dwellings in Shurton.

Testing of blasting operations has therefore been undertaken by EDF's earthworks contractors to determine how the underlying bedrock reacts to such events.

A noise and vibration survey was undertaken by AMEC consultants between 20th and 29th April 2010, allowing collection of baseline data as well as measurements during blasting events. All AMEC personnel involved in the monitoring programme have attained the UK Institute of Acoustics Certificate of Competence in Environmental Noise Measurements.

This report is a factual document containing the results of the continuous noise and vibration measurements undertaken at two locations simultaneously. Commentary is also provided regarding the potential for noise and/or vibration impacts based upon published disturbance criteria.

The following sections of this report describe the measurement work undertaken and give a summary of the results.

2.0 SITE DESCRIPTION

2.1 Site location and context

The Site is located on the north Somerset coast, east of Minehead and north of Bridgwater. Between 10 km and 20 km from the Site are the settlements of Williton, Watchet, Burnham-on-Sea, Bridgwater and Taunton and there are a number of smaller villages closer to the Site.

The Site is bounded to the north by the Bristol Channel (Bridgwater Bay) and to the south and west by agricultural fields. Land to the east is occupied by two nuclear power stations, Hinkley A and Hinkley B, which form the existing Hinkley Point power station complex. Hinkley A operated between 1965 and 2000 and is currently undergoing decommissioning. The station is now fully defueled and is being prepared for a period of aftercare and maintenance. Full site clearance is planned for 2095.

Hinkley B has operated since 1976. It is currently producing 70% of its maximum potential output of 860 MW and is scheduled to continue operating until at least 2016. Decommissioning will commence once operations have ceased.

2.2 Nearest noise and vibration sensitive receptors

The nearest receptor locations to the Site comprise residential dwellings in the villages of Burton, Shurton and Wick to the south. Baseline noise survey locations that are representative of these locations have therefore been selected, as well as locations on the northern and southern site boundaries.

Construction and operation of the development also has the potential to impact on noise sensitive operational activities (e.g. office spaces) at the Hinkley B site immediately to the east of the Site.

Noise generated by construction and operation road traffic on the main road network will have the potential to impact on noise sensitive receptors aligning the likely transportation route corridor. Baseline monitoring has been undertaken at two locations representative of dwellings that are likely to experience the highest magnitude of impact.

The baseline noise monitoring locations, are described in Table 1.

Table 1 Noise and vibration monitoring locations

Ref.	Location	Representative of	Grid Ref.	Approximate distance from trial blasting pits (m)
ML1	Bayleys Brook House	Residential dwellings in Shurton	320225, 144380	1,600
ML2	Knighton Farm (residential)	North of Hinkley Point B Training and Visitors Centre	320680, 146152	800

3.0 TRIAL BLAST EVENTS

Table 2 identifies the three trial blasts that were undertaken during the measurement period. Figure A.1 in Appendix A identifies the location of the trial blast pits in relation to the noise and vibration monitoring locations.

Table 2 Log of blast events

Date	Reference	Time	Maximum Instantaneous Charge (kg)	Description
22/04/10	B-BBH2	14:53	15	Depth 9.40 m below ground level with soft slurry in base
	B-BBH3	15:50	22.5	Depth 9.60 m below ground level with soft slurry in base
	B-BBH1	15:55	22	Depth 9.40 m below ground level with soft slurry in base

4.0 METHODOLOGY

4.1 Measurement methodology

The following guidance methodologies were adopted:

4.1.1 Noise

BS 7445:2003 Part 1 'Description and measurement of environmental noise – Guide to quantities and procedures'

BS 7445-1:2003 defines the verification and traceability of instrumentation and noise measurement, as well as describing the basic procedures for the determination of environmental noise levels.

BS 7445-1 defines the following criteria for selection of appropriate noise level measurement locations:

- Microphone position either:
    - at least 3.5 m from any reflecting surface (other than the ground), i.e. in 'free-field' and 1.2 – 1.5 m above the ground (acknowledgement is made to other standards with specific heights); or,
    - 1 – 2 m from the façade of a receptor building, and 1.2 – 1.5 m above each floor level of interest.
- Minimise interference due to meteorological conditions by either:
    - measurement over a range of meteorological conditions to determine the long-term average sound level; or,
    - measurement under carefully specified meteorological conditions (i.e. conditions that would result in the most stable sound propagation).

BS 7445-1 also describes procedures for equipment calibration, which are presented in Section 3.4, Quality Control Procedures.

4.1.2 Vibration

BS 6472:2008 Part 2 'Guide to evaluation of human exposure to vibration in buildings' - Blast-induced vibration'

BS 6472-2 recommends that measurement of vibration from blasting events should determine the Peak Particle Velocity (PPV), which is measured in mm/s. With respect to measurement location, BS 6472-2 states:

> *"…measurements should be made outside the building on a well-founded hard surface as close to the building as possible".*

4.2 Assessment criteria

4.2.1 Noise

Based on advice provided in Annex E of British Standard BS 5228: 2009 *'Noise and vibration control on construction and open sites' - Part 1 'Noise'*, the assessment criteria presented in Table 3 has been developed for earthworks associated with the construction of Hinkley Point C.

Table 3 Noise magnitude scale for preliminary works construction activities at Hinkley Point C

Assessment Period		**Construction Noise Magnitude dB $L_{Aeq,1hour}$ (free-field)**			
Day of Week	**Time of Day**	**Very Low**	**Low**	**Medium**	**High**
Monday – Friday	07.00 – 19.00	<45	45-55	55-65	>65
	19.00 – 23.00	<40	40-50	50-60	>60
	23.00 – 07:00	<35	35-40	40-45	>45
Saturday	07.00 – 19.00	<45	45-55	55-65	>65
	19.00 – 23.00	<40	40-50	50-60	>60
	23.00 – 07:00	<35	35-40	40-45	>45
Sunday and Bank Holidays	07.00 – 19.00	<40	40-50	50-60	>60
	19.00 – 23.00	<35	35-45	45-55	>55
	23.00 – 07:00	<35	35-40	40-45	>45

Notes: dB re: 20 μPa

4.2.2 Vibration

In terms of vibration perception, BS 5228-2 suggests that a level of 0.3 mm/s *"…might be just perceptible in residential environments"*. However, in terms of nuisance effects this relates to permanent continuous vibration sources, rather than infrequent blasting events as proposed.

BS 5228-2 provides useful discussion on the perception and effects of vibration on a community:

> *"Vibration nuisance is frequently associated with the assumption that, if vibrations can be felt, then damage is inevitable; however, considerably greater levels of vibration are required to cause damage to buildings and structures, or to cause computers and similar electronic equipment to malfunction. Vibrations transmitted from site activities to the neighbourhood can, therefore, cause anxiety as well as annoyance, and can disturb sleep, work or leisure activities. In*

any neighbourhood, some individuals will be more sensitive to vibration than others."

"…adverse community reaction is sometimes based upon concern over building damage, even when the vibration is just perceptible. It is therefore important to assure the community that vibration levels generally have to be of significant magnitude for even cosmetic damage to occur."

Table 1 of BS 6472-2 provides recommended maximum satisfactory magnitudes of vibration with respect to human response for up to three blast vibration events per day. These criteria, as measured at a residential receptor location, are presented in Table 4 below.

Table 4 Vibration magnitude assessment criteria (blasting operations)

Magnitude	Guidelines
High	Generation of PPV in excess of 24 mm/s
Medium	Generation of PPV in the range of >10 to <24mm/s
Low	Generation of PPV in the range of >6 to <10 mm/s
Very Low	Generation of PPV below 6 mm/s

In addition to the above, BS 6472-2 also recommends a limit of 2 mm/s for blast events occurring during the night-time period (23:00 – 07:00).

4.3 Monitoring period, duration and frequency

Long-term unattended measurements were undertaken at both monitoring locations. A summary of the monitoring regime and details of the microphone and seismograph positions, as well as a commentary of the significant noise sources at each location, is provided below.

4.3.1 ML1 Bayleys Brook House

The vibration transducer was positioned on a concrete surface connected to the northern extent of Bayleys Brook House residential property, approximately 1,600 m south of the trial blasting pits. A sandbag was placed over the transducer to hold it securely in place throughout the monitoring period.

The microphone was positioned approximately 3 m from the northern façade of Bayley Brook House at a height of 1.5 m above ground level.

Continuous monitoring was undertaken between Tuesday 20th and Thursday 29th April 2010.

The main daytime noise sources at this location include birdsong, surf, earthworks machinery operating to the south west and various industrial sources at Hinkley

Point A. Operation of Hinkley Point B is likely to have also contributed to the background noise levels, notably during the quieter night-time periods.

4.3.2 ML2 North of Hinkley Point B Training and Visitors Centre

The monitoring location was approximately 800 m east of the trial blasting pits, and approximately 30 m west of the Hinkley Point A boundary fence and access gate. A sandbag was placed over the transducer to hold it securely in place throughout the monitoring period.

The microphone was positioned at the same location but at a height of 1.5 m above ground level, in free-field conditions.

Continuous monitoring was undertaken between Tuesday 20th and Wednesday 28th April 2010.

The main daytime noise sources at this location include birdsong and residential activities such as gardening (lawn-mowing).

4.4 Equipment

Equipment used during this measurement survey included:

Rion NL-31	Class 1 Sound Level Meter	s/n 583274
Rion NA-31	Class 1 Sound Level Meter	s/n 773044
Vibrock V901	Seismograph	s/n 1449
Vibrock V901	Seismograph	s/n 896

4.5 Quality control procedures

All AMEC personnel involved in the monitoring programme have attained the UK Institute of Acoustics Certificate of Competence in Environmental Noise Measurements.

All equipment specified in Section 4.4 above (sound level meters, microphones, preamplifiers and field calibrators) had been fully calibrated within the 12 months preceding the survey. Calibration certificates for all monitoring equipment used are provided in Appendix D.

As stipulated in BS 7445-1: 2003, field calibrations (noise) were carried out in accordance with the manufacturer's specifications before and after each series of measurements. A class 1 field calibrator in accordance BS EN 60942: 2003 was used to set the sensitivity of the entire sound measurement system at the start of each series of measurements, or each medium-term monitoring period, and to check that no significant sensitivity drift had occurred upon completion.

4.6 Meteorological conditions

Throughout the monitoring period, the weather was generally dry and with above average temperatures for the time of year. On the day of the blasting tests (22/04/10): an easterly wind prevailed at a speed of 2-7 mph; the ambient temperature just exceeded the average maximum high (13˚C); and, there was no rainfall.

5.0 SUMMARY OF MEASUREMENT RESULTS

5.1 Monitoring data

A summary of the results of the noise and vibration measurements are presented in Tables 5 to 8. Graphs showing the variation in noise and maximum vibration levels are provided in Appendices B and C respectively.

For each monitoring period: 'Day' represents 07:00 – 23:00; 'Evening' represents 19:00 – 23:00; and, 'Night' represents 23:00 – 07:00.

Table 5 Summary of ambient noise levels – Bayleys Brook House (ML1)

Monitoring period (start date)	Measurement duration (T)	Sound Pressure Level, dB (fast time-weighting)		
		$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{Amax,T}$
Night (20/04/10)	8 hours	43.2	35.7	72.1
Day (21/04/10)	16 hours	53.8	37.5	93.7
Night (21/04/10)	8 hours	44.9	36.7	80.0
Day (22/04/10)	16 hours	45.9	37.1	80.0
Night (22/04/10)	8 hours	43.5	35.1	65.4
Day (23/04/10)	16 hours	46.5	35.3	86.9
Night (23/04/10)	8 hours	43.9	34.0	73.5
Day (24/04/10)	16 hours	63.8	36.1	103.9
Night (24/04/10)	8 hours	43.8	33.9	67.8
Day (25/04/10)	16 hours	48.2	37.1	83.5
Night (25/04/10)	8 hours	45.8	33.7	75.7
Day (26/04/10)	16 hours	46.1	37.6	78.9
Night (26/04/10)	8 hours	45.2	35.9	74.5
Day (27/04/10)	16 hours	49.9	36.4	80.5
Night (27/04/10)	8 hours	44.0	31.9	68.0
Day (28/04/10)	16 hours	45.1	36.5	74.7
Night (28/04/10)	8 hours	49.4	33.2	82.6

Notes: All values are in dB re 20 µPa, Free-field.

* L_{A90} values are arithmetic averages of individual 1-minute measurements

Table 6 Summary of ambient noise levels – North of Hinkley Point B Training and Visitors Centre (ML2)

Monitoring period (start date)	Measurement duration (T)	Sound Pressure Level, dB (fast time-weighting)		
		$L_{Aeq,T}$	$L_{A90,T}$ *	$L_{Amax,T}$
Night (20/04/10)	8 hours	47.3	45.7	66.2
Day (21/04/10)	16 hours	47.0	44.3	72.3
Night (21/04/10)	8 hours	48.8	47.4	69.4
Day (22/04/10)	16 hours	46.8	44.8	72.6
Night (22/04/10)	8 hours	48.9	46.4	85.0
Day (23/04/10)	16 hours	48.2	46.5	71.0
Night (23/04/10)	8 hours	47.5	46.1	69.2
Day (24/04/10)	16 hours	47.7	46.0	74.2
Night (24/04/10)	8 hours	47.5	46.1	68.8
Day (25/04/10)	16 hours	46.3	43.8	71.9
Night (25/04/10)	8 hours	47.8	45.8	69.1
Day (26/04/10)	16 hours	48.1	45.5	81.8
Night (26/04/10)	8 hours	49.0	46.7	66.5
Day (27/04/10)	16 hours	49.1	47.3	70.7
Night (27/04/10)	8 hours	48.7	47.2	67.0

Notes: All values are in dB re 20 µPa, Free-field.

* L_{A90} values are arithmetic averages of individual 1-minute measurements.

Table 7 Summary of measured vibration levels – Bayleys Brook House (ML1)

Monitoring period (start date)	Measurement duration (T)	Maximum vibration level, dB (fast time-weighting)	
		Average*	Maximum
Night (20/04/10)	8 hours	0.156	0.161
Day (21/04/10)	16 hours	0.158	0.281
Night (21/04/10)	8 hours	0.157	0.161
Day (22/04/10)	16 hours	0.159	0.201
Night (22/04/10)	8 hours	0.155	0.161
Day (23/04/10)	16 hours	0.159	0.161
Night (23/04/10)	8 hours	0.157	0.161
Day (24/04/10)	16 hours	0.160	0.763
Night (24/04/10)	8 hours	0.160	0.161
Day (25/04/10)	16 hours	0.160	0.201
Night (25/04/10)	8 hours	0.160	0.161
Day (26/04/10)	16 hours	0.160	0.402
Night (26/04/10)	8 hours	0.156	0.161
Day (27/04/10)	16 hours	0.160	0.161
Night (27/04/10)	8 hours	0.160	0.161
Day (28/04/10)	16 hours	0.160	0.161
Night (28/04/10)	8 hours	0.160	0.161

Notes: * Average of the '30-second maximum' recorded values.

Table 8 Summary of measured vibration levels – North of Hinkley Point B Training and Visitors Centre (ML2)

Monitoring period (start date)	Measurement duration (T)	Maximum vibration level, dB (fast time-weighting)	
		Average*	Maximum
Night (20/04/10)	8 hours	0.110	0.161
Day (21/04/10)	16 hours	0.090	0.402
Night (21/04/10)	8 hours	0.118	0.161
Day (22/04/10)	16 hours	0.086	0.402
Night (22/04/10)	8 hours	0.113	0.161
Day (23/04/10)	16 hours	0.084	0.161
Night (23/04/10)	8 hours	0.119	0.161
Day (24/04/10)	16 hours	0.079	0.161
Night (24/04/10)	8 hours	0.098	0.361
Day (25/04/10)	16 hours	0.091	0.241
Night (25/04/10)	8 hours	0.104	0.161
Day (26/04/10)	16 hours	0.075	0.161
Night (26/04/10)	8 hours	0.111	0.361
Day (27/04/10)	16 hours	0.073	0.161
Night (27/04/10)	8 hours	0.097	0.161
Day (28/04/10)	16 hours	0.079	0.161

Notes: * Average of the '30-second maximum' recorded values.

6.0 DISCUSSION

Figures 1 - 4 show the measured noise and vibration levels recorded at the moment of each blast event at each measurement position.

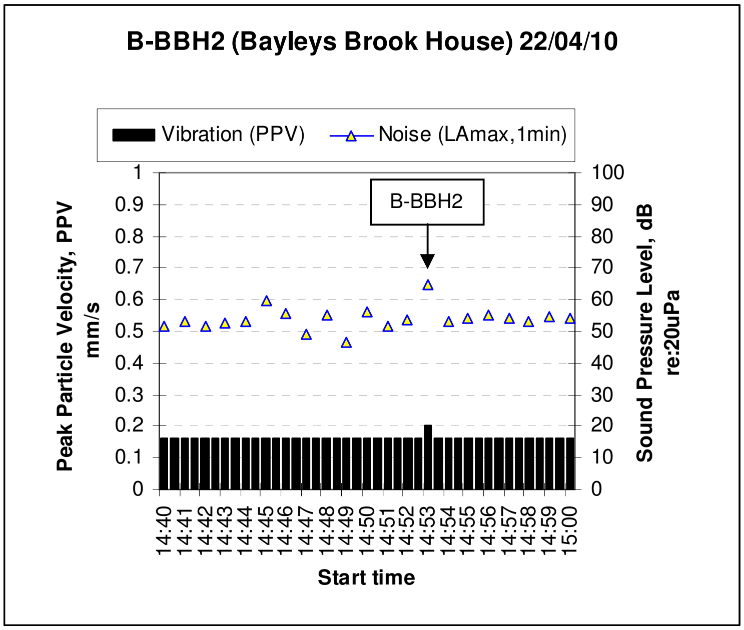


Figure 1 Measured noise and vibration levels at Bayleys Brook House during blast event B-BBH2

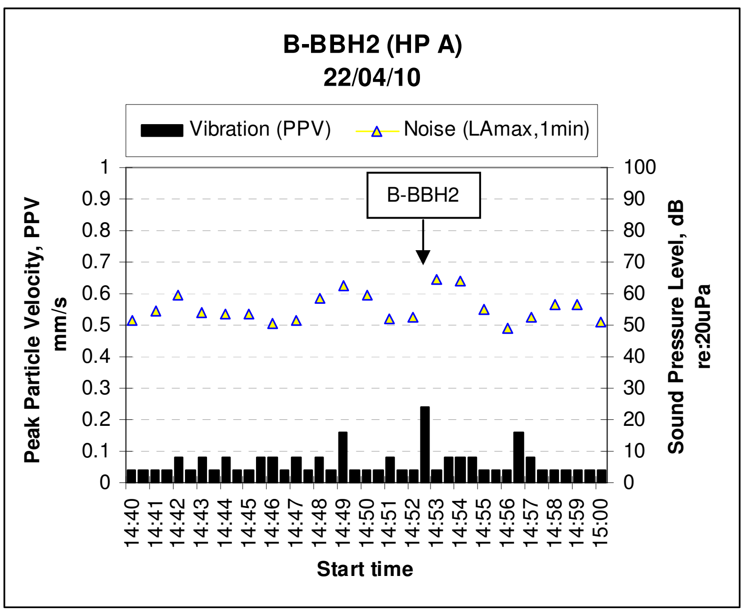


Figure 2 Measured noise and vibration levels at Hinkley Point A monitoring location during blast event B-BBH2

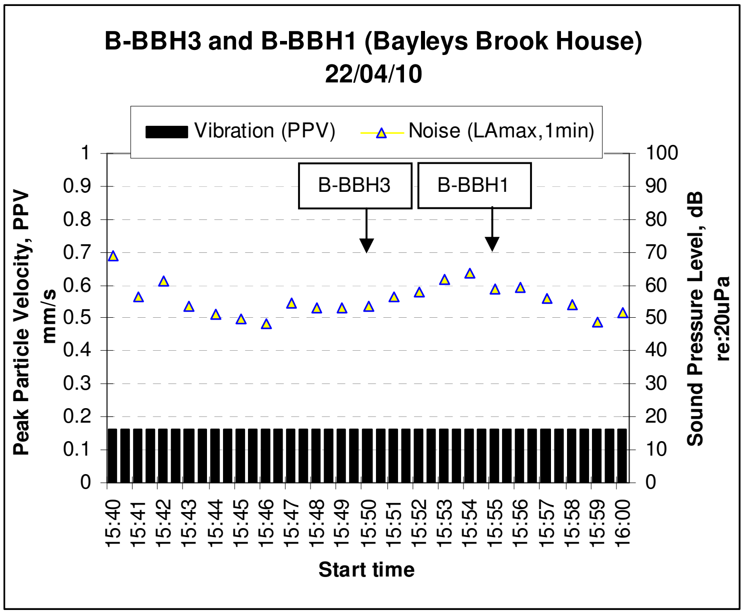


Figure 3 **Measured noise and vibration levels at Bayleys Brook House during blast events B-BBH3 and B-BBH1**

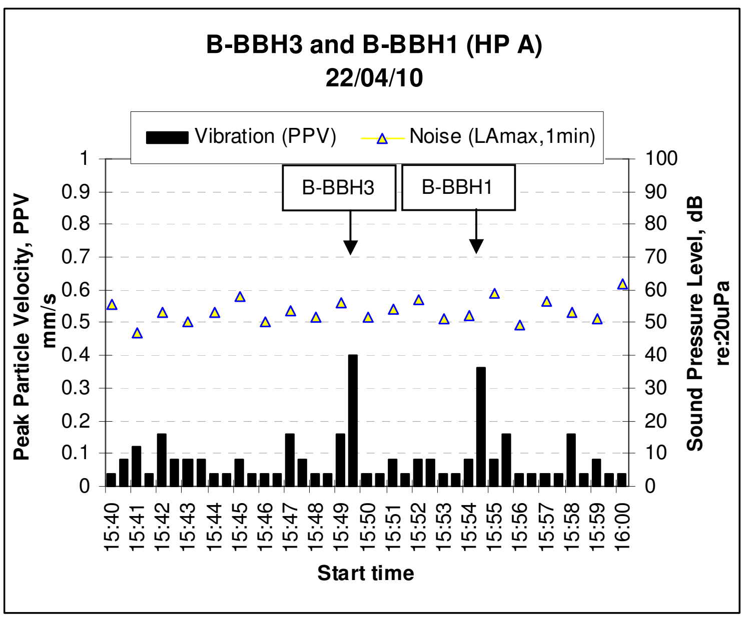


Figure 4 **Measured noise and vibration levels at Hinkley Point A monitoring location during blast events B-BBH3 and B-BBH1**

The figures above clearly indicate that vibration levels from blasting operations are unlikely to exceed the Very Low magnitude criteria (6 mm/s) identified in Table 4. Only blast event B-BBH2 registered an observable increase in vibration above the background level at Bayleys Brook House. This maximum recorded PPV level (0.201 mm/s) is below the 0.3 mm/s level that BS 5228-2 suggests *"…might be just perceptible in residential environments"*. It is however above 0.14 mm/s, the level at which BS 5228-2 states that *"…might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction."*

It should be noted that good practice for community relations and health and safety, i.e., notifying the community of planned blast events, and the pre-blast alarm, both serve to raise the sensitivity of local residents to both noise and vibration. Therefore, vibrations may have been perceived by alerted residents.

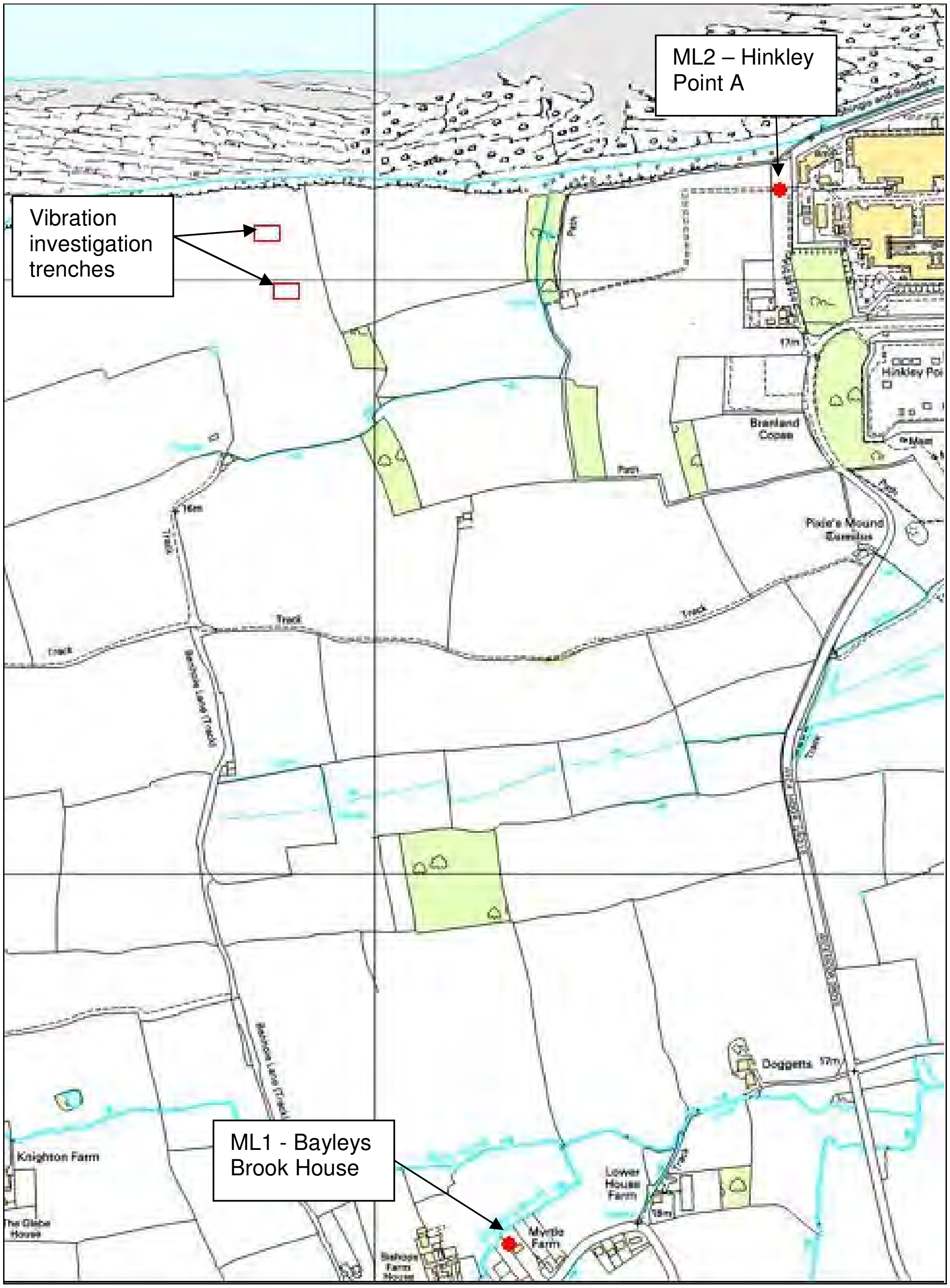
Peak vibration levels from the blast events are more clearly discernible in the measurement data obtained at the Hinkley Point A monitoring location, approximately half the distance (but in a different direction) from the blast site. However, the generated vibration levels at this location were again well below the Very Low magnitude criteria (6 mm/s).

It is difficult to be certain of the exact cause of the measured L_{Amax} during a given 1-minute measurement period. However, the maximum A-weighted instantaneous noise level at Bayleys Brook House did not exceed 65 dB $L_{Amax,T}$ as a result of the trial blasts.

Overall, it is concluded that the vibration magnitude of blast events, although possibly perceptible to alerted residents, was determined to be Very Low in relation to nuisance impacts. Cosmetic damage to buildings is highly unlikely as threshold values for buildings are much higher than those for perception and disturbance used in this study.

Appendix A Map of monitoring locations

Figure A.1 Monitoring locations ML1 and ML2



Appendix B Graphs showing variation in ambient noise levels

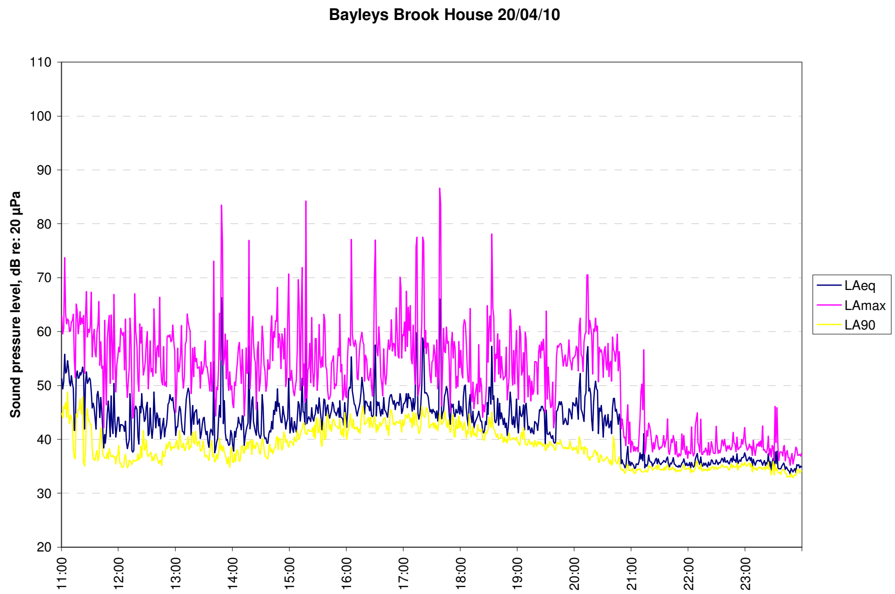


Figure B.1 Variation in ambient noise levels at Bayleys Brook House (20/04/10)

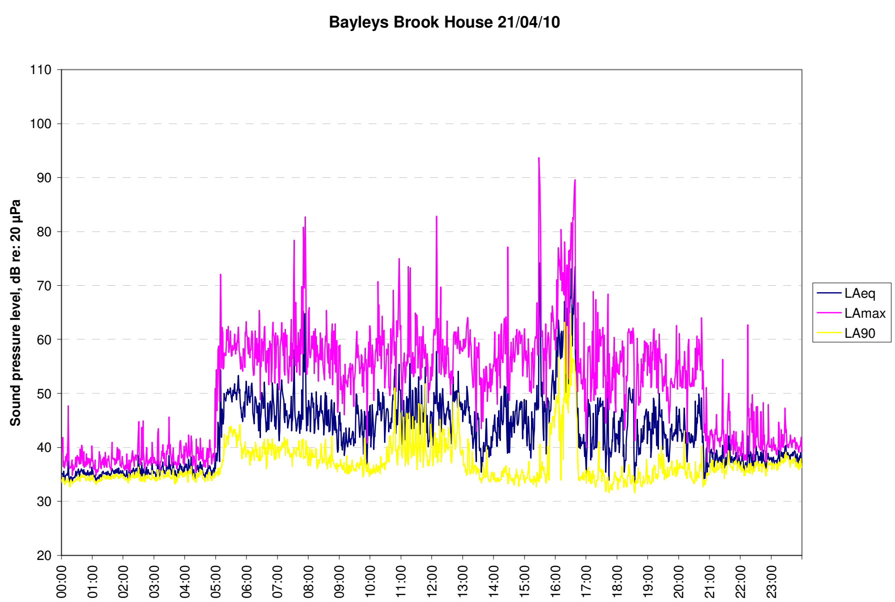


Figure B.2 Variation in ambient noise levels at Bayleys Brook House (21/04/10)

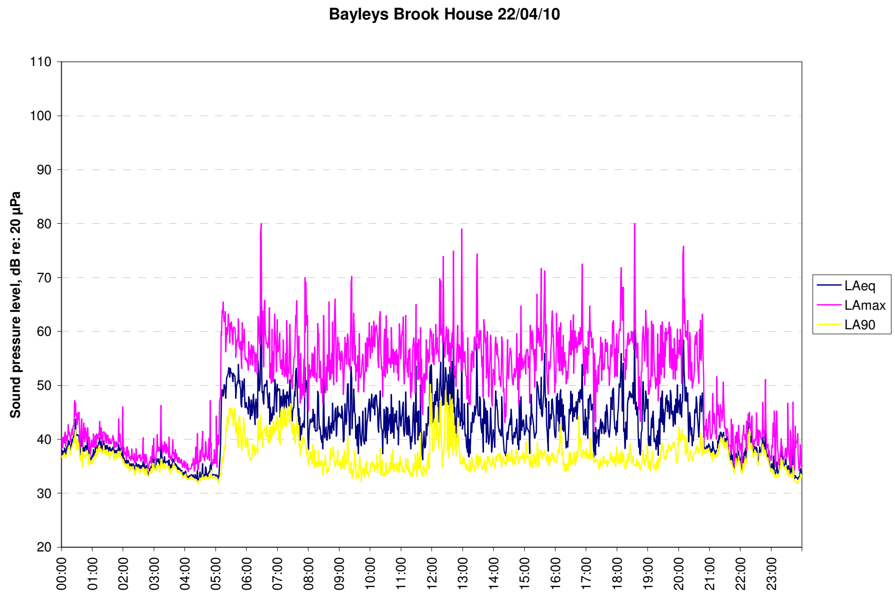


Figure B.3 Variation in ambient noise levels at Bayleys Brook House (22/04/10)

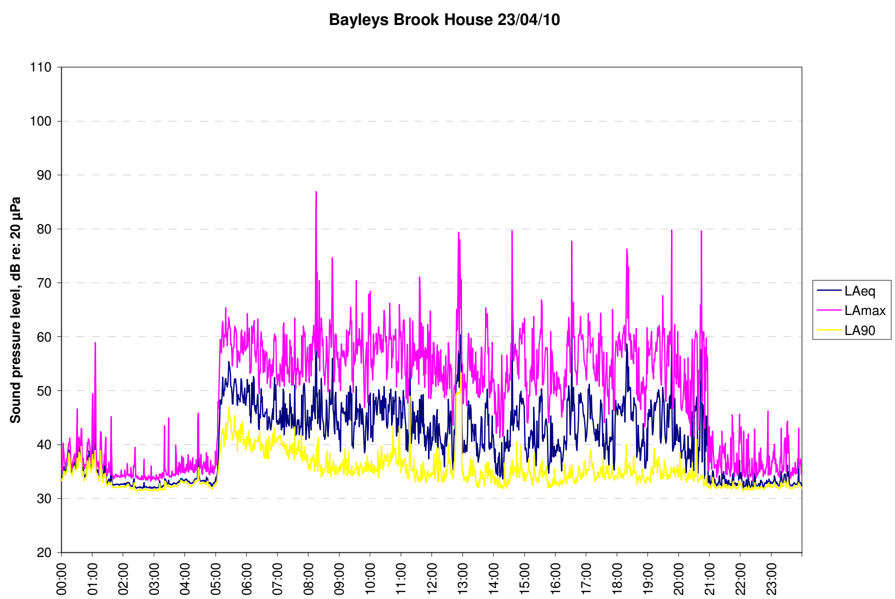


Figure B.4 Variation in ambient noise levels at Bayleys Brook House (23/04/10)

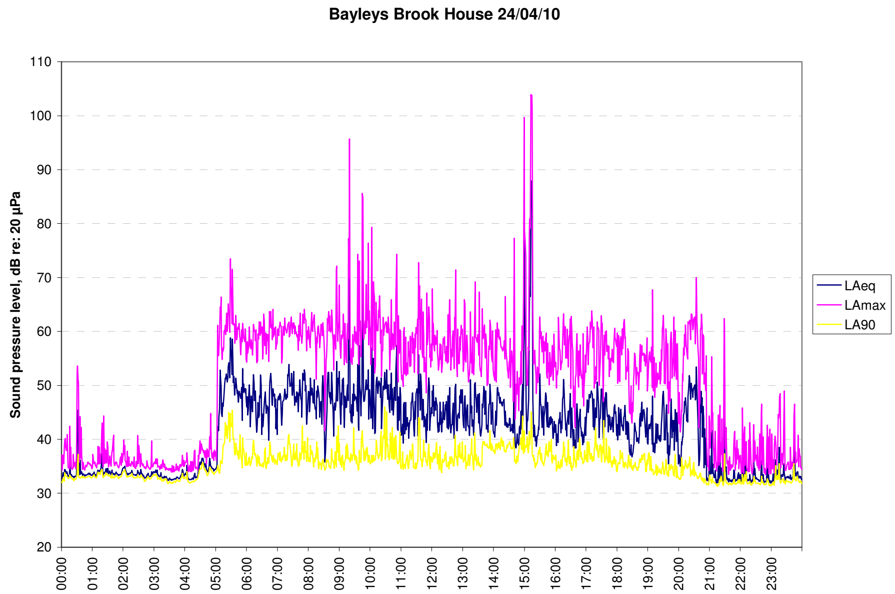


Figure B.5 Variation in ambient noise levels at Bayleys Brook House (24/04/10)

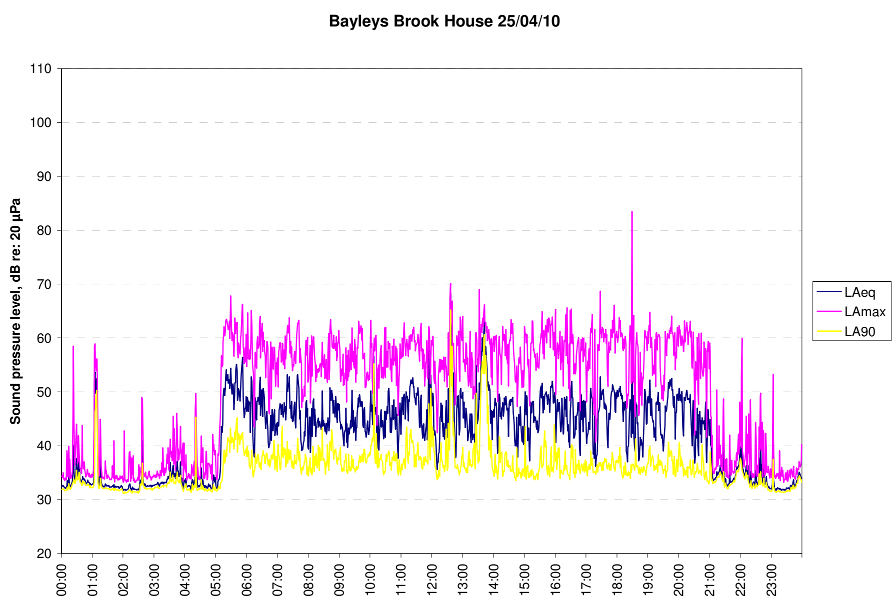


Figure B.6 Variation in ambient noise levels at Bayleys Brook House (25/04/10)

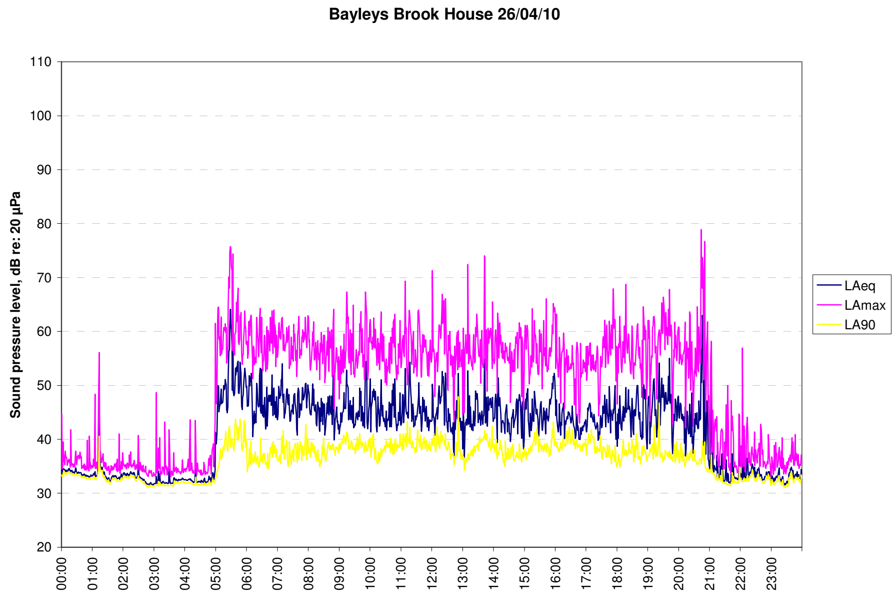


Figure B.7 Variation in ambient noise levels at Bayleys Brook House (26/04/10)

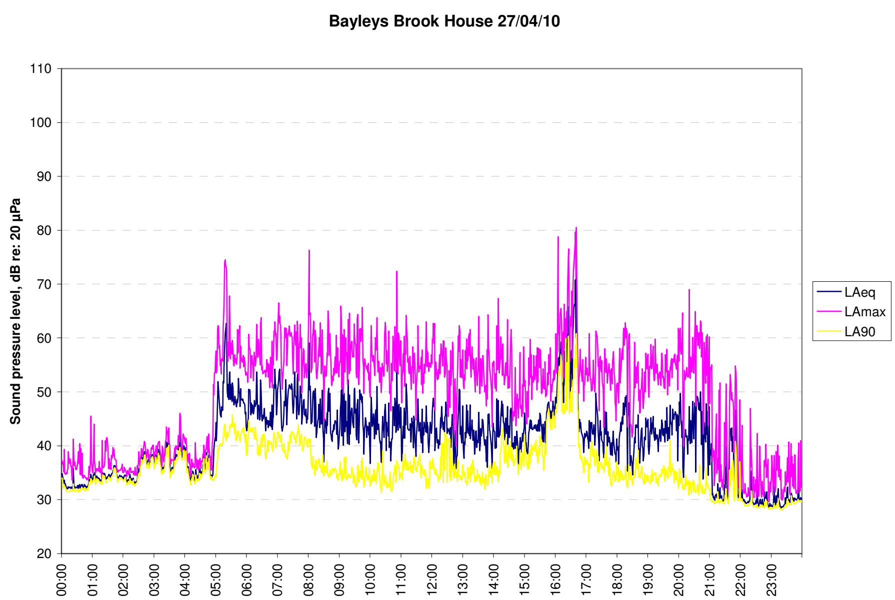


Figure B.8 Variation in ambient noise levels at Bayleys Brook House (27/04/10)

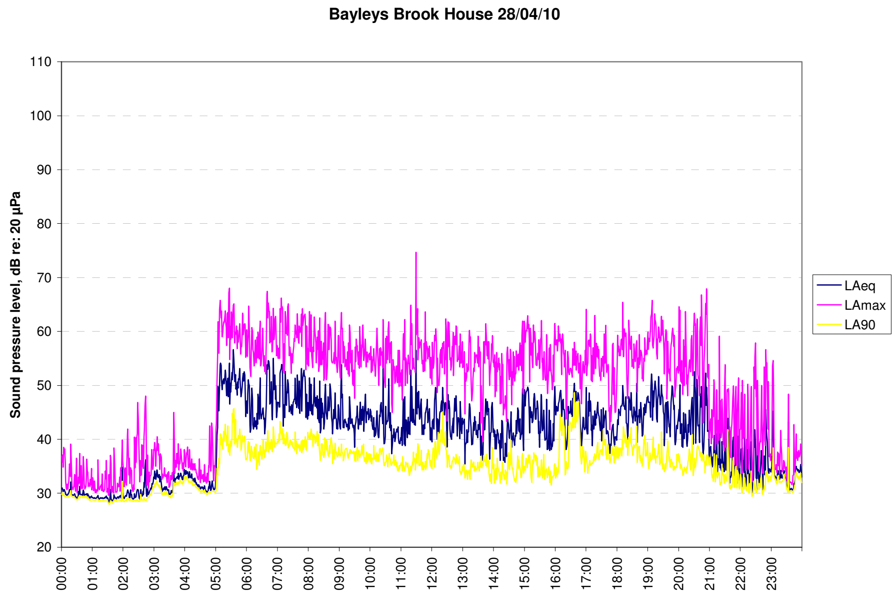


Figure B.9 Variation in ambient noise levels at Bayleys Brook House (28/04/10)

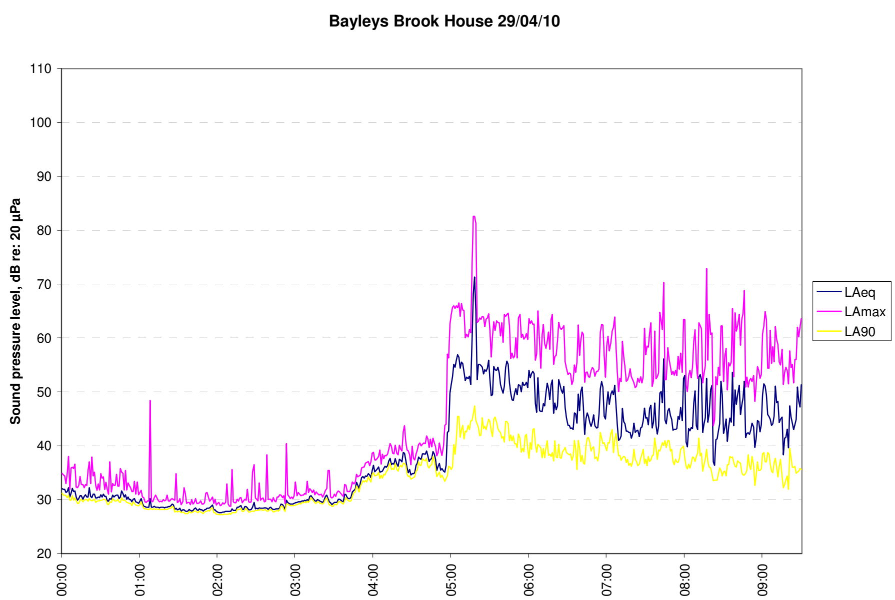


Figure B.11 Variation in ambient noise levels at Bayleys Brook House (29/04/10)

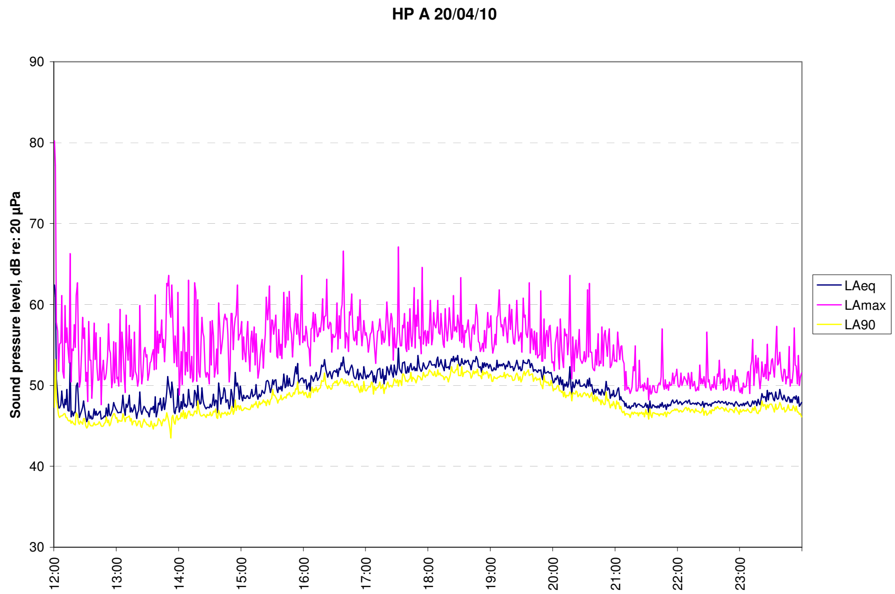


Figure B.11 **Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (20/04/10)**

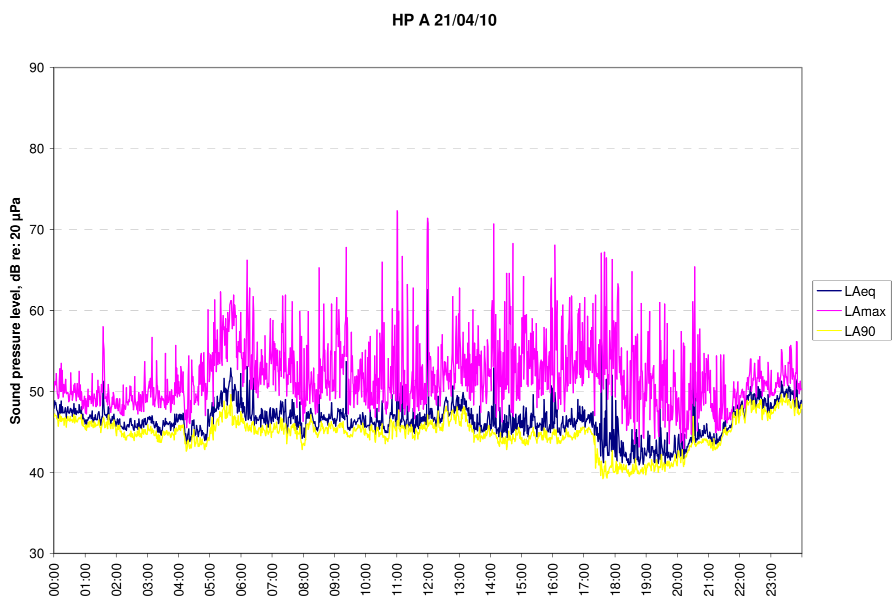


Figure B.12 **Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (21/04/10)**

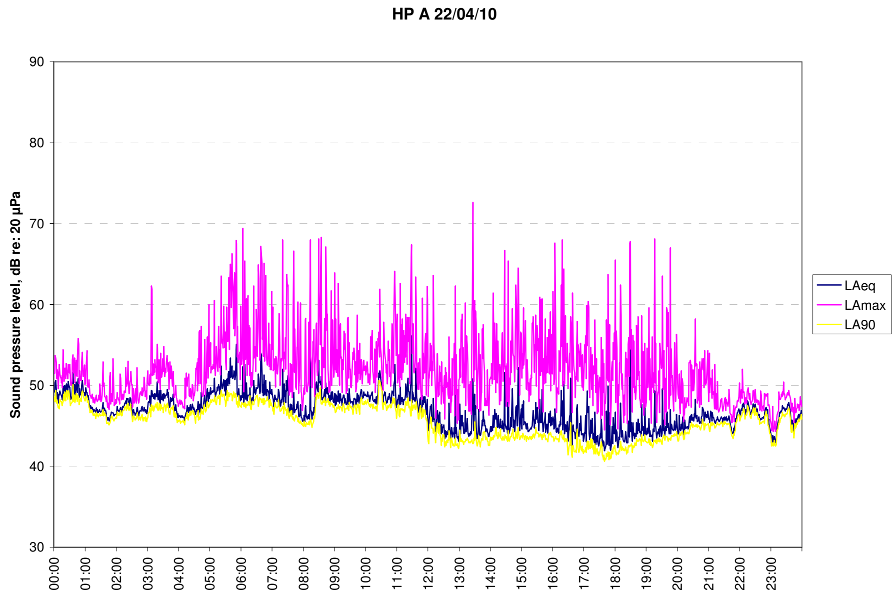


Figure B.13 Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (22/04/10)

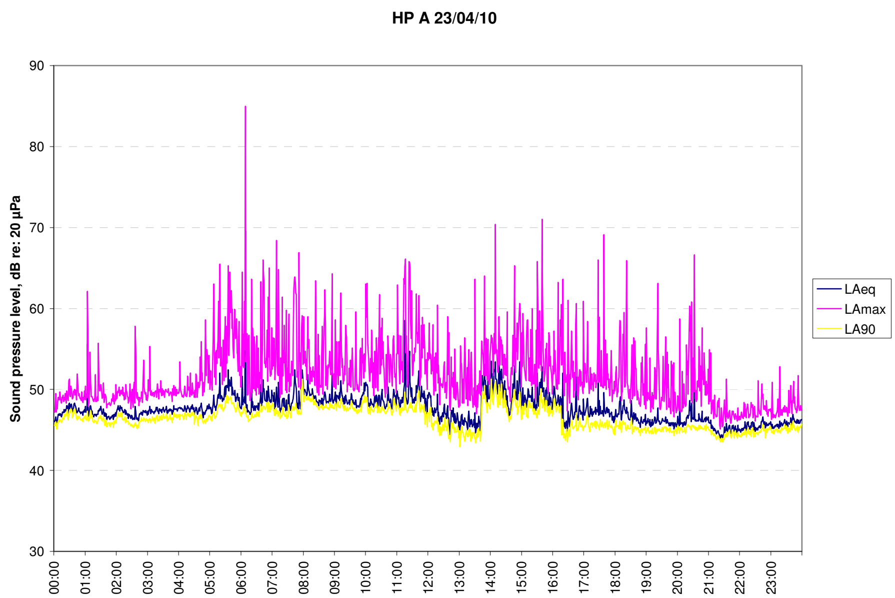


Figure B.14 Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (23/04/10)

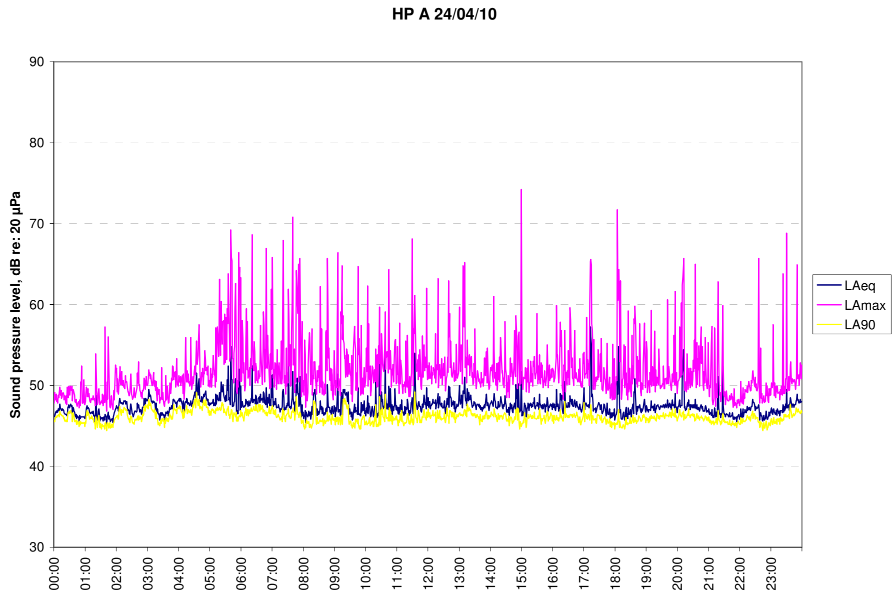


Figure B.15 Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (24/04/10)

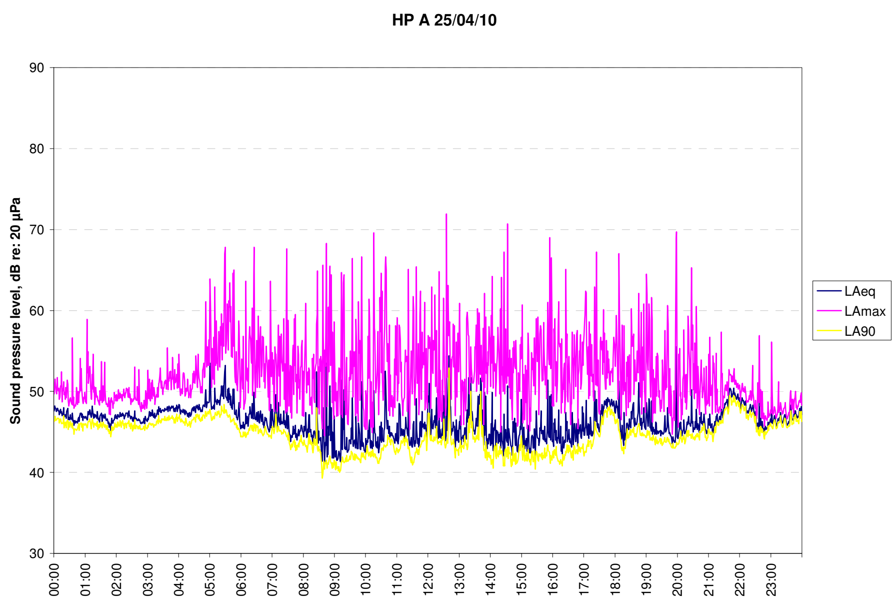


Figure B.16 Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (25/04/10)

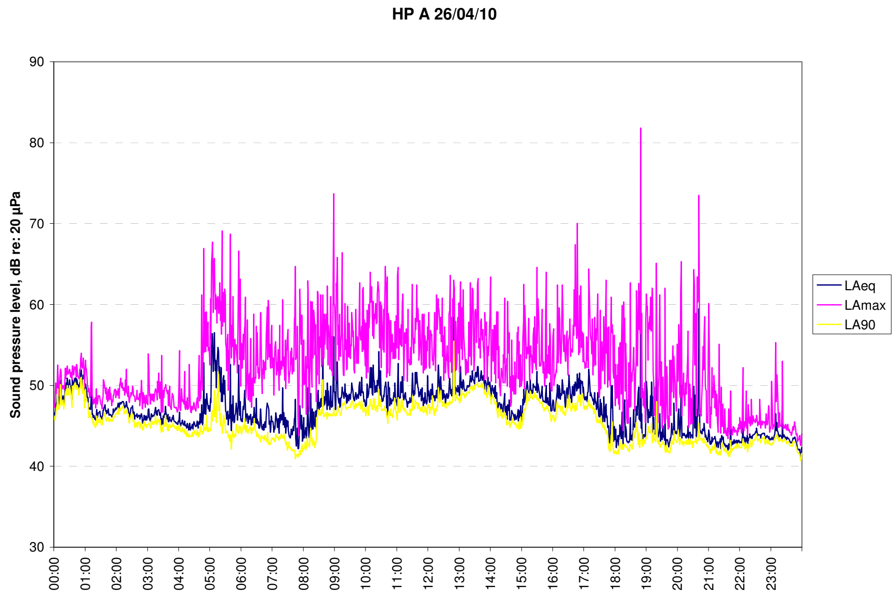


Figure B.17 Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (26/04/10)

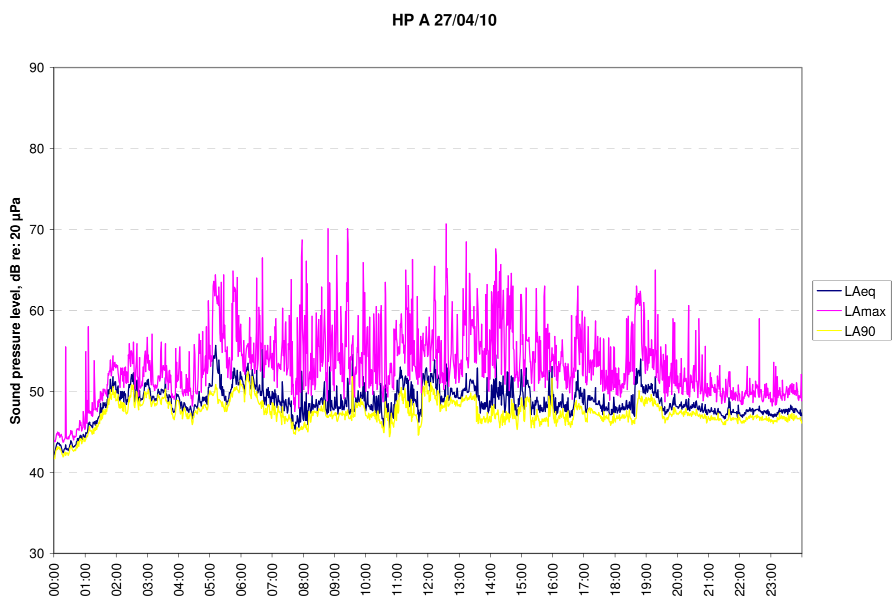


Figure B.17 Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (27/04/10)

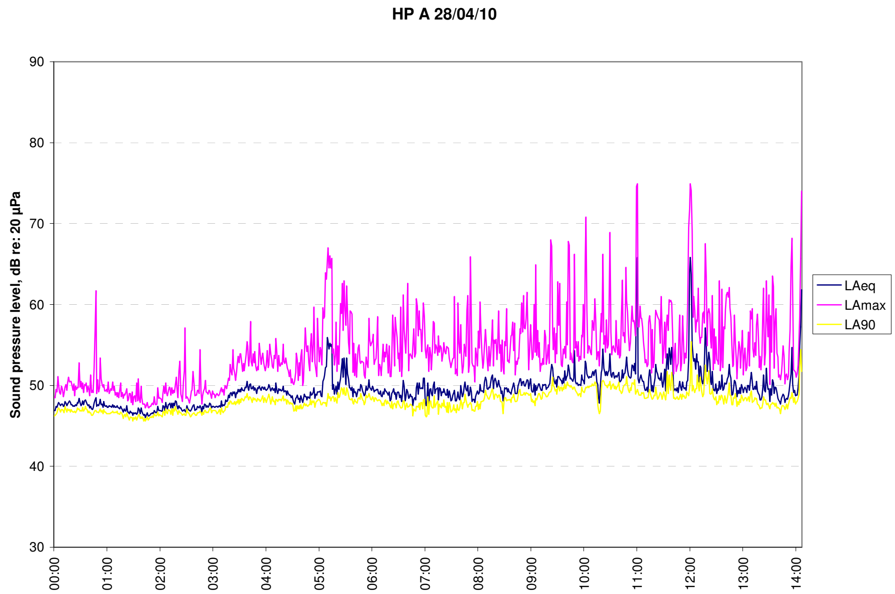


Figure B.17 **Variation in ambient noise levels - North of Hinkley Point B Training and Visitors Centre (28/04/10)**

Appendix C Graphs showing variation in maximum vibration levels

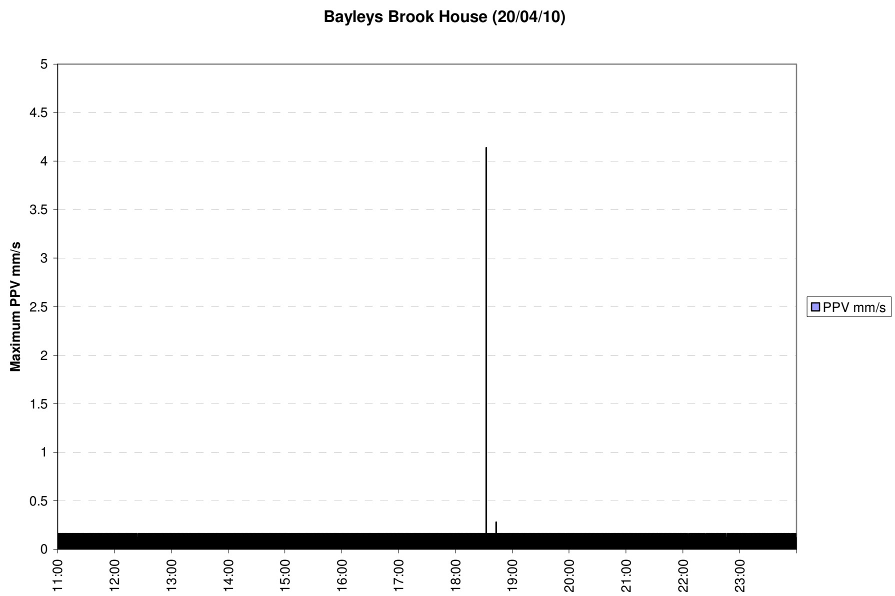


Figure C.1 Maximum vibration levels at Bayleys Brook House (20/04/10)

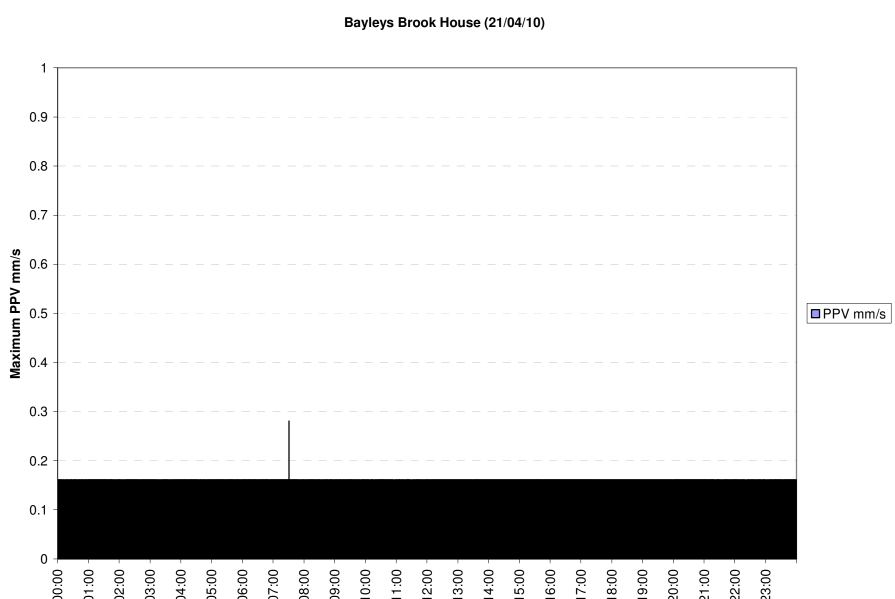


Figure C.2 Maximum vibration levels at Bayleys Brook House (21/04/10)

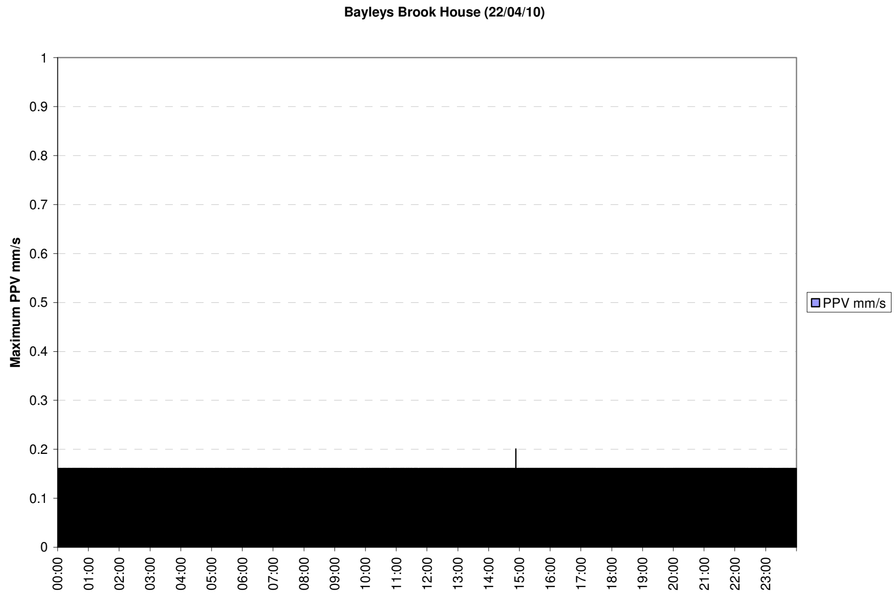


Figure C.3 Maximum vibration levels at Bayleys Brook House (22/04/10)

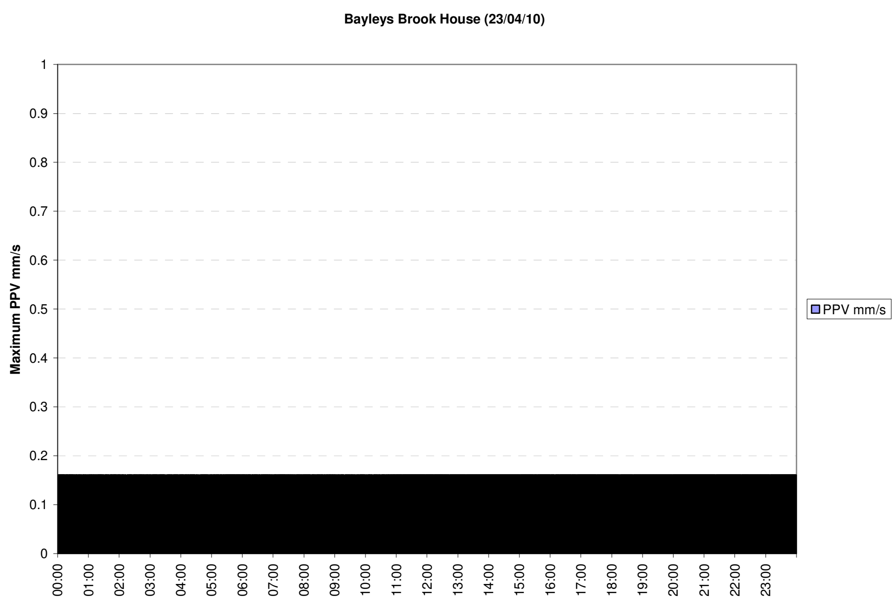


Figure C.4 Maximum vibration levels at Bayleys Brook House (23/04/10)

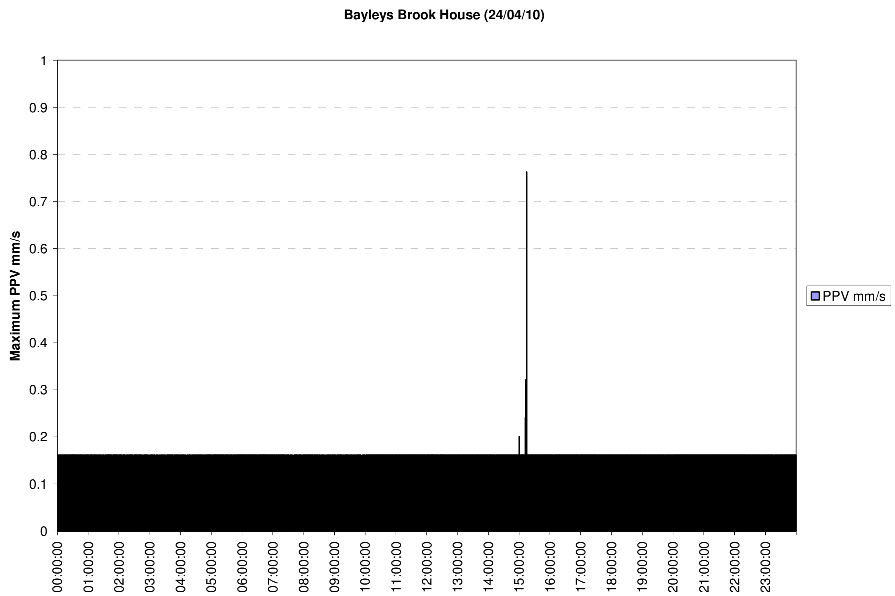


Figure C.5 Maximum vibration levels at Bayleys Brook House (24/04/10)

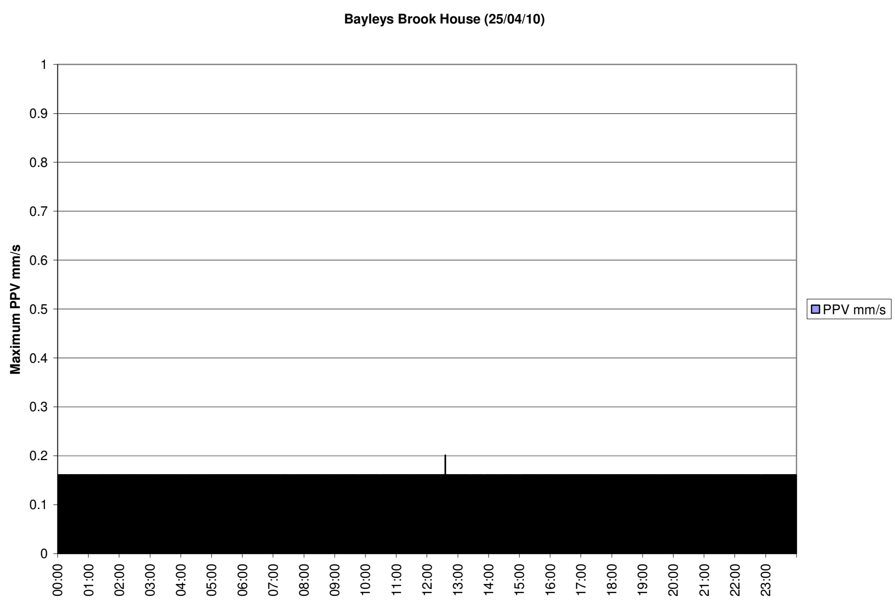


Figure C.6 Maximum vibration levels at Bayleys Brook House (25/04/10)

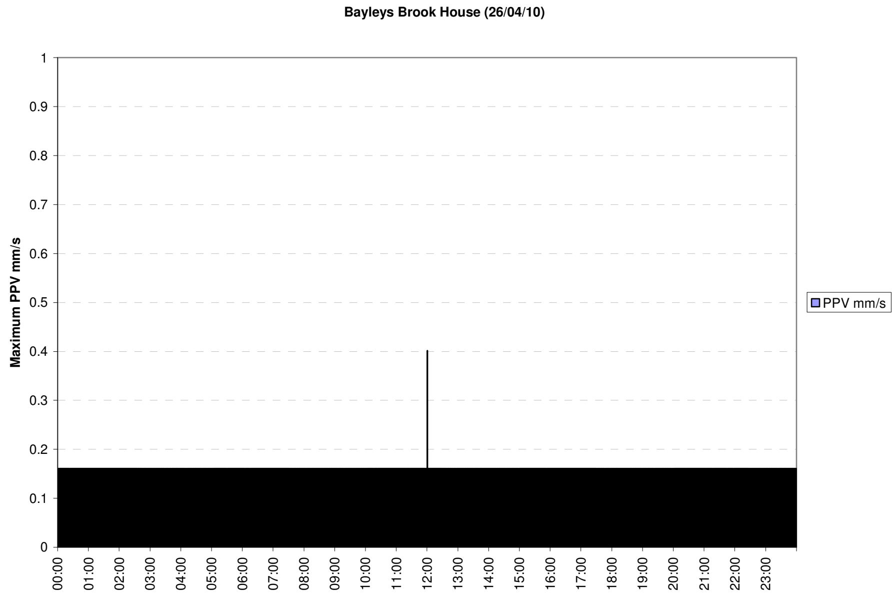


Figure C.7 Maximum vibration levels at Bayleys Brook House (26/04/10)

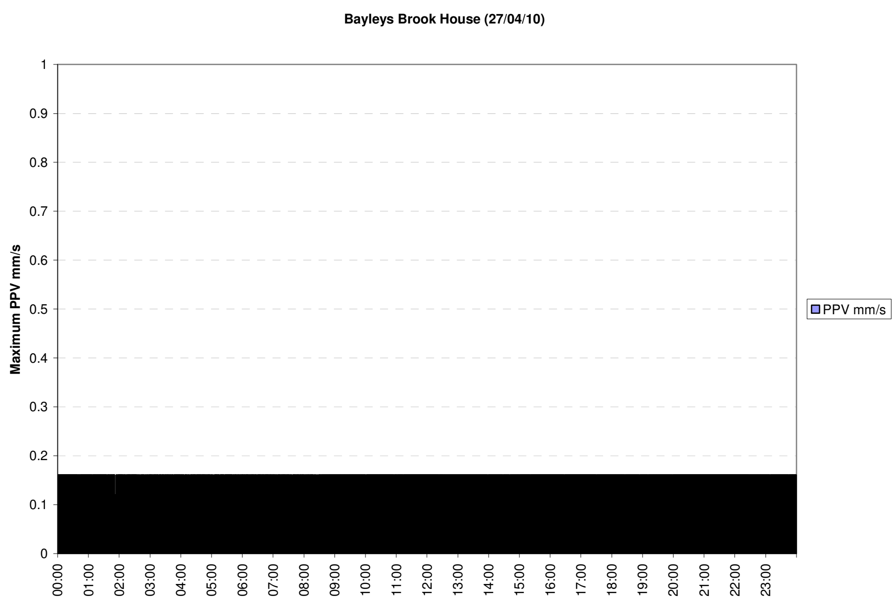


Figure C.8 Maximum vibration levels at Bayleys Brook House (27/04/10)

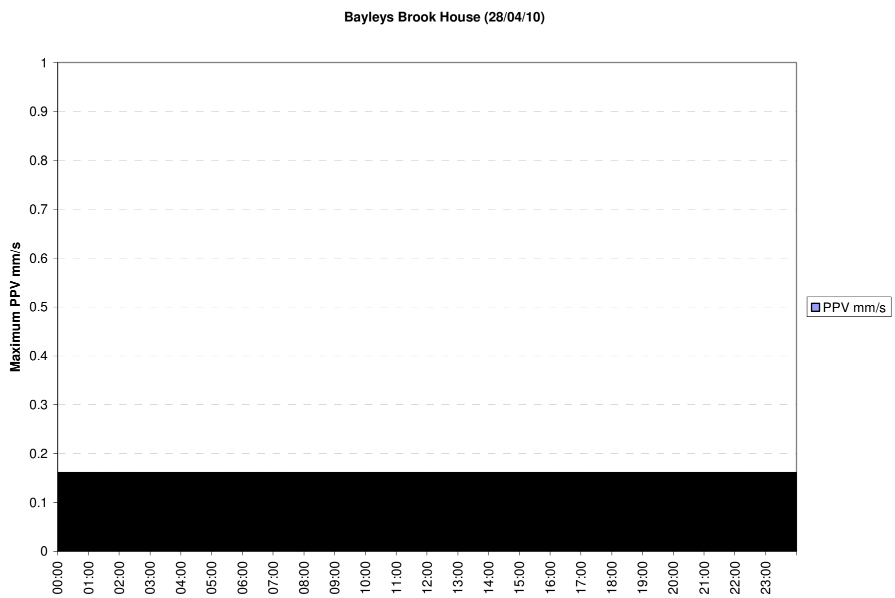


Figure C.9 Maximum vibration levels at Bayleys Brook House (28/04/10)

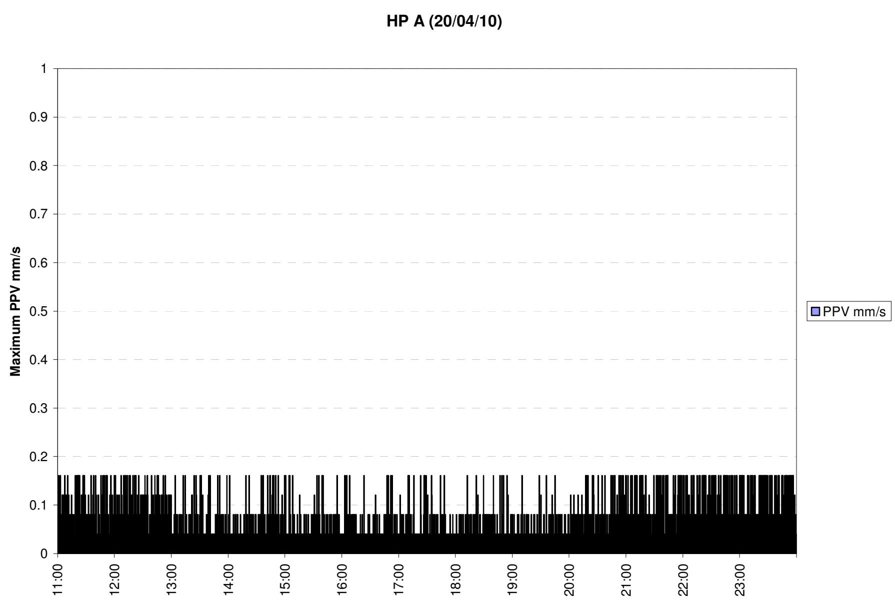


Figure C.10 Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (20/04/10)

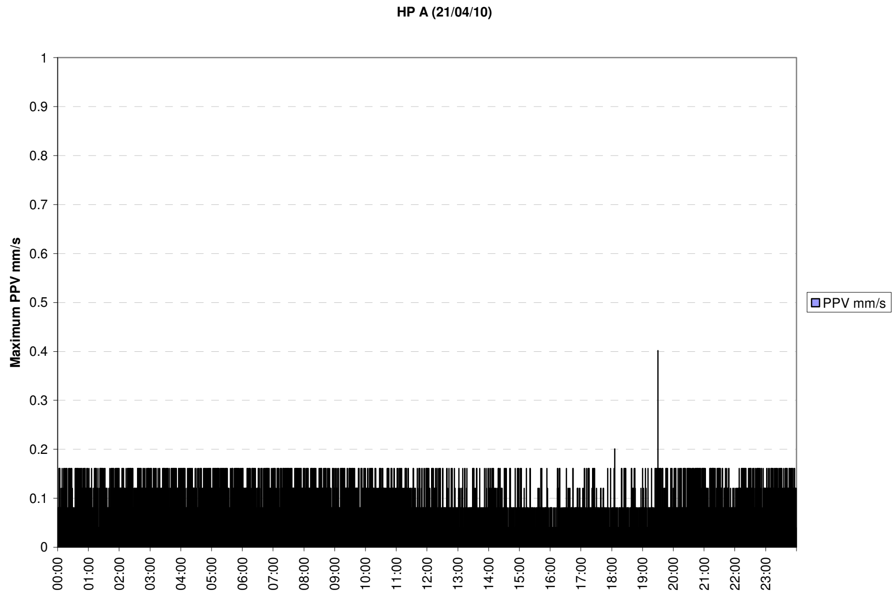


Figure C.10 Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (21/04/10)

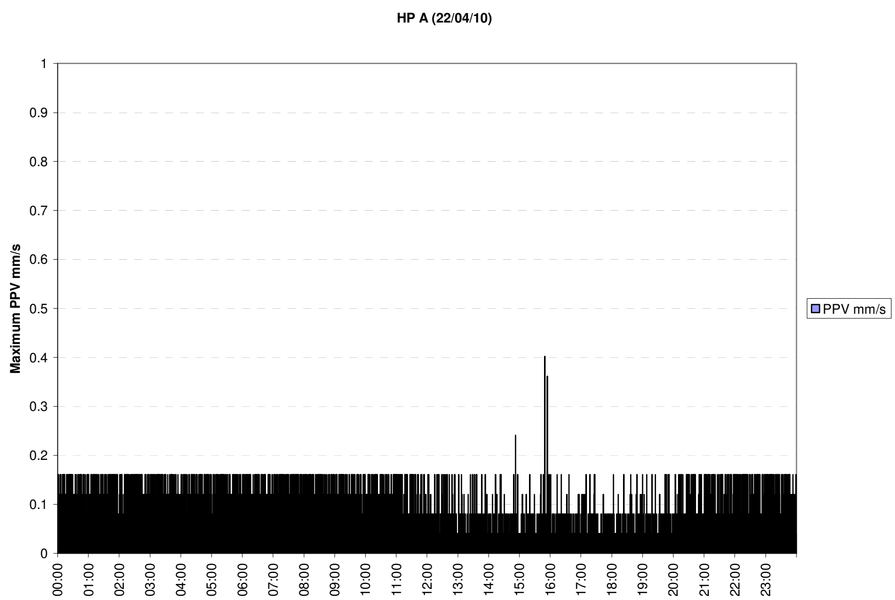


Figure C.12 Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (22/04/10)

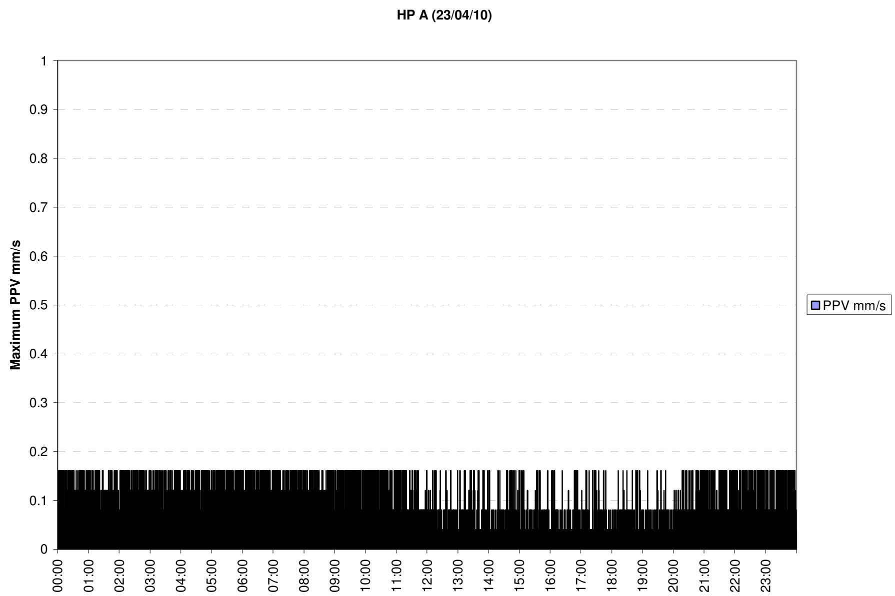


Figure C.13 **Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (23/04/10)**

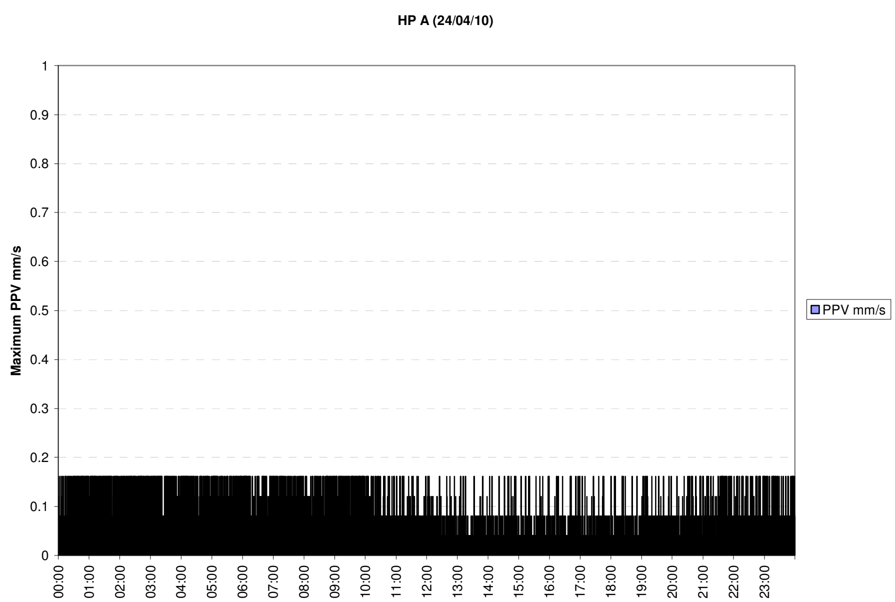


Figure C.14 **Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (24/04/10)**

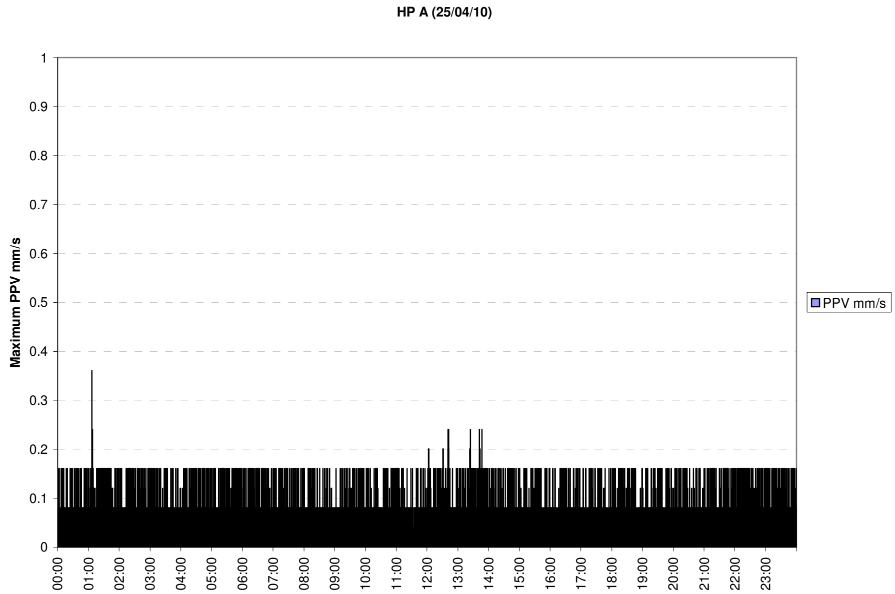


Figure C.15 **Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (25/04/10)**

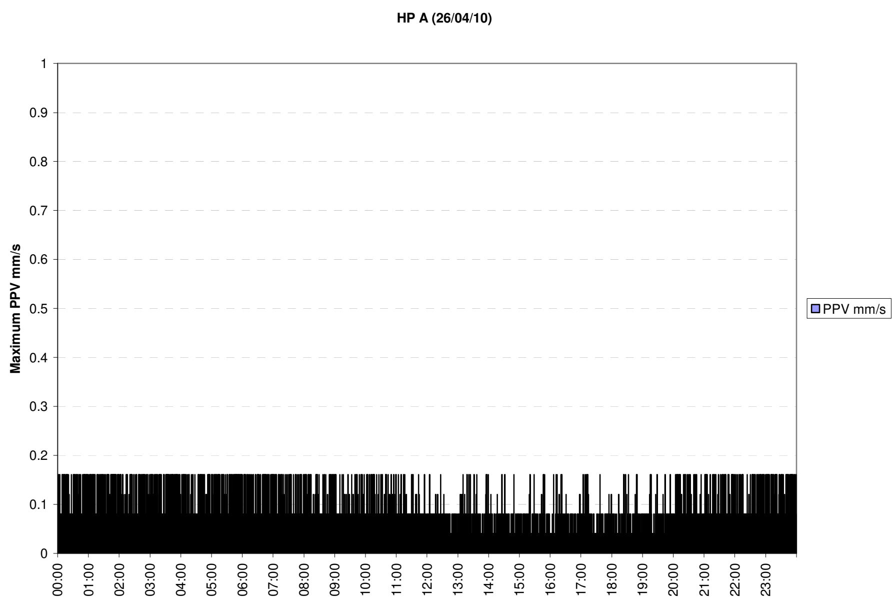


Figure C.16 **Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (26/04/10)**

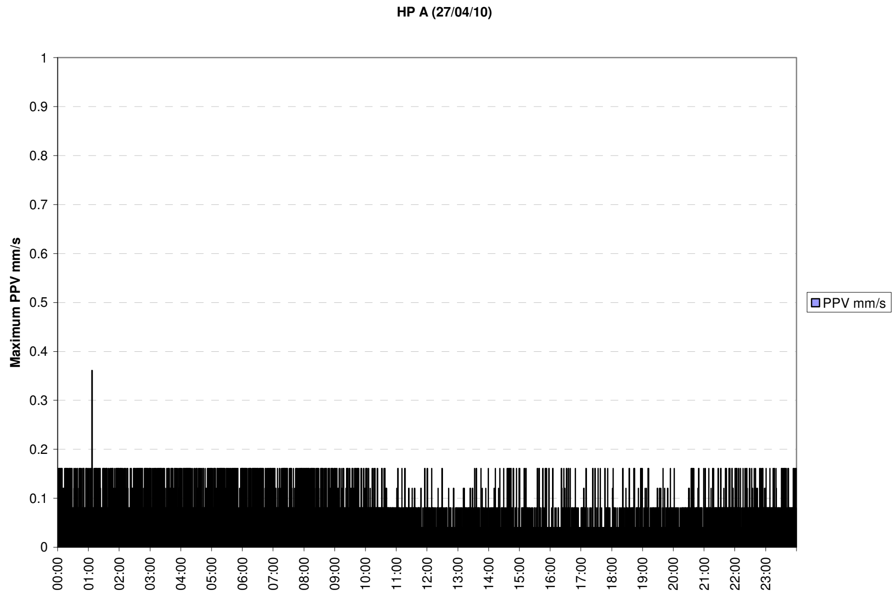


Figure C.17 **Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (27/04/10)**

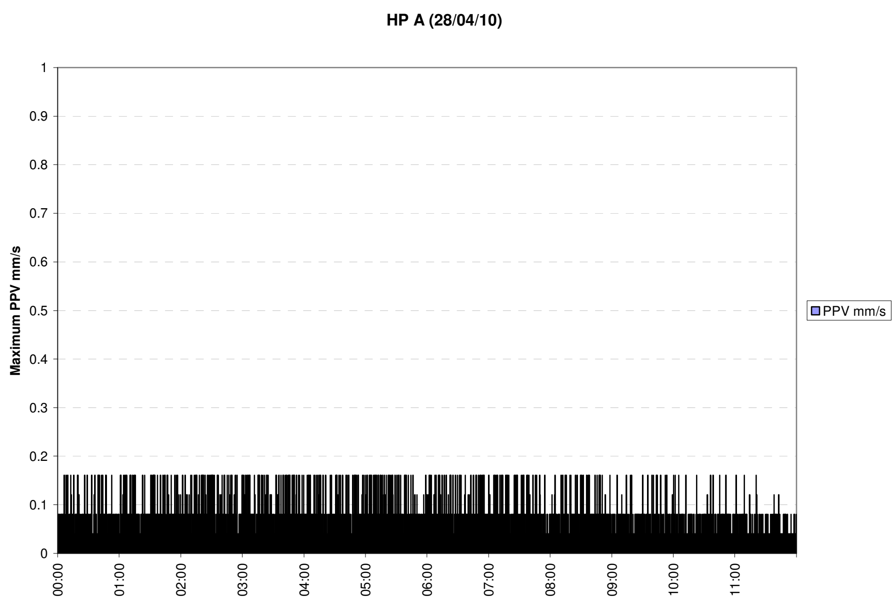


Figure C.18 **Maximum vibration levels - North of Hinkley Point B Training and Visitors Centre (28/04/10)**

Appendix D Calibration certificates

Figure D.1 Rion NL-31 (s/n 583274)

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	CAL021011
Date of Issue	03/02/2010
Customer	ANV Measurement Systems
	Description of Instrument
Sound Level Meter	Rion NL-31 Sound Level Meter [Serial No. 00583274] with Rion UC-53A Microphone [Serial No.313534] and Rion NH-21 Preamplifier [Serial No.27504] Fitted with a WS-10 foam windshield. The instrument successfully completed the Class 1 Periodic Tests of BS EN 61672.
Associated Calibrator	B & K 4226 S/N 1445373.
Date of Calibration	03/02/2010.
Test Procedure	..\..\Calibration Results Sheets\Current Approved Results Sheets\NL-31 Master 61672-3 Approved Issue 6 (BK 1445373).xls Test procedures in accordance with BS EN 61672-3:2006. NOTE: Test 10.1 (Self Generated Noise with Microphone Installed) omitted.
Test Engineer	Amrat Patel

APPROVED SIGNATORY ....
Les Jephson ☐ / Mike Breslin ☑

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 01908 642814
✉ info@noise-and-vibration.co.uk www.noise-and-vibration.co.uk

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Figure D.2 Rion NL-31 (s/n 773044)

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL041005**
Date of Issue	**06/04/2010**
Customer	**ANV Measurement Systems**
	Description of Instrument
Sound Level Meter	Rion NL-31 Sound Level Meter [Serial No. 00773044] with Rion UC-53A Microphone [Serial No. 312999] and Rion NH-21 Preamplifier [Serial No. 25055] Fitted with a WS-10 foam windshield. The instrument successfully completed the Class 1 Periodic Tests of BS EN 61672.
Associated Calibrator	B & K 4226 S/N 1445373.
Date of Calibration	06/04/2010.
Test Procedure	..\..\Calibration Results Sheets\Current Approved Results Sheets\NL-31 Master 61672-3 Approved Issue 6 (BK 1445373).xls Test procedures in accordance with BS EN 61672-3:2006. NOTE: Test 10.1 (Self Generated Noise with Microphone Installed) omitted.
Test Engineer	Amrat Patel

APPROVED SIGNATORY ....
Les Jephson ☐ / Mike Breslin ☑

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖷 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

ACOUSTICS NOISE AND VIBRATION LIMITED. REGISTERED IN ENGLAND NO. 3549028. REGISTERED OFFICE AS ABOVE.

NL – 31 Certificate of Calibration Issue : 4 Page 1 of 3

Figure D.3 Vibrock V901 (s/n 310986)

CALIBRATION CERTIFICATE

CALIBRATION CERTIFICATE NO.: 0310896

CLIENT: VIBROCK LTD HIRE UNIT

INSTRUMENT TYPE: V901

SERIAL NUMBER: 896

CALIBRATION DATE: 01/03/10

CALIBRATED BY: PJA

CALIBRATION ACCURACY:- @40Hz 10mm/s

	A channel	B channel	VDV channel
Peak Particle Velocity L	±5 %	±5 %	X ±5 %
Peak Particle Velocity V	±5 %	±5 %	Y ±5 %
Peak Particle Velocity T	±5 %	±5 %	Z ±5 %

AIR OVERPRESSURE CHANNEL - Peak Level Unweighted ±1 dB(Lin)

WE HEREBY CERTIFY THAT THIS SEISMOGRAPH FULLY COMPLIES WITH THE MANUFACTURERS SPECIFICATION

CERTIFIED BY:

DATE: 01/03/10

THIS CERTIFICATE IS VALID FOR 12 MONTHS

The above calibration was carried out using equipment calibrated as follows:-
Genrad Sound Level Calibrator 1562-A, serial number U0 132, calibrated February 2010
ISO-TECH IFG 100 Oscillator, serial number 300351, calibrated June 2009
Monitran Vibration Meter, serial number 213608, calibrated June 2009
Mastech M92A Multimeter, serial number 20030907471, calibrated June 2009

THIS CALIBRATION IS TRACEABLE TO NATIONAL STANDARDS

VIBROCK LIMITED
Shanakiel
Ilkeston Road
Heanor
Derbyshire DE75 7DR
Tel: 01773 711211
Fax: 01773 711311
Email: vibrock@vibrock.com
Web: http://www.vibrock.com

INST/CALCERT/18/05.02.10

VIBROCK

Figure D.4 Vibrock V901 (s/n 1101449)

CALIBRATION CERTIFICATE

CALIBRATION CERTIFICATE NO.: 0110 1449

CLIENT: VIBROCK LTD HIRE UNIT

INSTRUMENT TYPE: V901

SERIAL NUMBER: 1449

CALIBRATION DATE: 13/1/10

CALIBRATED BY: PJA

CALIBRATION ACCURACY:- @ 40Hz 10mm/s & 1mm/s

	A channel	B channel	VDV channel
Peak Particle Velocity L	±5 %	±5 %	X ±5 %
Peak Particle Velocity V	±5 %	±5 %	Y ±5 %
Peak Particle Velocity T	±5 %	±5 %	Z ±5 %

AIR OVERPRESSURE CHANNEL - Peak Level Unweighted ±1 dB(Lin)

WE HEREBY CERTIFY THAT THIS SEISMOGRAPH FULLY COMPLIES WITH THE MANUFACTURERS SPECIFICATION

CERTIFIED BY:

DATE: 13/1/10

THIS CERTIFICATE IS VALID FOR 12 MONTHS

The above calibration was carried out using equipment calibrated as follows:-
Genrad Sound Level Calibrator 1562-A, serial number U0 132, calibrated January 2009
ISO-TECH IFG 100 Oscillator, serial number 300351, calibrated June 2009
Monitran Vibration Meter, serial number 213608, calibrated June 2009
Mastech M92A Multimeter, serial number 20030907471, calibrated June 2009

THIS CALIBRATION IS TRACEABLE TO NATIONAL STANDARDS

VIBROCK LIMITED
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Web: http://www.vibrock.com

INST/CALCERT/17/07.08.08

VIBROCK

APPENDIX 11C: INTRODUCTION TO NOISE AND VIBRATION PRINCIPLES

Introduction to noise and vibration principles

Noise

1.1.1 Between the quietest audible sound and the loudest tolerable sound, there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range, a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

1.1.2 The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB L_A.

Table 11C.1 Sound pressure level in dB L_A for common situations

Typical Noise Level, dB L_A	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2 m
50	Quiet office, no machinery Boiling kettle at 0.5 m
60	Normal conversation
70	Telephone ringing at 2 m Vacuum cleaner at 3 m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5 m
120	Discotheque – 1 m in front of loudspeaker
140	Threshold of pain

1.1.3 The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB L_A, whereas in a suburban area this may increase up to 40 dB L_A and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

1.1.4 A parameter that is widely accepted as reflecting the underlying background noise level is the L_{A90} index. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a 1-hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

1.1.5 The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the total sound energy measured over that period. L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to describe environmental noise from individual sources that vary in level over their operational cycle.

1.1.6 The index historically adopted by the government since the early 1970s to assess road traffic noise is the L_{A10}. This is the noise level exceeded for 10% of the measurement time, over a 1-hour period the L_{A10} will be the noise level exceeded for 6 minutes.

1.1.7 Time weighting determines how quickly the sound level meter responds to changes in noise level. The ‘fast’ time weighting averages the measured level every eighth of a second, whereas the ‘slow’ weighting averages every one second. The ‘fast’ time weighting most closely follows the response of the human ear to sound level changes and is most commonly specified for environmental noise measurement purposes (including the L_{A10} and L_{A90} statistical parameters).

1.1.8 Most environmental noise measurements and assessments are undertaken in ‘free-field’, away from any existing reflecting surfaces (other than the ground). However, it is sometimes necessary to consider noise levels immediately external to a façade when considering the impact on residents inside properties and this normally requires the addition of up to 3 dB L_A to the predicted (or measured) free-field level due to noise reflection from the façade. The assessment of road traffic noise in the UK, for example, is based on a predicted (or measured) ‘façade’ noise level (using the L_{A10} statistical parameter).

1.1.9 Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels of 3 dB L_A or more (PPG 24, 1994)2. It is generally accepted that a change of 10 dB L_A in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level (PPG 24, 1994). (These findings do not necessarily apply to transient, non-steady or intermittent noise sources).

Vibration

1.1.10 When an object is in contact with a vibrating surface it is displaced about its reference (stationary) position. Displacement (in mm) is therefore one parameter that can be used to describe the magnitude of a vibration. For sinusoidal signals, displacement, velocity (m/s) and acceleration (m/s^2) amplitudes are related mathematically by a function of frequency and time. If phase is neglected (as is always the case when making time-averaged measurements), then the velocity can be obtained by dividing the acceleration signal by a factor proportional to frequency (measured in Hertz, Hz) and the displacement can then be obtained by dividing the acceleration signal by a factor proportional to the square of frequency.

1.1.11 For a complex acceleration signal giving rise to a complicated time history, there are several additional quantities that may be used to describe the vibration:

- The root mean square value (rms) is obtained by taking the square root of the mean of the sum of the squares of the instantaneous acceleration measured during the total measurement time (T);
- The peak value is the maximum instantaneous acceleration measured during the measurement time, (T). It is a useful indicator of the magnitude of short duration shocks;
- The Peak Particle Velocity (PPV) is the maximum instantaneous velocity of a particle at a point during a given time interval.

1.1.12 The limit of human perception to vibration is of the order of 0.15 mm/s to 0.3 mm/s PPV, in the frequency range 0.1 Hz to 1500 Hz. The human body is not equally sensitive to all frequencies of vibration and weighting curves to reflect the frequency dependency of the body have been developed and are contained within International Organisation of Standardisation (ISO) Standards. The weighting gives a good correlation between the measured vibration level and the subjective feeling or impact produced by the vibration.

1.1.13 The weightings can be incorporated into modern vibration meters, thus enabling measurement of vibration levels that correspond to human perception. Those vibrations occurring between 1-80 Hz are of particular interest when measuring exposure to whole-body vibration.

1.1.14 Vibration-induced damage to buildings can arise in different ways, making it difficult to arrive at universal criteria that will adequately and simply indicate damage risk. Damage can occur directly due to high dynamic stresses, due to accelerated ageing or indirectly when high quasi-static stresses are induced by, for example, soil compaction.

1.1.15 Figure B.1 of British Standard BS 5228: 2009 'Code of practice for noise and vibration control on construction and open sites', Part 2. 'Vibration' indicates, for example, that for a residential building (line 2) a PPV of greater than 15 mm/s at 4 Hz or greater than 50 mm/s at 40 Hz or above, measured at the base of the building, may be expected to result in cosmetic damage.

APPENDIX 11D: CONSTRUCTION NOISE CALCULATIONS AND ASSUMPTIONS

Table 11D.1 Construction noise calculations (Knighton Farm)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	900	74.9	10	0	30	900	1	1	26.1
1 x Road planer		110.0	900	74.9	10	0	30	900	1	1	25.1
1 x Dozer		105.0	900	74.9	10	0	30	900	1	1	20.1
1 x Road roller		108.0	900	74.9	10	0	30	900	1	1	23.1
1 x Asphalt paver (+ tipper lorry)		103.0	900	74.9	10	0	30	900	1	1	18.1
1 x Diesel water pump	81.0		900	46.9	10	0				1	24.1
1 x Diesel generator	74.0		900	46.9	10	0				1	17.1
										Total	**32**
Sea defence construction											
1 x Dredging ship		110.0	1750	82.1	10	0	50	1750	1	1	17.9
1 x Tracked excavator		106.0	1750	82.1	10	0	30	1750	1	1	13.9
1 x Concrete batching plant	80.0		1750	54.1	10	0				1	15.9
1 x Concrete pumping truck / ship		108.0	1750	82.1	10	0	50	1750	1	1	15.9
1 x Concrete pumping truck		108.0	1750	82.1	10	0	50	1750	1	1	15.9
1 x Diesel generator	74.0		1750	54.1	10	0				1	9.9
										Total	**23**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	580	70.1	0	0	10	580	1	1	35.9
1 x Dozer		105.0	580	70.1	0	0	30	580	1	1	34.9
1 x Augur piling rig	79.0		580	42.1	0	0				1	36.9
2 x Wheeled crane	81.0		580	42.1	0	0				1	38.9
2 x Flat bed lorry	80.0		580	42.1	0	0				1	37.9
1 x Small concrete mixer	61.0		580	42.1	0	0				1	18.9
1 x Road roller		108.0	580	70.1	0	0	20	580	1	1	37.9
1 x Asphalt paver (+ tipper lorry)		103.0	580	70.1	0	0	20	580	1	1	32.9
1 x Diesel water pump	81.0		580	42.1	0	0				1	38.9
1 x Diesel generator	74.0		580	42.1	0	0				1	31.9
										Total	**46**
Construction of emergency access road											
1 x Tracked excavator		106.0	600	70.5	0	0	30	600	1	1	35.5
1 x Dozer		105.0	600	70.5	0	0	30	600	1	1	34.5
1 x Small concrete mixer	61.0		600	42.5	0	0				1	18.5
1 x Hand-held road breaker	82.0		660	43.5	0	0				1	38.5
1 x Road roller		108.0	600	70.5	0	0	20	600	1	1	37.5
1 x Asphalt paver (+ tipper lorry)		103.0	600	70.5	0	0	20	600	1	1	32.5
1 x Diesel water pump	81.0		600	42.5	0	0				1	38.5
1 x Diesel generator	74.0		600	42.5	0	0				1	31.5
										Total	**45**
Deep excavation and concrete substitution											

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Tracked excavator / loader		112.0	1400	79.7	10	0	30	1400	1	1	22.4
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	1400	79.7	10	0	100	1400	1	1	25.4
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	540	69.3	0	0	100	540	1	1	45.7
4 x Rock breaker		114.0	1400	79.7	10	0	20	1400	1	1	24.4
1 x Concrete batching plant	80.0		1200	50.0	10	0				1	20.0
1 x Tracked mobile drilling rig		118.0	1400	79.7	10	0	30	1400	1	1	28.3
1 x Crushing plant	90.0		1200	50.0	10	0				1	30.0
1 x Crushing plant	90.0		1750	54.1	10	0				1	25.9
10 x Diesel water pumps	91.0		1400	51.7	10	0				1	29.3
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**46**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	1200	78.0	10	0	30	1200	1	1	14.0
2 x Sheet piling plant	66.0		1200	50.0	10	0				1	6.0
2 x Truck mounted concrete pump and boom arm	83.0		1200	50.0	10	0				1	23.0
1 x Concrete batching plant	80.0		1200	50.0	10	0				1	20.0
1 x Compressor (>50 kw)	70.0		1200	50.0	10	0				1	10.0
1 x Angle grinder (grinding steel)		108.0	1200	78.0	10	0	30	1200	1	1	20.0
1 x Concrete cutting (hand-held circular saw)		112.0	1200	78.0	10	0	30	1200	1	1	24.0
2 x Electric bolter		105.0	1200	78.0	10	0	30	1200	1	1	17.0
2 x Diesel water pumps	84.0		1200	50.0	10	0				1	24.0
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**30**
Tunnelling											
2 x Tracked excavator		109.0	1750	82.1	10	0	30	1750	1	1	16.9
2 x Tracked mobile crane	71.0		1750	54.1	10	0				1	6.9
1 x Rock breaker		108.0	1750	82.1	10	0	30	1750	1	1	15.9
1 x Tracked mobile drilling rig	66.0		1750	54.1	10	0				1	1.9
1 x Horizontal directional drilling rig	79.0		1750	54.1	10	0				1	14.9
2 x Dump truck (spoil distribution)		112.0	1750	82.1	10	0	30	1750	1	1	19.9
1 x Diesel generator	72.0		1750	54.1	10	0				1	7.9
										Total	**24**
Construction of nuclear island buildings											
20 x Tower crane	89.0		1400	51.7	10	0				1	27.4
1 x Tracked mobile crane		99.0	1400	79.7	10	0	30	1400	1	1	9.3
6 x Concrete placing boom	72.8		1400	51.7	10	0				1	11.1
2 x Sheet piling plant	66.0		1400	51.7	10	0				1	4.4
1 x Continuous flight augur drilling	79.0		1400	51.7	10	0				1	17.3
2 x Compressors (<50 kw)	73.0		1400	51.7	10	0				1	11.4
2 x Poker vibrators	72.0		1400	51.7	10	0				1	10.4

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Wheeled mobile telescopic crane	84.0		1400	51.7	10	0				1	22.4
3 x Concrete batching plant	84.8		1200	50.0	10	0				1	24.8
10 x Diesel water pumps	91.0		1400	51.7	10	0				1	29.3
2 x Angle grinder (grinding steel)		111.0	1400	79.7	10	0	30	1400	1	1	21.4
1 x Concrete cutting (hand-held circular saw)		112.0	1400	79.7	10	0	30	1400	1	1	22.3
2 x Electric bolter		105.0	1400	79.7	10	0	30	1400	1	1	15.4
2 x Diesel generators	77.0		1400	51.7	10	0				1	15.4
										Total	**34**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	950	75.4	10	0	30	950	1	1	22.6
1 x Small cement mixer	61.0		940	47.3	10	0				1	3.7
2 x Electric bolter		105.0	940	75.3	10	0	30	940	1	1	19.7
2 x Diesel water pumps	84.0		940	47.3	10	0				1	26.7
1 x Flat bed lorry		105.0	940	75.3	10	0	30	940	1	1	19.7
1 x Diesel generator	74.0		950	47.4	10	0				1	16.6
										Total	**29**
Construction of the substation											
2 x Mobile telescopic crane	80.0		1450	52.0	10	0				1	18.0
2 x Dump truck		112.0	1450	80.0	10	0	50	1450	1	1	22.0
2 x Tracked excavator / loader		109.0	1450	80.0	10	0	20	1450	1	1	19.0
2 x Truck mounted concrete pump and boom arm		111.0	1450	80.0	10	0	20	1450	1	1	21.0
1 x Tracked Breaker		111.0	1450	80.0	10	0	20	1450	1	1	21.0
2 x Compressors (<50 kw)	73.0		1450	52.0	10	0				1	11.0
1 x Diesel generator	74.0		1450	52.0	10	0				1	12.0
1 x Concrete cutting (hand-held circular saw)		112.0	1450	80.0	10	0	10	1450	1	1	22.0
2 x Electric bolter		105.0	1450	80.0	10	0	20	1450	1	1	15.0
1 x Small cement mixer	61.0		1450	52.0	10	0				1	-1.0
1 x Road roller		108.0	1450	80.0	10	0	30	1450	1	1	18.0
1 x Asphalt paver (+ tipper lorry)		103.0	1450	80.0	10	0	30	1450	1	1	13.0
										Total	**29**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	1200	78.0	10	0	30	1200	1	1	25.8
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	540	69.3	0	0	30	540	1	1	44.5
2 x Dozer (rolling and compaction)		112.0	1200	78.0	10	0	30	1200	1	1	24.0
1 x Wheel wash	70.0		1500	52.4	10	0				1	7.6
1 x Wheel wash	70.0		1200	50.0	10	0				1	10.0
1 x Diesel generator	74.0		1400	51.7	10	0				1	12.3
										Total	**45**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	500	68.5	0	0	90	500	1	1	43.5

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer (rolling and compaction)		112.0	500	68.5	0	0	90	500	1	1	43.5
2 x Dozer		108.0	500	68.5	0	0	90	500	1	1	39.5
										Total	**47**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	1250	78.4	10	0	50	1250	1	1	24.6
5 x Dozer		114.0	1250	78.4	10	0	100	1250	1	1	25.6
5 x Tracked excavator		120.0	1250	78.4	10	0	50	1250	1	1	31.6
4 x Vibratory roller		108.0	1250	78.4	10	0	30	1250	1	1	19.6
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	1250	78.4	10	0	200	1250	1	1	23.3
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	500	68.5	0	0	200	500	1	1	43.3
1 x Mobile telescopic crane	67.0		1250	50.4	10	0				1	6.6
5 x Diesel water pumps	88.0		1250	50.4	10	0				1	27.6
2 x Rock breaker		114.0	1250	78.4	10	0	30	1250	1	1	25.6
1 x Mobile rock crusher	90.0		1150	49.5	10	0				1	30.5
1 x Dredging ship		110.0	2000	83.5	10	0	30	2000	1	1	16.5
2 x Piling rig	90.0		1900	55.0	10	0				1	25.0
2 x Barge-mounted crane	82.0		1900	55.0	10	0				1	17.0
										Total	**44**

NOT PROTECTIVELY MARKED

Table 11D.2 Construction noise calculations (Doggetts)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	600	70.5	5	0	30	600	1	1	35.5
1 x Road planer		110.0	600	70.5	5	0	30	600	1	1	34.5
1 x Dozer		105.0	600	70.5	5	0	30	600	1	1	29.5
1 x Road roller		108.0	600	70.5	5	0	30	600	1	1	32.5
1 x Asphalt paver (+ tipper lorry)		103.0	600	70.5	5	0	30	600	1	1	27.5
1 x Diesel water pump	81.0		600	42.5	5	0				1	33.5
1 x Diesel generator	74.0		600	42.5	5	0				1	26.5
										Total	**41**
Sea defence construction											
1 x Dredging ship		110.0	1400	79.7	10	0	50	1400	1	1	20.3
1 x Tracked excavator		106.0	1400	79.7	10	0	30	1400	1	1	16.3
1 x Concrete batching plant	80.0		1400	51.7	10	0				1	18.3
1 x Concrete pumping truck / ship		108.0	1400	79.7	10	0	50	1400	1	1	18.3
1 x Concrete pumping truck		108.0	1400	79.7	10	0	50	1400	1	1	18.3
1 x Diesel generator	74.0		1400	51.7	10	0				1	12.3
										Total	**26**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	620	70.8	0	0	10	620	1	1	35.2
1 x Dozer		105.0	620	70.8	0	0	30	620	1	1	34.2
1 x Augur piling rig	79.0		620	42.8	0	0				1	36.2
2 x Wheeled crane	81.0		620	42.8	0	0				1	38.2
2 x Flat bed lorry	80.0		620	42.8	0	0				1	37.2
1 x Small concrete mixer	61.0		620	42.8	0	0				1	18.2
1 x Road roller		108.0	620	70.8	0	0	20	620	1	1	37.2
1 x Asphalt paver (+ tipper lorry)		103.0	620	70.8	0	0	20	620	1	1	32.2
1 x Diesel water pump	81.0		620	42.8	0	0				1	38.2
1 x Diesel generator	74.0		620	42.8	0	0				1	31.2
										Total	**46**
Construction of emergency access road											
1 x Tracked excavator		106.0	640	71.2	0	0	30	640	1	1	34.8
1 x Dozer		105.0	640	71.2	0	0	30	640	1	1	33.8
1 x Small concrete mixer	61.0		640	43.2	0	0				1	17.8
1 x Hand-held road breaker	82.0		670	43.7	0	0				1	38.3
1 x Road roller		108.0	640	71.2	0	0	20	640	1	1	36.8
1 x Asphalt paver (+ tipper lorry)		103.0	640	71.2	0	0	20	640	1	1	31.8
1 x Diesel water pump	81.0		640	43.2	0	0				1	37.8
1 x Diesel generator	74.0		640	43.2	0	0				1	30.8
										Total	**44**
Deep excavation and concrete substitution											

Plant	Source Noise (dB) L_{Aeq} at 10m	Source Noise (dB) Sound Power (L_{WA})	Distance m	Distance Attenuation dB	Screening Attenuation dB	Façade Correction dB	Traverse Length m	Minimum Distance m	Correction Factor F	On Time (%)	L_{Aeq} at Receptor dB
4 x Tracked excavator / loader		112.0	1050	76.5	10	0	30	1050	1	1	25.5
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	600	70.5	10	0	100	600	1	1	34.6
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	320	63.6	10	0	100	320	1	1	41.4
4 x Rock breaker		114.0	1050	76.5	10	0	20	1050	1	1	27.5
1 x Concrete batching plant	80.0		900	46.9	10	0				1	23.1
1 x Tracked mobile drilling rig		118.0	1050	76.5	10	0	30	1050	1	1	31.5
1 x Crushing plant	90.0		900	46.9	10	0				1	33.1
1 x Crushing plant	90.0		1400	51.7	10	0				1	28.3
10 x Diesel water pumps	91.0		1050	48.5	10	0				1	32.5
1 x Diesel generator	74.0		1050	48.5	10	0				1	15.5
										Total	**44**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	750	72.9	5	0	30	750	1	1	24.1
2 x Sheet piling plant	66.0		750	44.9	5	0				1	16.1
2 x Truck mounted concrete pump and boom arm	83.0		750	44.9	5	0				1	33.1
1 x Concrete batching plant	80.0		900	46.9	5	0				1	28.1
1 x Compressor (>50 kw)	70.0		750	44.9	5	0				1	20.1
1 x Angle grinder (grinding steel)		108.0	750	72.9	5	0	30	750	1	1	30.1
1 x Concrete cutting (hand-held circular saw)		112.0	750	72.9	5	0	30	750	1	1	34.1
2 x Electric bolter		105.0	750	72.9	5	0	30	750	1	1	27.1
2 x Diesel water pumps	84.0		750	44.9	5	0				1	34.1
1 x Diesel generator	74.0		750	44.9	5	0				1	24.1
										Total	**40**
Tunnelling											
2 x Tracked excavator		109.0	1400	79.7	10	0	30	1400	1	1	19.4
2 x Tracked mobile crane	71.0		1400	51.7	10	0				1	9.3
1 x Rock breaker		108.0	1400	79.7	10	0	30	1400	1	1	18.3
1 x Tracked mobile drilling rig	66.0		1400	51.7	10	0				1	4.4
1 x Horizontal directional drilling rig	79.0		1400	51.7	10	0				1	17.3
2 x Dump truck (spoil distribution)		112.0	1400	79.7	10	0	30	1400	1	1	22.4
1 x Diesel generator	72.0		1400	51.7	10	0				1	10.4
										Total	**26**
Construction of nuclear island buildings											
20 x Tower crane	89.0		1050	48.5	10	0				1	30.5
1 x Tracked mobile crane		99.0	1050	76.5	10	0	30	1050	1	1	12.5
6 x Concrete placing boom	72.8		1050	48.5	10	0				1	14.3
2 x Sheet piling plant	66.0		1050	48.5	10	0				1	7.5
1 x Continuous flight augur drilling	79.0		1050	48.5	10	0				1	20.5
2 x Compressors (<50 kw)	73.0		1050	48.5	10	0				1	14.5
2 x Poker vibrators	72.0		1050	48.5	10	0				1	13.5

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
4 x Wheeled mobile telescopic crane	84.0		1050	48.5	10	0				1	25.5
3 x Concrete batching plant	84.8		900	46.9	5	0				1	32.9
10 x Diesel water pumps	91.0		1050	48.5	10	0				1	32.5
2 x Angle grinder (grinding steel)		111.0	1050	76.5	10	0	30	1050	1	1	24.5
1 x Concrete cutting (hand-held circular saw)		112.0	1050	76.5	10	0	30	1050	1	1	25.5
2 x Electric bolter		105.0	1050	76.5	10	0	30	1050	1	1	18.5
2 x Diesel generators	77.0		1050	48.5	10	0				1	18.5
										Total	**38**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	110	52.0	0	0	30	110	1	1	56.0
1 x Small cement mixer	61.0		100	23.0	10	0				1	28.0
2 x Electric bolter		105.0	100	51.0	5	0	30	100	1	1	49.0
2 x Diesel water pumps	84.0		100	23.0	10	0				1	51.0
1 x Flat bed lorry		105.0	100	51.0	10	0	30	100	1	1	44.0
1 x Diesel generator	74.0		110	24.0	10	0				1	40.0
										Total	**58**
Construction of the substation											
2 x Mobile telescopic crane	80.0		1150	49.5	10	0				1	20.5
2 x Dump truck		112.0	1150	77.5	10	0	50	1150	1	1	24.5
2 x Tracked excavator / loader		109.0	1150	77.5	10	0	20	1150	1	1	21.5
2 x Truck mounted concrete pump and boom arm		111.0	1150	77.5	10	0	20	1150	1	1	23.5
1 x Tracked Breaker		111.0	1150	77.5	10	0	20	1150	1	1	23.5
2 x Compressors (<50 kw)	73.0		1150	49.5	10	0				1	13.5
1 x Diesel generator	74.0		1150	49.5	10	0				1	14.5
1 x Concrete cutting (hand-held circular saw)		112.0	1150	77.5	10	0	10	1150	1	1	24.5
2 x Electric bolter		105.0	1150	77.5	10	0	20	1150	1	1	17.5
1 x Small cement mixer	61.0		1150	49.5	10	0				1	1.5
1 x Road roller		108.0	1150	77.5	10	0	30	1150	1	1	20.5
1 x Asphalt paver (+ tipper lorry)		103.0	1150	77.5	10	0	30	1150	1	1	15.5
										Total	**32**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	1050	76.5	5	0	30	1050	1	1	32.2
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	600	70.5	5	0	30	600	1	1	38.3
2 x Dozer (rolling and compaction)		112.0	50	43.5	0	0	30	50	1	1	68.5
1 x Wheel wash	70.0		1000	48.0	10	0				1	12.0
1 x Wheel wash	70.0		600	42.5	5	0				1	22.5
1 x Diesel generator	74.0		750	44.9	5	0				1	24.1
										Total	**69**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	40	41.1	0	0	100	40	0.4	1	67.0

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer (rolling and compaction)		112.0	50	43.5	0	0	100	50	0.4	1	64.6
2 x Dozer		108.0	50	43.5	0	0	100	50	0.4	1	60.6
										Total	**70**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	1300	78.8	10	0	50	1300	1	1	24.2
5 x Dozer		114.0	1300	78.8	10	0	100	1300	1	1	25.1
5 x Tracked excavator		120.0	1300	78.8	10	0	50	1300	1	1	31.1
4 x Vibratory roller		108.0	1300	78.8	10	0	30	1300	1	1	19.2
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	1300	78.8	10	0	200	1300	1	1	22.9
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	750	72.9	10	0	200	750	1	1	28.9
1 x Mobile telescopic crane	67.0		1300	50.8	10	0				1	6.2
5 x Diesel water pumps	88.0		1300	50.8	10	0				1	27.1
2 x Rock breaker		114.0	1300	78.8	10	0	30	1300	1	1	25.2
1 x Mobile rock crusher	90.0		1200	50.0	10	0				1	30.0
1 x Dredging ship		110.0	2400	85.5	10	0	30	2400	1	1	14.5
2 x Piling rig	90.0		1900	55.0	10	0				1	25.0
2 x Barge-mounted crane	82.0		1900	55.0	10	0				1	17.0
										Total	**37**

Table 11D.3 Construction noise calculations (Bishops House Farm)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	950	75.4	10	0	30	950	1	1	25.6
1 x Road planer		110.0	950	75.4	10	0	30	950	1	1	24.6
1 x Dozer		105.0	950	75.4	10	0	30	950	1	1	19.6
1 x Road roller		108.0	950	75.4	10	0	30	950	1	1	22.6
1 x Asphalt paver (+ tipper lorry)		103.0	950	75.4	10	0	30	950	1	1	17.6
1 x Diesel water pump	81.0		950	47.4	10	0				1	23.6
1 x Diesel generator	74.0		950	47.4	10	0				1	16.6
										Total	**31**
Sea defence construction											
1 x Dredging ship		110.0	1750	82.1	10	0	50	1750	1	1	17.9
1 x Tracked excavator		106.0	1750	82.1	10	0	30	1750	1	1	13.9
1 x Concrete batching plant	80.0		1750	54.1	10	0				1	15.9
1 x Concrete pumping truck / ship		108.0	1750	82.1	10	0	50	1750	1	1	15.9
1 x Concrete pumping truck		108.0	1750	82.1	10	0	50	1750	1	1	15.9
1 x Diesel generator	74.0		1750	54.1	10	0				1	9.9
										Total	**23**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	140	54.7	5	0	10	140	1	1	46.3
1 x Dozer		105.0	140	54.7	5	0	30	140	1	1	45.3
1 x Augur piling rig	79.0		140	26.7	5	0				1	47.3
2 x Wheeled crane	81.0		140	26.7	10	0				1	44.4
2 x Flat bed lorry	80.0		140	26.7	5	0				1	48.4
1 x Small concrete mixer	61.0		140	26.7	5	0				1	29.3
1 x Road roller		108.0	140	54.7	5	0	20	140	1	1	48.3
1 x Asphalt paver (+ tipper lorry)		103.0	140	54.7	5	0	20	140	1	1	43.3
1 x Diesel water pump	81.0		150	27.4	5	0				1	48.6
1 x Diesel generator	74.0		180	29.4	5	0				1	39.6
										Total	**56**
Construction of emergency access road											
1 x Tracked excavator		106.0	60	45.5	0	0	30	60	1	1	60.5
1 x Dozer		105.0	60	45.5	0	0	30	60	1	1	59.5
1 x Small concrete mixer	61.0		60	17.5	0	0				1	43.5
1 x Hand-held road breaker	82.0		60	17.5	0	0				1	64.5
1 x Road roller		108.0	60	45.5	0	0	20	60	1	1	62.5
1 x Asphalt paver (+ tipper lorry)		103.0	60	45.5	0	0	20	60	1	1	57.5
1 x Diesel water pump	81.0		60	17.5	0	0				1	63.5
1 x Diesel generator	74.0		60	17.5	0	0				1	56.5
										Total	**70**
Deep excavation and concrete substitution											

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Tracked excavator / loader		112.0	1400	79.7	10	0	30	1400	1	1	22.4
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	1400	79.7	10	0	100	1400	1	1	25.4
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	400	66.1	10	0	100	400	1	1	39.0
4 x Rock breaker		114.0	1400	79.7	10	0	20	1400	1	1	24.4
1 x Concrete batching plant	80.0		1200	50.0	10	0				1	20.0
1 x Tracked mobile drilling rig		118.0	1400	79.7	10	0	30	1400	1	1	28.3
1 x Crushing plant	90.0		1750	54.1	10	0				1	25.9
1 x Crushing plant	90.0		1100	49.0	10	0				1	31.0
10 x Diesel water pumps	91.0		1400	51.7	10	0				1	29.3
1 x Diesel generator	74.0		1100	49.0	10	0				1	15.0
										Total	**41**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	1100	77.0	10	0	30	1100	1	1	15.0
2 x Sheet piling plant	66.0		1100	49.0	10	0				1	7.0
2 x Truck mounted concrete pump and boom arm	83.0		1100	49.0	10	0				1	24.0
1 x Concrete batching plant	80.0		1100	49.0	10	0				1	21.0
1 x Compressor (>50 kw)	70.0		1100	49.0	10	0				1	11.0
1 x Angle grinder (grinding steel)		108.0	1100	77.0	10	0	30	1100	1	1	21.0
1 x Concrete cutting (hand-held circular saw)		112.0	1100	77.0	10	0	30	1100	1	1	25.0
2 x Electric bolter		105.0	1100	77.0	10	0	30	1100	1	1	18.0
2 x Diesel water pumps	84.0		1100	49.0	10	0				1	25.0
1 x Diesel generator	74.0		1100	49.0	10	0				1	15.0
										Total	**31**
Tunnelling											
2 x Tracked excavator		109.0	1750	82.1	10	0	30	1750	1	1	16.9
2 x Tracked mobile crane	71.0		1750	54.1	10	0				1	6.9
1 x Rock breaker		108.0	1750	82.1	10	0	30	1750	1	1	15.9
1 x Tracked mobile drilling rig	66.0		1750	54.1	10	0				1	1.9
1 x Horizontal directional drilling rig	79.0		1750	54.1	10	0				1	14.9
2 x Dump truck (spoil distribution)		112.0	1750	82.1	10	0	30	1750	1	1	19.9
1 x Diesel generator	72.0		1750	54.1	10	0				1	7.9
										Total	**24**
Construction of nuclear island buildings											
20 x Tower crane	89.0		1350	51.3	10	0				1	27.8
1 x Tracked mobile crane		99.0	1350	79.3	10	0	30	1350	1	1	9.7
6 x Concrete placing boom	72.8		1350	51.3	10	0				1	11.5
2 x Sheet piling plant	66.0		1350	51.3	10	0				1	4.8
1 x Continuous flight augur drilling	79.0		1350	51.3	10	0				1	17.7
2 x Compressors (<50 kw)	73.0		1350	51.3	10	0				1	11.8
2 x Poker vibrators	72.0		1350	51.3	10	0				1	10.8

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Wheeled mobile telescopic crane	84.0		1350	51.3	10	0				1	22.8
3 x Concrete batching plant	84.8		1100	49.0	10	0				1	25.7
10 x Diesel water pumps	91.0		1350	51.3	10	0				1	29.7
2 x Angle grinder (grinding steel)		111.0	1350	79.3	10	0	30	1350	1	1	21.8
1 x Concrete cutting (hand-held circular saw)		112.0	1350	79.3	10	0	30	1350	1	1	22.7
2 x Electric bolter		105.0	1350	79.3	10	0	30	1350	1	1	15.8
2 x Diesel generators	77.0		1350	51.3	10	0				1	15.8
										Total	**34**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	450	67.3	5	0	30	450	1	1	35.7
1 x Small cement mixer	61.0		440	39.1	5	0				1	16.9
2 x Electric bolter		105.0	440	67.1	5	0	30	440	1	1	32.9
2 x Diesel water pumps	84.0		440	39.1	5	0				1	39.9
1 x Flat bed lorry		105.0	440	67.1	5	0	30	440	1	1	32.9
1 x Diesel generator	74.0		450	39.3	5	0				1	29.7
										Total	**43**
Construction of the substation											
2 x Mobile telescopic crane	80.0		725	44.5	10	0				1	25.5
2 x Dump truck		112.0	725	72.5	10	0	50	725	1	1	29.5
2 x Tracked excavator / loader		109.0	725	72.5	10	0	20	725	1	1	26.5
2 x Truck mounted concrete pump and boom arm		111.0	725	72.5	10	0	20	725	1	1	28.5
1 x Tracked Breaker		111.0	725	72.5	10	0	20	725	1	1	28.5
2 x Compressors (<50 kw)	73.0		725	44.5	10	0				1	18.5
1 x Diesel generator	74.0		725	44.5	10	0				1	19.5
1 x Concrete cutting (hand-held circular saw)		112.0	725	72.5	10	0	10	725	1	1	29.5
2 x Electric bolter		105.0	725	72.5	10	0	20	725	1	1	22.5
1 x Small cement mixer	61.0		725	44.5	10	0				1	6.5
1 x Road roller		108.0	725	72.5	10	0	30	725	1	1	25.5
1 x Asphalt paver (+ tipper lorry)		103.0	725	72.5	10	0	30	725	1	1	20.5
										Total	**37**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	1100	77.0	10	0	30	1100	1	1	26.7
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	400	66.1	0	0	30	400	1	1	47.7
2 x Dozer (rolling and compaction)		112.0	1100	77.0	10	0	30	1100	1	1	25.0
1 x Wheel wash	70.0		1100	49.0	10	0				1	11.0
1 x Wheel wash	70.0		1400	51.7	10	0				1	8.3
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**48**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	175	57.1	0	0	200	175	0.63	1	52.9

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer (rolling and compaction)		112.0	175	57.1	0	0	200	175	0.63	1	52.9
2 x Dozer		108.0	175	57.1	0	0	200	175	0.63	1	48.9
										Total	**57**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	1400	79.7	10	0	50	1400	1	1	23.4
5 x Dozer		114.0	1400	79.7	10	0	100	1400	1	1	24.3
5 x Tracked excavator		120.0	1400	79.7	10	0	50	1400	1	1	30.3
4 x Vibratory roller		108.0	1400	79.7	10	0	30	1400	1	1	18.4
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	1400	79.7	10	0	200	1400	1	1	22.1
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	480	68.0	5	0	200	480	1	1	38.7
1 x Mobile telescopic crane	67.0		1400	51.7	10	0				1	5.3
5 x Diesel water pumps	88.0		1400	51.7	10	0				1	26.3
2 x Rock breaker		114.0	1400	79.7	10	0	30	1400	1	1	24.4
1 x Mobile rock crusher	90.0		1200	50.0	10	0				1	30.0
1 x Dredging ship		110.0	2500	85.9	10	0	30	2500	1	1	14.1
2 x Piling rig	90.0		2000	55.5	10	0				1	24.5
2 x Barge-mounted crane	82.0		2000	55.5	10	0				1	16.5
										Total	**41**

Table 11D.4 Construction noise calculations (Wick House)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	1000	76.0	10	0	30	1000	1	1	25.0
1 x Road planer		110.0	1000	76.0	10	0	30	1000	1	1	24.0
1 x Dozer		105.0	1000	76.0	10	0	30	1000	1	1	19.0
1 x Road roller		108.0	1000	76.0	10	0	30	1000	1	1	22.0
1 x Asphalt paver (+ tipper lorry)		103.0	1000	76.0	10	0	30	1000	1	1	17.0
1 x Diesel water pump	81.0		1000	48.0	10	0				1	23.0
1 x Diesel generator	74.0		1000	48.0	10	0				1	16.0
										Total	**30**
Sea defence construction											
1 x Dredging ship		110.0	1950	83.3	10	0	50	1950	1	1	16.7
1 x Tracked excavator		106.0	1950	83.3	10	0	30	1950	1	1	12.7
1 x Concrete batching plant	80.0		1950	55.3	10	0				1	14.7
1 x Concrete pumping truck / ship		108.0	1950	83.3	10	0	50	1950	1	1	14.7
1 x Concrete pumping truck		108.0	1950	83.3	10	0	50	1950	1	1	14.7
1 x Diesel generator	74.0		1950	55.3	10	0				1	8.7
										Total	**22**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	1200	78.0	10	0	10	1200	1	1	18.0
1 x Dozer		105.0	1200	78.0	10	0	30	1200	1	1	17.0
1 x Augur piling rig	79.0		1200	50.0	10	0				1	19.0
2 x Wheeled crane	81.0		1200	50.0	10	0				1	21.0
2 x Flat bed lorry	80.0		1200	50.0	10	0				1	20.0
1 x Small concrete mixer	61.0		1200	50.0	10	0				1	1.0
1 x Road roller		108.0	1200	78.0	10	0	20	1200	1	1	20.0
1 x Asphalt paver (+ tipper lorry)		103.0	1200	78.0	10	0	20	1200	1	1	15.0
1 x Diesel water pump	81.0		1200	50.0	10	0				1	21.0
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**28**
Construction of emergency access road											
1 x Tracked excavator		106.0	1200	78.0	10	0	30	1200	1	1	18.0
1 x Dozer		105.0	1200	78.0	10	0	30	1200	1	1	17.0
1 x Small concrete mixer	61.0		1200	50.0	10	0				1	1.0
1 x Hand-held road breaker	82.0		1200	50.0	10	0				1	22.0
1 x Road roller		108.0	1200	78.0	10	0	20	1200	1	1	20.0
1 x Asphalt paver (+ tipper lorry)		103.0	1200	78.0	10	0	20	1200	1	1	15.0
1 x Diesel water pump	81.0		1200	50.0	10	0				1	21.0
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**27**
Deep excavation and concrete substitution											
4 x Tracked excavator / loader		112.0	1480	80.3	10	0	30	1480	1	1	21.8

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	1480	80.3	10	0	100	1480	1	1	24.8
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	850	74.2	5	0	100	850	1	1	35.8
4 x Rock breaker		114.0	1480	80.3	10	0	20	1480	1	1	23.8
1 x Concrete batching plant	80.0		1680	53.6	10	0				1	16.4
1 x Tracked mobile drilling rig		118.0	1480	80.3	10	0	30	1480	1	1	27.7
1 x Crushing plant	90.0		1950	55.3	10	0				1	24.7
1 x Crushing plant	90.0		1480	52.3	10	0				1	27.7
10 x Diesel water pumps	91.0		1480	52.3	10	0				1	28.7
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**38**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	1200	78.0	10	0	30	1200	1	1	14.0
2 x Sheet piling plant	66.0		1200	50.0	10	0				1	6.0
2 x Truck mounted concrete pump and boom arm	83.0		1200	50.0	10	0				1	23.0
1 x Concrete batching plant	80.0		1200	50.0	10	0				1	20.0
1 x Compressor (>50 kw)	70.0		1200	50.0	10	0				1	10.0
1 x Angle grinder (grinding steel)		108.0	1200	78.0	10	0	30	1200	1	1	20.0
1 x Concrete cutting (hand-held circular saw)		112.0	1200	78.0	10	0	30	1200	1	1	24.0
2 x Electric bolter		105.0	1200	78.0	10	0	30	1200	1	1	17.0
2 x Diesel water pumps	84.0		1200	50.0	10	0				1	24.0
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**30**
Tunnelling											
2 x Tracked excavator		109.0	1950	83.3	10	0	30	1950	1	1	15.8
2 x Tracked mobile crane	71.0		1950	55.3	10	0				1	5.7
1 x Rock breaker		108.0	1950	83.3	10	0	30	1950	1	1	14.7
1 x Tracked mobile drilling rig	66.0		1950	55.3	10	0				1	0.8
1 x Horizontal directional drilling rig	79.0		1950	55.3	10	0				1	13.7
2 x Dump truck (spoil distribution)		112.0	1950	83.3	10	0	30	1950	1	1	18.8
1 x Diesel generator	72.0		1950	55.3	10	0				1	6.8
										Total	**22**
Construction of nuclear island buildings											
20 x Tower crane	89.0		1480	52.3	10	0				1	26.8
1 x Tracked mobile crane		99.0	1480	80.3	10	0	30	1480	1	1	8.7
6 x Concrete placing boom	72.8		1480	52.3	10	0				1	10.5
2 x Sheet piling plant	66.0		1480	52.3	10	0				1	3.8
1 x Continuous flight augur drilling	79.0		1480	52.3	10	0				1	16.7
2 x Compressors (<50 kw)	73.0		1480	52.3	10	0				1	10.8
2 x Poker vibrators	72.0		1480	52.3	10	0				1	9.8
4 x Wheeled mobile telescopic crane	84.0		1480	52.3	10	0				1	21.8

NOT PROTECTIVELY MARKED

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
3 x Concrete batching plant	84.8		1680	53.6	10	0				1	21.1
10 x Diesel water pumps	91.0		1480	52.3	10	0				1	28.7
2 x Angle grinder (grinding steel)		111.0	1480	80.3	10	0	30	1480	1	1	20.8
1 x Concrete cutting (hand-held circular saw)		112.0	1480	80.3	10	0	30	1480	1	1	21.7
2 x Electric bolter		105.0	1480	80.3	10	0	30	1480	1	1	14.8
2 x Diesel generators	77.0		1480	52.3	10	0				1	14.8
										Total	**33**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	580	70.1	5	0	30	580	1	1	32.9
1 x Small cement mixer	61.0		570	41.9	5	0				1	14.1
2 x Electric bolter		105.0	570	69.9	5	0	30	570	1	1	30.1
2 x Diesel water pumps	84.0		570	41.9	5	0				1	37.1
1 x Flat bed lorry		105.0	570	69.9	5	0	30	570	1	1	30.1
1 x Diesel generator	74.0		580	42.1	5	0				1	26.9
										Total	**40**
Construction of the substation											
2 x Mobile telescopic crane	80.0		950	47.4	10	0				1	22.6
2 x Dump truck		112.0	950	75.4	10	0	50	950	1	1	26.6
2 x Tracked excavator / loader		109.0	950	75.4	10	0	20	950	1	1	23.6
2 x Truck mounted concrete pump and boom arm		111.0	950	75.4	10	0	20	950	1	1	25.6
1 x Tracked Breaker		111.0	950	75.4	10	0	20	950	1	1	25.6
2 x Compressors (<50 kw)	73.0		950	47.4	10	0				1	15.6
1 x Diesel generator	74.0		950	47.4	10	0				1	16.6
1 x Concrete cutting (hand-held circular saw)		112.0	950	75.4	10	0	10	950	1	1	26.6
2 x Electric bolter		105.0	950	75.4	10	0	20	950	1	1	19.6
1 x Small cement mixer	61.0		950	47.4	10	0				1	3.6
1 x Road roller		108.0	950	75.4	10	0	30	950	1	1	22.6
1 x Asphalt paver (+ tipper lorry)		103.0	950	75.4	10	0	30	950	1	1	17.6
										Total	**34**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	1100	77.0	10	0	30	1100	1	1	26.7
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	800	73.6	0	0	30	800	1	1	40.2
2 x Dozer (rolling and compaction)		112.0	1100	77.0	10	0	30	1100	1	1	25.0
1 x Wheel wash	70.0		1000	48.0	10	0				1	12.0
1 x Wheel wash	70.0		1400	51.7	10	0				1	8.3
1 x Diesel generator	74.0		1200	50.0	10	0				1	14.0
										Total	**41**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	800	73.6	5	0	40	800	1	1	33.4
2 x Dozer (rolling and compaction)		112.0	800	73.6	5	0	40	800	1	1	33.4

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer		108.0	800	73.6	5	0	40	800	1	1	29.4
										Total	**37**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	3000	87.9	10	0	50	3000	1	1	15.1
5 x Dozer		114.0	3000	87.9	10	0	100	3000	1	1	16.1
5 x Tracked excavator		120.0	3000	87.9	10	0	50	3000	1	1	22.1
4 x Vibratory roller		108.0	3000	87.9	10	0	30	3000	1	1	10.1
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	3000	87.9	10	0	200	3000	1	1	13.8
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	2600	86.4	10	0	200	2600	1	1	15.4
1 x Mobile telescopic crane	67.0		3000	59.9	10	0				1	-2.9
5 x Diesel water pumps	88.0		3000	59.9	10	0				1	18.1
2 x Rock breaker		114.0	3000	87.9	10	0	30	3000	1	1	16.1
1 x Mobile rock crusher	90.0		2900	59.6	10	0				1	20.4
1 x Dredging ship		110.0	3800	90.5	10	0	30	3800	1	1	9.5
2 x Piling rig	90.0		3400	61.3	10	0				1	18.7
2 x Barge-mounted crane	82.0		3400	61.3	10	0				1	10.7
										Total	**28**

Table 11D.5 Construction noise calculations (Benhole Lane (south))

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	1000	76.0	10	0	30	1000	1	1	25.0
1 x Road planer		110.0	1000	76.0	10	0	30	1000	1	1	24.0
1 x Dozer		105.0	1000	76.0	10	0	30	1000	1	1	19.0
1 x Road roller		108.0	1000	76.0	10	0	30	1000	1	1	22.0
1 x Asphalt paver (+ tipper lorry)		103.0	1000	76.0	10	0	30	1000	1	1	17.0
1 x Diesel water pump	81.0		1000	48.0	10	0				1	23.0
1 x Diesel generator	74.0		1000	48.0	10	0				1	16.0
										Total	**30**
Sea defence construction											
1 x Dredging ship		110.0	1150	77.5	10	0	50	1150	1	1	22.5
1 x Tracked excavator		106.0	1150	77.5	10	0	30	1150	1	1	18.5
1 x Concrete batching plant	80.0		1150	49.5	10	0				1	20.5
1 x Concrete pumping truck / ship		108.0	1150	77.5	10	0	50	1150	1	1	20.5
1 x Concrete pumping truck		108.0	1150	77.5	10	0	50	1150	1	1	20.5
1 x Diesel generator	74.0		1150	49.5	10	0				1	14.5
										Total	**28**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	500	68.5	10	0	10	500	1	1	27.5
1 x Dozer		105.0	500	68.5	10	0	30	500	1	1	26.5
1 x Augur piling rig	79.0		500	40.5	10	0				1	28.5
2 x Wheeled crane	81.0		500	40.5	10	0				1	30.5
2 x Flat bed lorry	80.0		500	40.5	10	0				1	29.5
1 x Small concrete mixer	61.0		500	40.5	10	0				1	10.5
1 x Road roller		108.0	500	68.5	10	0	20	500	1	1	29.5
1 x Asphalt paver (+ tipper lorry)		103.0	500	68.5	10	0	20	500	1	1	24.5
1 x Diesel water pump	81.0		500	40.5	10	0				1	30.5
1 x Diesel generator	74.0		500	40.5	10	0				1	23.5
										Total	**38**
Construction of emergency access road											
1 x Tracked excavator		106.0	500	68.5	10	0	30	500	1	1	27.5
1 x Dozer		105.0	500	68.5	10	0	30	500	1	1	26.5
1 x Small concrete mixer	61.0		500	40.5	10	0				1	10.5
1 x Hand-held road breaker	82.0		500	40.5	10	0				1	31.5
1 x Road roller		108.0	500	68.5	10	0	20	500	1	1	29.5
1 x Asphalt paver (+ tipper lorry)		103.0	500	68.5	10	0	20	500	1	1	24.5
1 x Diesel water pump	81.0		500	40.5	10	0				1	30.5
1 x Diesel generator	74.0		500	40.5	10	0				1	23.5
										Total	**37**
Deep excavation and concrete substitution											

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Tracked excavator / loader		112.0	830	74.0	10	0	30	830	1	1	28.0
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	830	74.0	10	0	100	830	1	1	31.0
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	100	51.0	0	0	100	100	0.63	1	62.0
4 x Rock breaker		114.0	830	74.0	10	0	20	830	1	1	30.0
1 x Concrete batching plant	80.0		860	46.4	10	0				1	23.6
1 x Tracked mobile drilling rig		118.0	830	74.0	10	0	30	830	1	1	34.0
1 x Crushing plant	90.0		1100	49.0	10	0				1	31.0
1 x Crushing plant	90.0		800	45.6	10	0				1	34.4
10 x Diesel water pumps	91.0		830	46.0	10	0				1	35.0
1 x Diesel generator	74.0		830	46.0	10	0				1	18.0
										Total	**62**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	550	69.5	10	0	30	550	1	1	22.5
2 x Sheet piling plant	66.0		550	41.5	10	0				1	14.5
2 x Truck mounted concrete pump and boom arm	83.0		550	41.5	10	0				1	31.5
1 x Concrete batching plant	80.0		550	41.5	10	0				1	28.5
1 x Compressor (>50 kw)	70.0		550	41.5	10	0				1	18.5
1 x Angle grinder (grinding steel)		108.0	550	69.5	10	0	30	550	1	1	28.5
1 x Concrete cutting (hand-held circular saw)		112.0	550	69.5	10	0	30	550	1	1	32.5
2 x Electric bolter		105.0	550	69.5	10	0	30	550	1	1	25.5
2 x Diesel water pumps	84.0		550	41.5	10	0				1	32.5
1 x Diesel generator	74.0		550	41.5	10	0				1	22.5
										Total	**39**
Tunnelling											
2 x Tracked excavator		109.0	1200	78.0	10	0	30	1200	1	1	21.0
2 x Tracked mobile crane	71.0		1200	50.0	10	0				1	11.0
1 x Rock breaker		108.0	1200	78.0	10	0	30	1200	1	1	20.0
1 x Tracked mobile drilling rig	66.0		1200	50.0	10	0				1	6.0
1 x Horizontal directional drilling rig	79.0		1200	50.0	10	0				1	19.0
2 x Dump truck (spoil distribution)		112.0	1200	78.0	10	0	30	1200	1	1	24.0
1 x Diesel generator	72.0		1200	50.0	10	0				1	12.0
										Total	**28**
Construction of nuclear island buildings											
20 x Tower crane	89.0		880	46.6	10	0				1	32.4
1 x Tracked mobile crane		99.0	880	74.6	10	0	30	880	1	1	14.4
6 x Concrete placing boom	72.8		880	46.6	10	0				1	16.2
2 x Sheet piling plant	66.0		880	46.6	10	0				1	9.4
1 x Continuous flight augur drilling	79.0		880	46.6	10	0				1	22.4
2 x Compressors (<50 kw)	73.0		880	46.6	10	0				1	16.4
2 x Poker vibrators	72.0		880	46.6	10	0				1	15.4

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
4 x Wheeled mobile telescopic crane	84.0		880	46.6	10	0				1	27.4
3 x Concrete batching plant	84.8		880	46.6	10	0				1	28.2
10 x Diesel water pumps	91.0		880	46.6	10	0				1	34.4
2 x Angle grinder (grinding steel)		111.0	880	74.6	10	0	30	880	1	1	26.4
1 x Concrete cutting (hand-held circular saw)		112.0	880	74.6	10	0	30	880	1	1	27.4
2 x Electric bolter		105.0	880	74.6	10	0	30	880	1	1	20.4
2 x Diesel generators	77.0		880	46.6	10	0				1	20.4
										Total	**39**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	750	72.9	10	0	30	750	1	1	25.1
1 x Small cement mixer	61.0		750	44.9	10	0				1	6.1
2 x Electric bolter		105.0	750	72.9	10	0	30	750	1	1	22.1
2 x Diesel water pumps	84.0		750	44.9	10	0				1	29.1
1 x Flat bed lorry		105.0	750	72.9	10	0	30	750	1	1	22.1
1 x Diesel generator	74.0		750	44.9	10	0				1	19.1
										Total	**32**
Construction of the substation											
2 x Mobile telescopic crane	80.0		750	44.9	10	0				1	25.1
2 x Dump truck		112.0	750	72.9	10	0	50	750	1	1	29.1
2 x Tracked excavator / loader		109.0	750	72.9	10	0	20	750	1	1	26.1
2 x Truck mounted concrete pump and boom arm		111.0	750	72.9	10	0	20	750	1	1	28.1
1 x Tracked Breaker		111.0	750	72.9	10	0	20	750	1	1	28.1
2 x Compressors (<50 kw)	73.0		750	44.9	10	0				1	18.1
1 x Diesel generator	74.0		750	44.9	10	0				1	19.1
1 x Concrete cutting (hand-held circular saw)		112.0	750	72.9	10	0	10	750	1	1	29.1
2 x Electric bolter		105.0	750	72.9	10	0	20	750	1	1	22.1
1 x Small cement mixer	61.0		750	44.9	10	0				1	6.1
1 x Road roller		108.0	750	72.9	10	0	30	750	1	1	25.1
1 x Asphalt paver (+ tipper lorry)		103.0	750	72.9	10	0	30	750	1	1	20.1
										Total	**36**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	650	71.3	10	0	30	650	1	1	32.4
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	50	43.5	0	0	30	50	1	1	70.3
2 x Dozer (rolling and compaction)		112.0	650	71.3	10	0	30	650	1	1	30.7
1 x Wheel wash	70.0		1200	50.0	10	0				1	10.0
1 x Wheel wash	70.0		800	45.6	10	0				1	14.4
1 x Diesel generator	74.0		650	43.3	10	0				1	20.7
										Total	**70**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	250	60.9	5	0	50	250	1	1	46.1

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer (rolling and compaction)		112.0	250	60.9	5	0	50	250	1	1	46.1
2 x Dozer		108.0	250	60.9	5	0	50	250	1	1	42.1
										Total	**50**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	800	73.6	10	0	50	800	1	1	29.4
5 x Dozer		114.0	800	73.6	10	0	100	800	1	1	30.4
5 x Tracked excavator		120.0	800	73.6	10	0	50	800	1	1	36.4
4 x Vibratory roller		108.0	800	73.6	10	0	30	800	1	1	24.4
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	800	73.6	10	0	200	800	1	1	28.2
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	80	48.6	0	0	200	80	1	1	63.2
1 x Mobile telescopic crane	67.0		800	45.6	10	0				1	11.4
5 x Diesel water pumps	88.0		800	45.6	10	0				1	32.4
2 x Rock breaker		114.0	800	73.6	10	0	30	800	1	1	30.4
1 x Mobile rock crusher	90.0		500	40.5	10	0				1	39.5
1 x Dredging ship		110.0	1800	82.4	10	0	30	1800	1	1	17.6
2 x Piling rig	90.0		1400	51.7	10	0				1	28.4
2 x Barge-mounted crane	82.0		1400	51.7	10	0				1	20.4
										Total	**63**

Table 11D.6 Construction noise calculations (Benhole Lane (north))

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	950	75.4	0	0	30	950	1	1	35.6
1 x Road planer		110.0	950	75.4	0	0	30	950	1	1	34.6
1 x Dozer		105.0	950	75.4	0	0	30	950	1	1	29.6
1 x Road roller		108.0	950	75.4	0	0	30	950	1	1	32.6
1 x Asphalt paver (+ tipper lorry)		103.0	950	75.4	0	0	30	950	1	1	27.6
1 x Diesel water pump	81.0		950	47.4	0	0				1	33.6
1 x Diesel generator	74.0		950	47.4	0	0				1	26.6
										Total	**41**
Sea defence construction											
1 x Dredging ship		110.0	300	62.9	0	0	50	300	1	1	47.1
1 x Tracked excavator		106.0	300	62.9	0	0	30	300	1	1	43.1
1 x Concrete batching plant	80.0		300	34.9	0	0				1	45.1
1 x Concrete pumping truck / ship		108.0	300	62.9	0	0	50	300	1	1	45.1
1 x Concrete pumping truck		108.0	300	62.9	0	0	50	300	1	1	45.1
1 x Diesel generator	74.0		300	34.9	0	0				1	39.1
										Total	**52**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	1300	78.8	10	0	10	1300	1	1	17.2
1 x Dozer		105.0	1300	78.8	10	0	30	1300	1	1	16.2
1 x Augur piling rig	79.0		1300	50.8	10	0				1	18.2
2 x Wheeled crane	81.0		1300	50.8	10	0				1	20.2
2 x Flat bed lorry	80.0		1300	50.8	10	0				1	19.2
1 x Small concrete mixer	61.0		1300	50.8	10	0				1	0.2
1 x Road roller		108.0	1300	78.8	10	0	20	1300	1	1	19.2
1 x Asphalt paver (+ tipper lorry)		103.0	1300	78.8	10	0	20	1300	1	1	14.2
1 x Diesel water pump	81.0		1300	50.8	10	0				1	20.2
1 x Diesel generator	74.0		1300	50.8	10	0				1	13.2
										Total	**28**
Construction of emergency access road											
1 x Tracked excavator		106.0	1300	78.8	10	0	30	1300	1	1	17.2
1 x Dozer		105.0	1300	78.8	10	0	30	1300	1	1	16.2
1 x Small concrete mixer	61.0		1300	50.8	10	0				1	0.2
1 x Hand-held road breaker	82.0		1300	50.8	10	0				1	21.2
1 x Road roller		108.0	1300	78.8	10	0	20	1300	1	1	19.2
1 x Asphalt paver (+ tipper lorry)		103.0	1300	78.8	10	0	20	1300	1	1	14.2
1 x Diesel water pump	81.0		1300	50.8	10	0				1	20.2
1 x Diesel generator	74.0		1300	50.8	10	0				1	13.2
										Total	**27**
Deep excavation and concrete substitution											

4 x Tracked excavator / loader		112.0	470	67.8	10	0	30	470	1	1	34.2
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	470	67.8	10	0	100	470	1	1	37.2
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	580	70.1	10	0	100	580	1	1	34.9
4 x Rock breaker		114.0	470	67.8	10	0	20	470	1	1	36.2
1 x Concrete batching plant	80.0		650	43.3	0	0				1	36.7
1 x Tracked mobile drilling rig		118.0	470	67.8	10	0	30	470	1	1	40.2
1 x Crushing plant	90.0		450	39.3	0	0				1	50.7
1 x Crushing plant	90.0		950	47.4	0	0				1	42.6
10 x Diesel water pumps	91.0		470	39.8	10	0				1	41.2
1 x Diesel generator	74.0		470	39.8	10	0				1	24.2
										Total	**53**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	250	60.9	0	0	30	250	1	1	41.1
2 x Sheet piling plant	66.0		250	32.9	0	0				1	33.1
2 x Truck mounted concrete pump and boom arm	83.0		250	32.9	0	0				1	50.1
1 x Concrete batching plant	80.0		650	43.3	0	0				1	36.7
1 x Compressor (>50 kw)	70.0		250	32.9	0	0				1	37.1
1 x Angle grinder (grinding steel)		108.0	250	60.9	0	0	30	250	1	1	47.1
1 x Concrete cutting (hand-held circular saw)		112.0	250	60.9	0	0	30	250	1	1	51.1
2 x Electric bolter		105.0	250	60.9	0	0	30	250	1	1	44.1
2 x Diesel water pumps	84.0		250	32.9	0	0				1	51.1
1 x Diesel generator	74.0		250	32.9	0	0				1	41.1
										Total	**57**
Tunnelling											
2 x Tracked excavator		109.0	650	71.3	10	0	30	650	1	1	27.7
2 x Tracked mobile crane	71.0		650	43.3	10	0				1	17.7
1 x Rock breaker		108.0	650	71.3	10	0	30	650	1	1	26.7
1 x Tracked mobile drilling rig	66.0		650	43.3	10	0				1	12.7
1 x Horizontal directional drilling rig	79.0		650	43.3	10	0				1	25.7
2 x Dump truck (spoil distribution)		112.0	650	71.3	10	0	30	650	1	1	30.7
1 x Diesel generator	72.0		650	43.3	10	0				1	18.7
										Total	**34**
Construction of nuclear island buildings											
20 x Tower crane	89.0		470	39.8	5	0				1	44.2
1 x Tracked mobile crane		99.0	470	67.8	5	0	30	470	1	1	26.2
6 x Concrete placing boom	72.8		470	39.8	5	0				1	28.0
2 x Sheet piling plant	66.0		470	39.8	5	0				1	21.2
1 x Continuous flight augur drilling	79.0		470	39.8	5	0				1	34.2
2 x Compressors (<50 kw)	73.0		470	39.8	5	0				1	28.2
2 x Poker vibrators	72.0		470	39.8	5	0				1	27.2
4 x Wheeled mobile telescopic crane	84.0		470	39.8	5	0				1	39.2
3 x Concrete batching plant	84.8		650	43.3	0	0				1	41.4
10 x Diesel water pumps	91.0		470	39.8	5	0				1	46.2
2 x Angle grinder (grinding steel)		111.0	470	67.8	5	0	30	470	1	1	38.2
1 x Concrete cutting (hand-held circular saw)		112.0	470	67.8	5	0	30	470	1	1	39.2

2 x Electric bolter		105.0	470	67.8	5	0	30	470	1	1	32.2
2 x Diesel generators	77.0		470	39.8	5	0				1	32.2
										Total	**51**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	1100	77.0	10	0	30	1100	1	1	21.0
1 x Small cement mixer	61.0		1100	49.0	10	0				1	2.0
2 x Electric bolter		105.0	1100	77.0	10	0	30	1100	1	1	18.0
2 x Diesel water pumps	84.0		1100	49.0	10	0				1	25.0
1 x Flat bed lorry		105.0	1100	77.0	10	0	30	1100	1	1	18.0
1 x Diesel generator	74.0		1100	49.0	10	0				1	15.0
										Total	**28**
Construction of the substation											
2 x Mobile telescopic crane	80.0		750	44.9	10	0				1	25.1
2 x Dump truck		112.0	750	72.9	10	0	50	750	1	1	29.1
2 x Tracked excavator / loader		109.0	750	72.9	10	0	20	750	1	1	26.1
2 x Truck mounted concrete pump and boom arm		111.0	750	72.9	10	0	20	750	1	1	28.1
1 x Tracked Breaker		111.0	750	72.9	10	0	20	750	1	1	28.1
2 x Compressors (<50 kw)	73.0		750	44.9	10	0				1	18.1
1 x Diesel generator	74.0		750	44.9	10	0				1	19.1
1 x Concrete cutting (hand-held circular saw)		112.0	750	72.9	10	0	10	750	1	1	29.1
2 x Electric bolter		105.0	750	72.9	10	0	20	750	1	1	22.1
1 x Small cement mixer	61.0		750	44.9	10	0				1	6.1
1 x Road roller		108.0	750	72.9	10	0	30	750	1	1	25.1
1 x Asphalt paver (+ tipper lorry)		103.0	750	72.9	10	0	30	750	1	1	20.1
										Total	**36**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	400	66.1	0	0	30	400	1	1	47.7
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	50	43.5	0	0	30	50	1	1	70.3
2 x Dozer (rolling and compaction)		112.0	250	60.9	0	0	30	250	1	1	51.1
1 x Wheel wash	70.0		950	47.4	0	0				1	22.6
1 x Wheel wash	70.0		1270	50.6	10	0				1	9.4
1 x Diesel generator	74.0		400	38.1	0	0				1	35.9
										Total	**70**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	1100	77.0	10	0	50	1100	1	1	25.0
2 x Dozer (rolling and compaction)		112.0	1100	77.0	10	0	50	1100	1	1	25.0
2 x Dozer		108.0	1100	77.0	10	0	50	1100	1	1	21.0
										Total	**29**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	100	51.0	0	0	50	100	1	1	62.0
5 x Dozer		114.0	100	51.0	0	0	100	100	1	1	63.0
5 x Tracked excavator		120.0	100	51.0	0	0	50	100	1	1	69.0
4 x Vibratory roller		108.0	100	51.0	0	0	30	100	1	1	57.0
3 x Dump truck (spoil distribution) operating on		111.8	100	51.0	0	0	200	100	1	1	60.8

the aggregates handling site											
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	500	68.5	10	0	200	500	1	1	33.3
1 x Mobile telescopic crane	67.0		150	27.4	0	0				1	39.6
5 x Diesel water pumps	88.0		100	23.0	0	0				1	65.0
2 x Rock breaker		114.0	100	51.0	0	0	30	100	1	1	63.0
1 x Mobile rock crusher	90.0		250	32.9	0	0				1	57.1
1 x Dredging ship		110.0	1000	76.0	0	0	30	1000	1	1	34.0
2 x Piling rig	90.0		600	42.5	0	0				1	47.6
2 x Barge-mounted crane	82.0		600	42.5	0	0				1	39.6
										Total	**73**

Table 11D.7 Construction noise calculations (Coastal footpath)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	800	73.6	0	0	30	800	1	1	37.4
1 x Road planer		110.0	800	73.6	0	0	30	800	1	1	36.4
1 x Dozer		105.0	800	73.6	0	0	30	800	1	1	31.4
1 x Road roller		108.0	800	73.6	0	0	30	800	1	1	34.4
1 x Asphalt paver (+ tipper lorry)		103.0	800	73.6	0	0	30	800	1	1	29.4
1 x Diesel water pump	81.0		800	45.6	0	0				1	35.4
1 x Diesel generator	74.0		800	45.6	0	0				1	28.4
										Total	**43**
Sea defence construction											
1 x Dredging ship		110.0	150	55.4	0	0	50	150	1	1	54.6
1 x Tracked excavator		106.0	150	55.4	0	0	30	150	1	1	50.6
1 x Concrete batching plant	80.0		150	27.4	0	0				1	52.6
1 x Concrete pumping truck / ship		108.0	150	55.4	0	0	50	150	1	1	52.6
1 x Concrete pumping truck		108.0	150	55.4	0	0	50	150	1	1	52.6
1 x Diesel generator	74.0		150	27.4	0	0				1	46.6
										Total	**60**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	1600	81.1	10	0	10	1600	1	1	14.9
1 x Dozer		105.0	1600	81.1	10	0	30	1600	1	1	13.9
1 x Augur piling rig	79.0		1600	53.1	10	0				1	15.9
2 x Wheeled crane	81.0		1600	53.1	10	0				1	17.9
2 x Flat bed lorry	80.0		1600	53.1	10	0				1	16.9
1 x Small concrete mixer	61.0		1600	53.1	10	0				1	-2.1
1 x Road roller		108.0	1600	81.1	10	0	20	1600	1	1	16.9
1 x Asphalt paver (+ tipper lorry)		103.0	1600	81.1	10	0	20	1600	1	1	11.9
1 x Diesel water pump	81.0		1600	53.1	10	0				1	17.9
1 x Diesel generator	74.0		1600	53.1	10	0				1	10.9
										Total	**25**
Construction of emergency access road											
1 x Tracked excavator		106.0	1600	81.1	10	0	30	1600	1	1	14.9
1 x Dozer		105.0	1600	81.1	10	0	30	1600	1	1	13.9
1 x Small concrete mixer	61.0		1600	53.1	10	0				1	-2.1
1 x Hand-held road breaker	82.0		1600	53.1	10	0				1	18.9
1 x Road roller		108.0	1600	81.1	10	0	20	1600	1	1	16.9
1 x Asphalt paver (+ tipper lorry)		103.0	1600	81.1	10	0	20	1600	1	1	11.9
1 x Diesel water pump	81.0		1600	53.1	10	0				1	17.9
1 x Diesel generator	74.0		1600	53.1	10	0				1	10.9
										Total	**24**
Deep excavation and concrete substitution											
4 x Tracked excavator / loader		112.0	250	60.9	5	0	30	250	1	1	46.1

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	250	60.9	5	0	100	250	1	1	49.1
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	800	73.6	10	0	100	800	1	1	31.4
4 x Rock breaker		114.0	250	60.9	5	0	20	250	1	1	48.1
1 x Concrete batching plant	80.0		570	41.9	0	0				1	38.1
1 x Tracked mobile drilling rig		118.0	250	60.9	5	0	30	250	1	1	52.1
1 x Crushing plant	90.0		450	39.3	0	0				1	50.7
1 x Crushing plant	90.0		800	45.6	0	0				1	44.4
10 x Diesel water pumps	91.0		250	32.9	5	0				1	53.1
1 x Diesel generator	74.0		250	32.9	5	0				1	36.1
										Total	**58**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	170	56.8	5	0	30	170	1	1	40.2
2 x Sheet piling plant	66.0		170	28.8	5	0				1	32.2
2 x Truck mounted concrete pump and boom arm	83.0		170	28.8	5	0				1	49.2
1 x Concrete batching plant	80.0		570	41.9	0	0				1	38.1
1 x Compressor (>50 kw)	70.0		170	28.8	5	0				1	36.2
1 x Angle grinder (grinding steel)		108.0	170	56.8	5	0	30	170	1	1	46.2
1 x Concrete cutting (hand-held circular saw)		112.0	170	56.8	5	0	30	170	1	1	50.2
2 x Electric bolter		105.0	170	56.8	5	0	30	170	1	1	43.2
2 x Diesel water pumps	84.0		170	28.8	5	0				1	50.2
1 x Diesel generator	74.0		170	28.8	5	0				1	40.2
										Total	**56**
Tunnelling											
2 x Tracked excavator		109.0	230	60.0	0	0	30	230	1	1	49.0
2 x Tracked mobile crane	71.0		230	32.0	0	0				1	39.0
1 x Rock breaker		108.0	230	60.0	0	0	30	230	1	1	48.0
1 x Tracked mobile drilling rig	66.0		230	32.0	0	0				1	34.0
1 x Horizontal directional drilling rig	79.0		230	32.0	0	0				1	47.0
2 x Dump truck (spoil distribution)		112.0	230	60.0	0	0	30	230	1	1	52.0
1 x Diesel generator	72.0		230	32.0	0	0				1	40.0
										Total	**56**
Construction of nuclear island buildings											
20 x Tower crane	89.0		300	34.9	5	0				1	49.1
1 x Tracked mobile crane		99.0	300	62.9	5	0	30	300	1	1	31.1
6 x Concrete placing boom	72.8		300	34.9	5	0				1	32.9
2 x Sheet piling plant	66.0		300	34.9	5	0				1	26.1
1 x Continuous flight augur drilling	79.0		300	34.9	5	0				1	39.1
2 x Compressors (<50 kw)	73.0		300	34.9	5	0				1	33.1
2 x Poker vibrators	72.0		300	34.9	5	0				1	32.1
4 x Wheeled mobile telescopic crane	84.0		300	34.9	5	0				1	44.1

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
3 x Concrete batching plant	84.8		570	41.9	0	0				1	42.9
10 x Diesel water pumps	91.0		300	34.9	5	0				1	51.1
2 x Angle grinder (grinding steel)		111.0	300	62.9	5	0	30	300	1	1	43.1
1 x Concrete cutting (hand-held circular saw)		112.0	300	62.9	5	0	30	300	1	1	44.1
2 x Electric bolter		105.0	300	62.9	5	0	30	300	1	1	37.1
2 x Diesel generators	77.0		300	34.9	5	0				1	37.1
										Total	**55**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	1340	79.2	10	0	30	1340	1	1	18.8
1 x Small cement mixer	61.0		1340	51.2	10	0				1	-0.2
2 x Electric bolter		105.0	1340	79.2	10	0	30	1340	1	1	15.8
2 x Diesel water pumps	84.0		1340	51.2	10	0				1	22.8
1 x Flat bed lorry		105.0	1340	79.2	10	0	30	1340	1	1	15.8
1 x Diesel generator	74.0		1340	51.2	10	0				1	12.8
										Total	**26**
Construction of the substation											
2 x Mobile telescopic crane	80.0		690	44.0	0	0				1	36.0
2 x Dump truck		112.0	690	72.0	0	0	50	690	1	1	40.0
2 x Tracked excavator / loader		109.0	690	72.0	0	0	20	690	1	1	37.0
2 x Truck mounted concrete pump and boom arm		111.0	690	72.0	0	0	20	690	1	1	39.0
1 x Tracked Breaker		111.0	690	72.0	0	0	20	690	1	1	39.0
2 x Compressors (<50 kw)	73.0		690	44.0	0	0				1	29.0
1 x Diesel generator	74.0		690	44.0	0	0				1	30.0
1 x Concrete cutting (hand-held circular saw)		112.0	690	72.0	0	0	10	690	1	1	40.0
2 x Electric bolter		105.0	690	72.0	0	0	20	690	1	1	33.0
1 x Small cement mixer	61.0		690	44.0	0	0				1	17.0
1 x Road roller		108.0	690	72.0	0	0	30	690	1	1	36.0
1 x Asphalt paver (+ tipper lorry)		103.0	690	72.0	0	0	30	690	1	1	31.0
										Total	**47**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	100	51.0	0	0	30	100	1	1	62.8
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	850	74.2	10	0	30	850	1	1	29.5
2 x Dozer (rolling and compaction)		112.0	100	51.0	0	0	30	100	1	1	61.0
1 x Wheel wash	70.0		780	45.3	0	0				1	24.7
1 x Wheel wash	70.0		1300	50.8	10	0				1	9.2
1 x Diesel generator	74.0		200	30.5	0	0				1	43.5
										Total	**65**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	1400	79.7	10	0	200	1400	1	1	22.4
2 x Dozer (rolling and compaction)		112.0	1400	79.7	10	0	200	1400	1	1	22.4

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer		108.0	1400	79.7	10	0	200	1400	1	1	18.4
										Total	**26**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	150	55.4	5	0	50	150	1	1	52.6
5 x Dozer		114.0	150	55.4	5	0	100	150	1	1	53.6
5 x Tracked excavator		120.0	150	55.4	5	0	50	150	1	1	59.6
4 x Vibratory roller		108.0	150	55.4	5	0	30	150	1	1	47.6
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	150	55.4	5	0	200	150	1	1	51.4
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	800	73.6	10	0	200	800	1	1	28.2
1 x Mobile telescopic crane	67.0		200	30.5	5	0				1	31.5
5 x Diesel water pumps	88.0		150	27.4	5	0				1	55.6
2 x Rock breaker		114.0	150	55.4	5	0	30	150	1	1	53.6
1 x Mobile rock crusher	90.0		550	41.5	5	0				1	43.5
1 x Dredging ship		110.0	900	74.9	0	0	30	900	1	1	35.1
2 x Piling rig	90.0		350	36.6	0	0				1	53.4
2 x Barge-mounted crane	82.0		350	36.6	0	0				1	45.4
										Total	**64**

NOT PROTECTIVELY MARKED

Table 11D.8 Construction noise calculations (Pixies Mound)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Tracked Breaker		111.0	50	43.5	0	0	30	50	1	1	67.5
1 x Road planer		110.0	50	43.5	0	0	30	50	1	1	66.5
1 x Dozer		105.0	50	43.5	0	0	30	50	1	1	61.5
1 x Road roller		108.0	50	43.5	0	0	30	50	1	1	64.5
1 x Asphalt paver (+ tipper lorry)		103.0	50	43.5	0	0	30	50	1	1	59.5
1 x Diesel water pump	81.0		50	15.5	0	0				1	65.5
1 x Diesel generator	74.0		50	15.5	0	0				1	58.5
										Total	**73**
Sea defence construction											
1 x Dredging ship		110.0	800	73.6	5	0	50	800	1	1	31.4
1 x Tracked excavator		106.0	800	73.6	5	0	30	800	1	1	27.4
1 x Concrete batching plant	80.0		600	42.5	5	0				1	32.5
1 x Concrete pumping truck / ship		108.0	800	73.6	5	0	50	800	1	1	29.4
1 x Concrete pumping truck		108.0	800	73.6	5	0	50	800	1	1	29.4
1 x Diesel generator	74.0		800	45.6	5	0				1	23.4
										Total	**38**
Construction of bridge over Bum Brook											
1 x Tracked excavator		106.0	1370	79.4	10	0	10	1370	1	1	16.6
1 x Dozer		105.0	1370	79.4	10	0	30	1370	1	1	15.6
1 x Augur piling rig	79.0		1370	51.4	10	0				1	17.6
2 x Wheeled crane	81.0		1370	51.4	10	0				1	19.6
2 x Flat bed lorry	80.0		1370	51.4	10	0				1	18.6
1 x Small concrete mixer	61.0		1370	51.4	10	0				1	-0.4
1 x Road roller		108.0	1370	79.4	10	0	20	1370	1	1	18.6
1 x Asphalt paver (+ tipper lorry)		103.0	1370	79.4	10	0	20	1370	1	1	13.6
1 x Diesel water pump	81.0		1370	51.4	10	0				1	19.6
1 x Diesel generator	74.0		1370	51.4	10	0				1	12.6
										Total	**27**
Construction of emergency access road											
1 x Tracked excavator		106.0	1370	79.4	10	0	30	1370	1	1	16.6
1 x Dozer		105.0	1370	79.4	10	0	30	1370	1	1	15.6
1 x Small concrete mixer	61.0		1370	51.4	10	0				1	-0.4
1 x Hand-held road breaker	82.0		1370	51.4	10	0				1	20.6
1 x Road roller		108.0	1370	79.4	10	0	20	1370	1	1	18.6
1 x Asphalt paver (+ tipper lorry)		103.0	1370	79.4	10	0	20	1370	1	1	13.6
1 x Diesel water pump	81.0		1370	51.4	10	0				1	19.6
1 x Diesel generator	74.0		1370	51.4	10	0				1	12.6
										Total	**26**
Deep excavation and concrete substitution											
4 x Tracked excavator / loader		112.0	400	66.1	5	0	30	400	1	1	41.0

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
4 x Dump truck (spoil distribution) operating on the main platform site		115.0	400	66.1	5	0	100	400	1	1	44.0
4 x Dump truck (spoil distribution) operating on the southern SSA land		115.0	500	68.5	10	0	100	500	1	1	36.5
4 x Rock breaker		114.0	400	66.1	5	0	20	400	1	1	43.0
1 x Concrete batching plant	80.0		600	42.5	0	0				1	37.5
1 x Tracked mobile drilling rig		118.0	400	66.1	5	0	30	400	1	1	46.9
1 x Crushing plant	90.0		360	36.9	5	0				1	48.1
1 x Crushing plant	90.0		900	46.9	5	0				1	38.1
10 x Diesel water pumps	91.0		400	38.1	5	0				1	47.9
1 x Diesel generator	74.0		400	38.1	5	0				1	30.9
										Total	**54**
Construction of temporary and permanent buildings (non-nuclear)											
2 x Tracked mobile crane		102.0	175	57.1	0	0	30	175	1	1	44.9
2 x Sheet piling plant	66.0		175	29.1	0	0				1	36.9
2 x Truck mounted concrete pump and boom arm	83.0		175	29.1	0	0				1	53.9
1 x Concrete batching plant	80.0		600	42.5	0	0				1	37.5
1 x Compressor (>50 kw)	70.0		175	29.1	0	0				1	40.9
1 x Angle grinder (grinding steel)		108.0	175	57.1	0	0	30	175	1	1	50.9
1 x Concrete cutting (hand-held circular saw)		112.0	175	57.1	0	0	30	175	1	1	54.9
2 x Electric bolter		105.0	175	57.1	0	0	30	175	1	1	47.9
2 x Diesel water pumps	84.0		175	29.1	0	0				1	54.9
1 x Diesel generator	74.0		175	29.1	0	0				1	44.9
										Total	**61**
Tunnelling											
2 x Tracked excavator		109.0	600	70.5	10	0	30	600	1	1	28.6
2 x Tracked mobile crane	71.0		600	42.5	10	0				1	18.5
1 x Rock breaker		108.0	600	70.5	10	0	30	600	1	1	27.5
1 x Tracked mobile drilling rig	66.0		600	42.5	10	0				1	13.6
1 x Horizontal directional drilling rig	79.0		600	42.5	10	0				1	26.5
2 x Dump truck (spoil distribution)		112.0	600	70.5	10	0	30	600	1	1	31.6
1 x Diesel generator	72.0		600	42.5	10	0				1	19.6
										Total	**35**
Construction of nuclear island buildings											
20 x Tower crane	89.0		400	38.1	5	0				1	46.0
1 x Tracked mobile crane		99.0	400	66.1	5	0	30	400	1	1	27.9
6 x Concrete placing boom	72.8		400	38.1	5	0				1	29.7
2 x Sheet piling plant	66.0		400	38.1	5	0				1	23.0
1 x Continuous flight augur drilling	79.0		400	38.1	5	0				1	35.9
2 x Compressors (<50 kw)	73.0		400	38.1	5	0				1	30.0
2 x Poker vibrators	72.0		400	38.1	5	0				1	29.0
4 x Wheeled mobile telescopic crane	84.0		400	38.1	5	0				1	41.0

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F	(%)	dB
3 x Concrete batching plant	84.8		600	42.5	0	0				1	42.3
10 x Diesel water pumps	91.0		400	38.1	5	0				1	47.9
2 x Angle grinder (grinding steel)		111.0	400	66.1	5	0	30	400	1	1	40.0
1 x Concrete cutting (hand-held circular saw)		112.0	400	66.1	5	0	30	400	1	1	40.9
2 x Electric bolter		105.0	400	66.1	5	0	30	400	1	1	34.0
2 x Diesel generators	77.0		400	38.1	5	0				1	34.0
										Total	**52**
Construction of contractors campus											
2 x Mobile telescopic crane		108.0	650	71.3	10	0	30	650	1	1	26.7
1 x Small cement mixer	61.0		650	43.3	10	0				1	7.7
2 x Electric bolter		105.0	650	71.3	10	0	30	650	1	1	23.7
2 x Diesel water pumps	84.0		650	43.3	10	0				1	30.7
1 x Flat bed lorry		105.0	650	71.3	10	0	30	650	1	1	23.7
1 x Diesel generator	74.0		650	43.3	10	0				1	20.7
										Total	**33**
Construction of the substation											
2 x Mobile telescopic crane	80.0		300	34.9	0	0				1	45.1
2 x Dump truck		112.0	300	62.9	0	0	50	300	1	1	49.1
2 x Tracked excavator / loader		109.0	300	62.9	0	0	20	300	1	1	46.1
2 x Truck mounted concrete pump and boom arm		111.0	300	62.9	0	0	20	300	1	1	48.1
1 x Tracked Breaker		111.0	300	62.9	0	0	20	300	1	1	48.1
2 x Compressors (<50 kw)	73.0		300	34.9	0	0				1	38.1
1 x Diesel generator	74.0		300	34.9	0	0				1	39.1
1 x Concrete cutting (hand-held circular saw)		112.0	300	62.9	0	0	10	300	1	1	49.1
2 x Electric bolter		105.0	300	62.9	0	0	20	300	1	1	42.1
1 x Small cement mixer	61.0		300	34.9	0	0				1	26.1
1 x Road roller		108.0	300	62.9	0	0	30	300	1	1	45.1
1 x Asphalt paver (+ tipper lorry)		103.0	300	62.9	0	0	30	300	1	1	40.1
										Total	**56**
Final landscaping											
3 x Dump truck (spoil distribution) operating on the construction platform		113.8	200	58.5	0	0	30	200	1	1	55.2
3 x Dump truck (spoil distribution) operating on the southern SSA land		113.8	500	68.5	5	0	30	500	1	1	40.3
2 x Dozer (rolling and compaction)		112.0	200	58.5	0	0	30	200	1	1	53.5
1 x Wheel wash	70.0		200	30.5	0	0				1	39.5
1 x Wheel wash	70.0		680	43.8	10	0				1	16.2
1 x Diesel generator	74.0		300	34.9	0	0				1	39.1
										Total	**58**
Early Restoration Landscaping											
2 x Dump truck (spoil distribution)		112.0	790	73.4	10	0	200	790	1	1	28.6
2 x Dozer (rolling and compaction)		112.0	790	73.4	10	0	200	790	1	1	28.6

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
2 x Dozer		108.0	790	73.4	10	0	200	790	1	1	24.6
										Total	**32**
Construction of temporary jetty and aggregates handling facility											
2 x 17t Scraper		113.0	1000	76.0	10	0	50	1000	1	1	27.0
5 x Dozer		114.0	1000	76.0	10	0	100	1000	1	1	28.0
5 x Tracked excavator		120.0	1000	76.0	10	0	50	1000	1	1	34.0
4 x Vibratory roller		108.0	1000	76.0	10	0	30	1000	1	1	22.0
3 x Dump truck (spoil distribution) operating on the aggregates handling site		111.8	1000	76.0	10	0	200	1000	1	1	25.8
3 x Dump truck (spoil distribution) operating on the southern SSA land		111.8	1100	77.0	10	0	200	1100	1	1	24.7
1 x Mobile telescopic crane	67.0		1000	48.0	10	0				1	9.0
5 x Diesel water pumps	88.0		1000	48.0	10	0				1	30.0
2 x Rock breaker		114.0	1000	76.0	10	0	30	1000	1	1	28.0
1 x Mobile rock crusher	90.0		1100	49.0	10	0				1	31.0
1 x Dredging ship		110.0	2000	83.5	10	0	30	2000	1	1	16.5
2 x Piling rig	90.0		1500	52.4	10	0				1	27.6
2 x Barge-mounted crane	82.0		1500	52.4	10	0				1	19.6
										Total	**39**

Table 11D.9 Assumed construction machinery – Hinkley Point C Development Site

Activity	Noise sources
Upgrade of roads on BE land	1 x Tracked Breaker 1 x Road planer 1 x Dozer 1 x Road roller 1 x Asphalt paver (+ tipper lorry) 1 x Diesel water pump 1 x Diesel generator
Sea defence construction (design to be agreed)	1 x Dredging ship 1 x Tracked excavator 1 x Concrete batching plant 1 x Concrete pumping truck/ship 1 x Concrete pumping truck 1 x Diesel generator
Construction of bridge over Bum Brook	1 x Tracked excavator 1 x Dozer 1 x Augur piling rig 2 x Wheeled crane 2 x Flat bed lorry 1 x Small concrete mixer 1 x Road roller 1 x Asphalt paver (+ tipper lorry) 1 x Diesel water pump 1 x Diesel generator
Construction of emergency access road	1 x Tracked excavator 1 x Dozer 1 x Small concrete mixer 1 x Hand-held road breaker 1 x Road roller 1 x Asphalt paver (+ tipper lorry) 1 x Diesel water pump 1 x Diesel generator
Deep excavation and concrete substitution	4 x Tracked excavator/loader 4 x Dump truck (spoil distribution) operating in the BDA 4 x Dump truck (spoil distribution) operating in the SCPA 4 x Rock breaker 1 x Concrete batching plant 1 x Tracked mobile drilling rig 1 x Crushing plant 1 x Crushing plant 10 x Diesel water pumps 1 x Diesel generator

Activity	Noise sources
Construction of temporary and permanent buildings (non-nuclear)	2 x Tracked mobile crane 2 x Sheet piling plant 2 x Truck mounted concrete pump and boom arm 1 x Concrete batching plant 1 x Compressor (>50 kw) 1 x Angle grinder (grinding steel) 1 x Concrete cutting (hand-held circular saw) 2 x Electric bolter 2 x Diesel water pumps 1 x Diesel generator
Tunnelling	2 x Tracked excavator 2 x Tracked mobile crane 1 x Rock breaker 1 x Tracked mobile drilling rig 1 x Horizontal directional drilling rig 2 x Dump truck (spoil distribution) 1 x Diesel generator
Construction of nuclear island buildings	20 x Tower crane 1 x Tracked mobile crane 6 x Concrete placing boom 2 x Sheet piling plant 1 x Continuous flight augur drilling 2 x Compressors (<50 kw) 2 x Poker vibrators 4 x Wheeled mobile telescopic crane 3 x Concrete batching plant 10 x Diesel water pumps 2 x Angle grinder (grinding steel) 1 x Concrete cutting (hand-held circular saw) 2 x Electric bolter 2 x Diesel generators
Construction of contractors campus	2 x mobile telescopic crane 1 x Small concrete mixer 2 x Electric bolter 2 x Diesel water pumps 1 x Flat bed lorry 1 x Diesel generator
Construction of the substation	2 x mobile telescopic crane 2 x Dump truck 2 x Tracked excavator/loader 2 x Truck mounted concrete pump and boom arm 1 x Tracked Breaker 2 x Compressors (<50 kw) 1 x Diesel generator 1 x Concrete cutting (hand-held circular saw) 2 x Electric bolter 1 x Small concrete mixer 1 x Road roller 1 x Asphalt paver (+ tipper lorry)

Activity	Noise sources
Final landscaping	3 x Dump truck (spoil distribution) operating in the BDA 3 x Dump truck (spoil distribution) operating in the SCPA 2 x Dozer (rolling and compaction) 1 x Wheel wash 1 x Wheel wash 1 x Diesel generator
Early restoration landscaping	2 x Dump truck (spoil distribution) 2 x Dozer (rolling and compaction) 2 x Dozer
Construction of temporary jetty and aggregates handling facility	2 x 17t Scraper 5 x Dozer 5 x Tracked excavator 4 x Vibratory roller 3 x Dump truck (spoil distribution) operating on the aggregates handling site 3 x Dump truck (spoil distribution) operating on the southern SSA land 1 x Mobile telescopic crane 5 x Diesel water pumps 2 x Rock breaker 1 x Mobile rock crusher 1 x Dredging ship 2 x Piling rig 2 x Barge-mounted crane

Table 11D.10 Washford Cross roundabout construction noise calculations (Tropiquaria Zoo)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Road planer		110	25	35.9	0	3	40	25	0.5	0.5	71.0
1 x Dozer		105	25	35.9	0	3	40	25	0.5	0.5	66.0
1 x Road roller		108	25	35.9	0	3	40	25	0.5	0.25	66.0
1 x Asphalt paver (+ tipper lorry)		103	25	35.9	0	3	40	25	0.5	0.25	61.0
										Total	**73**

Table 11D.11 Washford Cross roundabout construction noise calculations (Shells Cottages)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Road planer		110	200	58.5	0	3	40	200	1	0.5	51.5
1 x Dozer		105	200	58.5	0	3	40	200	1	0.5	46.5
1 x Road roller		108	200	58.5	0	3	40	200	1	0.25	46.5
1 x Asphalt paver (+ tipper lorry)		103	200	58.5	0	3	40	200	1	0.25	41.5
										Total	**54**

Table 11D.12 Sandford Corner roundabout construction noise calculations (Nearest residential dwelling)

Plant	Source Noise (dB)		Distance	Distance Attenuation	Screening Attenuation	Façade Correction	Traverse Length	Minimum Distance	Correction Factor	On Time (%)	L_{Aeq} at Receptor
	L_{Aeq} at 10m	Sound Power (L_{WA})	m	dB	dB	dB	m	m	F		dB
Upgrade of roads on BE land											
1 x Road planer		25	35.9	0	3	40	25	25	0.5	0.5	71.0
1 x Dozer		25	35.9	0	3	40	25	25	0.5	0.5	66.0
1 x Road roller		25	35.9	0	3	40	25	25	0.5	0.25	66.0
1 x Asphalt paver (+ tipper lorry)		25	35.9	0	3	40	25	25	0.5	0.25	61.0
										Total	**73**

APPENDIX 11E: DETAILED CONSTRUCTION NOISE MODELLING

Construction Noise Prediction Modelling Using CadnaA Software

a) Objective

The objective of the noise prediction modelling exercise was to predict construction noise levels at discrete points in time during the preliminary works and HPC construction phase at the nearest noise sensitive receptor locations. This exercise is intended to be supplemental to the detailed construction noise calculations presented in **Appendix 11D** of **Chapter 11, Volume 2** of the Environmental Statement. The following scenarios were assessed:

Scenario A (approx. Q4 2011) - two months into preliminary works, assuming the following activities:

- residual hedge and tree removal;
- stripping of topsoil;
- topsoil stockpiling at both at the southern operational extent of the Southern Construction Phase Area (latitude 144750mN) and at the western boundary of the Southern Construction Phase Area; and
- preparation works for construction of the northern roundabout close to Pixies Mound.

Scenario B (approx. Q2 2012) **-** six months into preliminary works, assuming the following activities:

- deep (rock) excavation would be ongoing at UK EPR Units 1 and 2;
- excavated materials would continue to be transported to the stockpiles within the Southern Construction Phase Area;
- dump truck using circular haul route between northern and southern land; and
- site levelling at the site of the proposed southern access roundabout.

Scenario C (approx. Q2 2013) - During this phase of works, the following activities are assumed to be ongoing:

- deep excavation and concrete substitution at the location of the UK EPR reactor units;
- construction of temporary and permanent ancillary buildings;
- operation of the temporary jetty;
- tunnelling and construction of the cooling water inlet and outlets;
- construction of the National Grid 400kV substation;
- construction of the on-site accommodation campus; and
- distribution of removed overburden, and storage on the SCPA land.

Scenario D (approx. Q4 2014) - During this phase of works, the following activities are assumed to be ongoing:

- construction of nuclear island buildings;

- construction of temporary and permanent ancillary buildings;
- operation of the temporary jetty;
- construction of the National Grid 400kV substation;
- tunnelling and construction of the cooling water inlet and outlets;
- distribution of removed overburden, and storage on the SCPA land; and
- occupation of the on-site accommodation campus.

Scenario E (approx. Q4 2014) **–** During this phase of works, the following activities are assumed to be ongoing and the night-time construction/maintenance activities would be undertaken:

- construction of nuclear island buildings;
- construction of temporary and permanent ancillary buildings;
- operation of the temporary jetty;
- occupation of the on-site accommodation campus;
- tunnelling and construction of the cooling water inlet and outlets; and
- distribution of tunnel arisings to the fresh rock stockpile area south of Green Lane.

Construction machinery type and numbers assumed for each assessed scenario were in accordance with equipment list for the respective activities presented in Table 11D.9 of **Appendix 11D**.

b) Noise prediction modelling software and calculation methodology

Noise propagation calculations were undertaken in accordance with British Standard BS5228:2009 'Noise and vibration control on construction and open sites' - Part 1 'Noise', which is embedded as a software module.

Predictions of construction noise levels at the receptor locations take account of features that may affect propagation, such as ground absorption; and, screening by the natural and/or formed topography. Other factors, such as the length of the working, traverse and the machinery 'on-time' are also included within the calculations. For this study, it was assumed that all plant and machinery are operating continuously over a 1-hour period, therefore no 'on-time' correction was applied.

Predicted noise levels are therefore a worst case basis and in practice the actual noise levels may not attain those predicted. It should be noted that predicted noise levels are based upon the assumption that standard good construction practice measures will be applied. Such measures to control noise impacts are outlined in BS5228-1:2009. Therefore, source noise data, used in the construction noise calculations, for specified plant (provided in BS5228-1) is based upon well-maintained equipment, and where appropriate integral acoustic enclosures. It should be noted that, in applying the BS5228-1:2009 noise prediction calculation methodology, a maximum screening attenuation of 10dB is used. In reality, attenuation due to screening (for example, by topographical features) might be significantly higher than calculated. The predicted construction noise levels are therefore considered to be overestimated and precautionary.

c) Modelling parameters

i. Modelling the topography

The existing topography of was modelled using 1m LIDAR (Light Reflection and Ranging) data. Beyond this area, 10m Ordnance Survey contours were imported into the model. For each assessed scenario, the local topography of both the northern Built Development Area East and West) and southern land (Southern Construction Phase Area) was adjusted.

Overall, the general gradient change is from the north (sea level) to the south, where the nearest sensitive receptor buildings are located at a level of 20 – 30 m AOD.

ii. Modelling buildings and other obstacles

Existing buildings and cylinders (including chimney stacks) were incorporated within the model. The location and 2-dimensional extent of existing building were based on the 1:10,000 colour raster Ordnance Survey tile.

The height of buildings located on the existing Hinkley Point A and B power stations have been estimated, whilst the height of all sensitive receptor buildings have been set to 6m, allowing for properties of up to two storeys.

iii. Modelling noise sources (emission points)

The following two types of noise sources were included in the model:

- Point sources (construction equipment and machinery)
- Line sources (haul roads)

Octave band noise emission data for each type of construction and earthworks machinery (for example: bulldozers, excavators and dump trucks) were obtained from the Appendices of BS5228-1:2009, where available. The octave sound power levels for equipment assumed in each model scenario (see Tables 11E.1 to 11E.2) are presented in Table 11E.3.

Table 11E.1: Hinkley Point C construction phase noise sources assumed for each assessed scenario

Machinery	Number of operating noise sources				
	A	B	C	D	E
17t Scraper	10	8	0	0	0
28t Dozer	11	10	6	6	2
Mini excavator with hydraulic breaker	2	2	3	3	1
44t Tracked excavator loading dump truck	4	4	4	2	1
20t Tracked mobile drilling rig	1	1	2	2	1
Diesel water pump	6	6	13	13	6
Pulveriser mounted on excavator	4	4	5	3	3
90t Tracked semi-mobile crusher	3	3	2	2	0
wheel wash	1	1	1	1	1

Machinery	Number of operating noise sources				
	A	B	C	D	E
Ship generator	0	0	1	1	1
Jetty conveyor drive unit	0	0	2	2	2
Jetty conveyor/pipeline	0	0	1	1	1
600t Tracked mobile crane	0	0	7	7	3
Directional drill (generator)	0	0	1	1	1
Diesel generator	0	0	5	6	4
10t Sheet piling plant	0	0	3	4	0
26t Truck mounted concrete pump and boom arm	0	0	5	3	0
>50kW Compressor	0	0	4	5	2
Angle grinder (grinding steel)	0	0	0	2	0
Concrete cutting (hand-held circular saw)	0	0	1	2	0
Electric bolter	0	0	7	6	2
Concrete batching plant	0	0	2	2	2
22t Tower crane	0	0	0	20	10
Concrete placing boom	0	0	0	6	4
35t Crawler mounted continuous flight augur drill	0	0	0	1	0
Poker vibrator	0	0	0	2	1
4t Vibratory roller	4	2	0	0	0
400t Wheeled mobile telescopic crane	0	0	0	4	3
Small cement mixer	0	0	3	1	0
50t Mobile telescopic crane	1	0	2	0	0
Vibratory compactor (Wacker plate)	2	0	0	0	0
Road roller	0	0	1	1	0
Asphalt paver	0	0	1	1	0
35t Tracked excavator/loader	0	0	2	2	0
Air Handling Unit (accommodation campus)	0	0	0	3	3
Air Source Heat Pump (ASHP) (accommodation campus)	0	0	0	10	10
5-a-side football pitches (accommodation campus)	0	0	0	2	0

Table 11E.2 shows the number of vehicle movements on each on-site haul road during the assessed scenarios, based upon earthworks volumes calculations.

Table 11E.2 Dump truck movements on haul roads assumed for each assessed Hinkley Point C construction scenario

Ref.	Haul road	Number of movements per hour (40t Articulated dump truck)				
		A	B	C	D	E
H1	Haul Road - southern E-W (north)	30	32	9	4	2
H2	Haul Road - southern E-W (north)	15	5	2	1	0
H3	Haul Road - eastern N-S (south)	45	37	9	4	0
H4	Haul Road - N-S link (north)	30	32	0	0	0
H5	Haul Road - Construction compound loop (north)	0	2	2	40	36*
H6	Haul Road - southern E-W link (north) to western N-S	0	32	9	39	36
H7	Haul Road - northern E-W (north)	0	5	18	12	6
H8	Haul Road - northern access roundabout link	0	1	2	1	0
H9	Haul Road - N-S link (north) to EPR1 site	0	5	12	8	4
H10	Haul Road - E-W link (north)	0	2	2	4	2
H11	Haul Road - N-S link (north)	0	2	0	0	0
H12	Haul Road - western N-S route	0	37	10	42	36*
H13	Haul Road - southern access roundabout link	0	8	2	0	0
H14	Haul Road – northern site boundary (E-W)	0	0	2	38	36*
H15	Haul Road – E-W link immediately north of Green Lane	0	0	2	2	0
H16	Haul Road – E-W link at southern boundary of the operational extent of the SCPA (144750m N)	0	0	10	6	0

*Note: * Only part of the respective haul road in use at night (ID H12 extends to southern boundary of proposed fresh rock stockpile at 145110mN)*

Table 11E.3 Octave sound power data used in the construction noise prediction model

Source	Level ID	Octave Band Sound Power Level, dBlin LW									
		63	125	250	500	1000	2000	4000	8000	dBlin	dBA
28t Dozer	C2 11	103	107	105	105	102	99	93	85	112.0	107.0
Mini excavator with hydraulic breaker	C5 2	107	103	101	102	105	105	103	98	112.6	110.5
44t Tracked excavator loading dump truck	C1 10	110	106	110	109	109	106	100	92	116.5	113.0
20t Tracked mobile drilling rig	C9 1	114	120	113	116	112	111	106	105	123.4	118.1
Diesel water pump	C11 1	109	111	105	103	104	103	97	91	114.9	108.8
Pulveriser mounted on excavator	C1 3	113	104	102	103	102	103	98	93	114.8	108.1
90t Tracked semi-mobile crusher	C9 14	119	119	116	115	113	111	106	96	124.3	118.1
Wheel wash	WHEEL	-	-	-	-	98	-	-	-	98.0	98.0
Ship generator	-	-	106	-	-	-	-	-	-	106.1	90.0
Conveyor drive unit	-	-	-	-	108	-	-	-	-	108.2	105.0
600t Tracked mobile crane	C4 50	96	99	96	90	94	94	83	74	103.4	98.6
Directional drill (generator)	C2 44	95	108	102	100	100	100	96	89	110.6	105.7
Diesel generator	C4 84	103	100	104	98	97	93	84	75	108.4	101.7
10t Sheet piling plant	C3 9	102	99	91	88	84	82	78	72	104.2	91.0
26t Truck mounted concrete pump and boom arm	C4 29	111	105	103	103	102	103	95	91	113.7	107.8
>50kW Compressor	F1 Comp	-	114	-	-	-	-	-	-	114.1	98.0
Angle grinder (grinding steel)	C4 93	85	79	80	88	98	105	101	101	107.1	108.1
Concrete cutting (hand-held circular saw)	C4 73	101	95	98	96	101	106	106	105	108.1	108.7
Electric bolter	BOLT	-	-	-	102	-	-	-	-	102.0	98.8
Concrete batching plant	D6 11	-	-	-	108	-	-	-	-	108.0	111.2

Source	Level ID	Octave Band Sound Power Level, dBlin LW								dBlin	dBA
		63	125	250	500	1000	2000	4000	8000		
22t Tower crane	C4 48	110	105	108	104	94	94	84	78	113.5	104.5
Concrete placing boom	C4 37	91	96	93	90	87	81	81	77	99.5	92.4
35t Crawler mounted continuous flight augur drill	C3 21	109	109	106	104	102	100	96	91	114.0	107.4
Poker vibrator	C4 34	90	98	98	92	90	89	87	84	102.4	96.7
400t Wheeled mobile telescopic crane	C4 38	108	107	101	102	101	101	92	83	112.3	106.2
Conveyor/pipeline	-	-	-	-	84	-	-	-	-	84.2	81.0
4t Vibratory roller	C4 34	104	106	102	105	105	105	101	98	112.7	101.5
Small cement mixer	C4 23	89	93	86	86	85	81	79	77	96.1	89.6
50t Mobile telescopic crane	C4 46	106	97	95	92	90	85	77	68	107.1	94.6
Vibratory compactor (Wacker plate)	C5 29	104	106	102	105	105	105	101	98	112.7	110.5
40t Articulated dump truck	C6 26	116	112	103	101	103	100	96	88	117.9	107.2
Air handling unit (accommodation campus)	AHU					65				65	65
Air Source Heat Pump (ASHP) (accommodation campus)	ASHP	-	78	73.1	67.8	63	68.5	52.1	46	79.9	70.2
5-a-side football pitch (accommodation campus)					69*					69*	65*

Note: * Sound power level per square metre (dB/m^2)

d) Other modelling parameters

i. Ground absorption

All land outside of the HPC development site and the existing nuclear power generation sites at Hinkley Point was assigned a sound absorption factor of 1.00 (soft ground) for the purpose of noise propagation calculations. Land within the construction area, including the Southern Construction Phase Area was assigned an absorption factor of 0.25.

ii. Meteorological conditions

Annual hourly sequential meteorological data which was generated using the United Kingdom Meteorological Office (UKMO) Numerical Weather Prediction Model for the Hinkley Point site was used to define meteorological condition in the noise propagation model. This dataset provides sequential hourly of data (from 1 January 2004 to 31 December 2008).

The following meteorological conditions were assumed:

- Temperature: 10ºC (average temperature 2004 – 2008 inclusive was 11.3ºC).
- Relative Humidity: 70% (average relative humidity 2004 – 2008 inclusive was 77.5%)

iii. Foliage/woodland areas

Areas of existing foliage have been identified within the model. However, these areas have no acoustic features and are therefore not accounted for within noise propagation calculations.

iv. Reflections

Given the distance separation between the Built Development Areas and the nearest noise sensitive receptors, a single order of reflection was permitted within the model.

e) Noise sensitive receptor locations (immission points)

Immission points are positions of noise reception calculation. Modelled prediction calculations determine both the broadband noise and the octave band data at each immission point resulting during each assessed construction scenario.

Immission points were positioned in free-field (i.e. greater than 3.5 m from any reflecting surface other than the ground) at three residential receptor locations and four public amenity locations (footpaths, permissive routes and Pixies Mound). These positions are defined in Table 11E.4 below, and shown in **Figure 11.1** of the ES.

Table 11E.4 Noise Immission Points

Receptor location	Ref.	Ordnance Survey co-ordinates		
		x	y	z (relative to local ground level), m
Knighton Farm	R9	320598.6	144714.1	1.8
Bishops House Farm	R10	319375.7	144513.5	1.8
Doggetts	R7	320092.1	144405.7	1.8
Benhole Lane (south) - public footpath	R5	319714.8	144975.3	1.8
Benhole Lane (north) - public footpath	R4	319535.8	145806.0	1.8
Coastal footpath	R1	319857.7	146151.8	1.8
Pixies Mound	R3	320890.2	145573	1.8

f) Model outputs

Table 11E.5 summarises the construction noise levels, predicted using CadnaA modelling in accordance with BS 5228-1, at each selected receptor location during each assessed scenario. The predicted noise levels are worst-case, assuming that all plant and machinery is operating.

Table 11E.5 Summary of predicted Hinkley Point C construction noise levels at identified sensitive receptor locations (excluding existing ambient noise)

Ref.	Receptor	Type	Predicted $L_{Aeq,T}$ Sound Pressure Level, dB (Free-field)				
			A	B	C	D	E
R9	Knighton Farm	Private residential	52	56	54	46	39
R10	Bishops House Farm	Private residential	49	49	46	47	39
R7	Doggetts	Private residential	47	48	44	43	38
R5	Benhole Lane (south)	Outdoor amenity - Public footpath/PRoW	61	61	54	59	50
R4	Benhole Lane (north)	Outdoor amenity - Public footpath/PRoW	65	57	58	62	58
R1	Coastal footpath	Outdoor amenity - Public footpath/PRoW	60	53	54	57	52
R3	Pixies Mound	Outdoor amenity - Historical feature	69	57	59	61	52

Table 11E.6 below shows the effect of adding measured typical ambient daytime noise levels to these values and therefore provides an indication of potential impacts when compared with magnitude threshold values.

Table 11E.6 Summary of predicted ambient noise levels at identified sensitive receptor locations during Hinkley Point C construction (including existing ambient noise)

Ref.	Receptor	Type	Predicted $L_{Aeq,T}$ Sound Pressure Level, dB (Free-field)				
			A	B	C	D	E
R9	Knighton Farm	Private residential	51	51	49	49	39
R10	Bishops House Farm	Private residential	48	49	46	45	38
R7	Doggetts	Private residential	53	56	54	49	39
R5	Benhole Lane (south)	Outdoor amenity - Public footpath/PRoW	61	61	54	59	50
R4	Benhole Lane (north)	Outdoor amenity - Public footpath/PRoW	65	57	59	62	58
R1	Coastal footpath	Outdoor amenity - Public footpath/PRoW	60	53	55	58	52
R3	Pixies Mound	Outdoor amenity - Historical feature	69	58	59	61	52

Predicted site preparation noise levels include the arithmetic mean of the measured baseline ambient daytime noise levels ($L_{Aeq,15min}$) at receptor locations between 07:00 and 19:00. Ambient daytime noise levels:

- Knighton Farm = 46 dB $L_{Aeq,T}$;
- Doggetts = 45 dB $L_{Aeq,T}$;
- Bishops Farm House = 41 dB $L_{Aeq,T}$;
- Benhole Lane (S) = 41 dB $L_{Aeq,T}$;
- Benhole Lane (N) and coastal footpath = 43 dB $L_{Aeq,T}$; and
- Pixies Mound = 49 dB $L_{Aeq,T}$.

Figures 11.3 to **11.7** show CadnaA noise contour plots, excluding existing ambient noise levels, for each assessed scenario, modelled at a height of 4 m above ground level. The predicted noise levels are worst-case, assuming that all plant and machinery is operating.

APPENDIX 11F: DETIALED OPERATIONAL NOISE MODELLING

1.1 Operational noise prediction modelling using Cadna A software

a) Objective

The objective of the noise prediction model was to determine the overall noise contribution from all operational sources associated with both proposed UK EPR units at the nearest noise sensitive receptor locations.

b) Noise prediction modelling software and calculation methodology

The Hinkley Point C (HPC) noise modelling study utilised Cadna A noise prediction model (Version 4) software, created by DataKustik GmbH, Germany. Noise propagation calculations were undertaken in accordance with the International Standards Organisation guidance document ISO 9613: Part 2: 1996 'Attenuation of sound during propagation outdoors' (Ref. 11F.1).

ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors, in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the sound pressure level under meteorological conditions favourable to propagation from source to the receiver. These conditions are for downwind propagation, as specified in 5.4.3.3 of IS0 1996/BS 7445 or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as can occur at night.

The method specified in part 2 of IS0 9613 consists specifically of octave-band algorithms (with nominal mid-band frequencies from 63 Hz to 8 kHz) for calculating the attenuation of sound that originates from a point sound source, or an assembly of point sources. The source (or sources) may be moving or stationary. Specific terms are provided in the algorithms for the following physical effects:

- geometrical divergence A_{div};
  - $A_{div} = [20 \log(d/d_0) +11]$ dB
  - where: d= the distance from source to receiver (m) and d_0 is the reference distance (1m).
- atmospheric absorption Aatm;
  - $A_{atm} = \alpha d/1000$
  - where; α = the atmospheric absorption coefficient (dB Km^{-1}), d = distance in metres.
- ground effect A_{gr};
  - A_{gr} = A, + A, + A,
  - Where A, = attenuation in the source region, A, = attenuation in the receiver region and A, = attenuation in the middle region.
- screening by obstacles A_{bar};
  - Where A_{bar} is calculated using an octave band based Makaewa/fresnel number based algorithm taking into account diffraction over the top and around the edges of any barrier.

Additionally the methodology includes allowances for reflection of sound off surfaces in the vertical plane (reflections off the ground and in the horizontal plane are allowed for in the calculation of the ground effect).

The ISO 9613 method is applicable in practice to a great variety of noise sources and environments. It is applicable, directly or indirectly, to most situations concerning road or rail traffic, commercial and industrial noise sources, construction activities, and many other ground-based noise sources.

The calculation of the equivalent continuous downwind sound pressure level at a receiver location, L_{AT}(DW), is calculated for each point source, using:

$$L_{AT}(DW) = L_w + D_c - A$$

Where:

L_w, is the octave-band sound power level, in decibels, produced by the point sound source relative to a reference sound power of one picowatt (1 pW);

D_c is the directivity correction, in decibels, that describes the extent by which the equivalent continuous sound pressure level from the point sound source deviates in a specified direction from the level of an omni-directional point sound source producing sound power level L_w; D_c equals the directivity index D_I of the point sound source plus an index D_Ω, that accounts for sound propagation into solid angles less than 4π steradians; for an omni-directional point sound source radiating into free space, D_c, = 0 dB. Where sources are immediately external to building elements (façades/roof), the model includes directivity (i.e. $D_c = 3$);

A is the octave-band attenuation, in decibels, that occurs during propagation from the point sound source to the receiver.

The attenuation term A is given by:

$$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{mis}$$

Where:

- A_{div} is the attenuation due to geometrical divergence;
- A_{atm} is the attenuation due to atmospheric absorption;
- A_{gr} is the attenuation due to the ground effect;
- A_{bar} is the attenuation due to a barrier; and
- A_{mis} is the attenuation due to miscellaneous other effects.

c) Modelling parameters

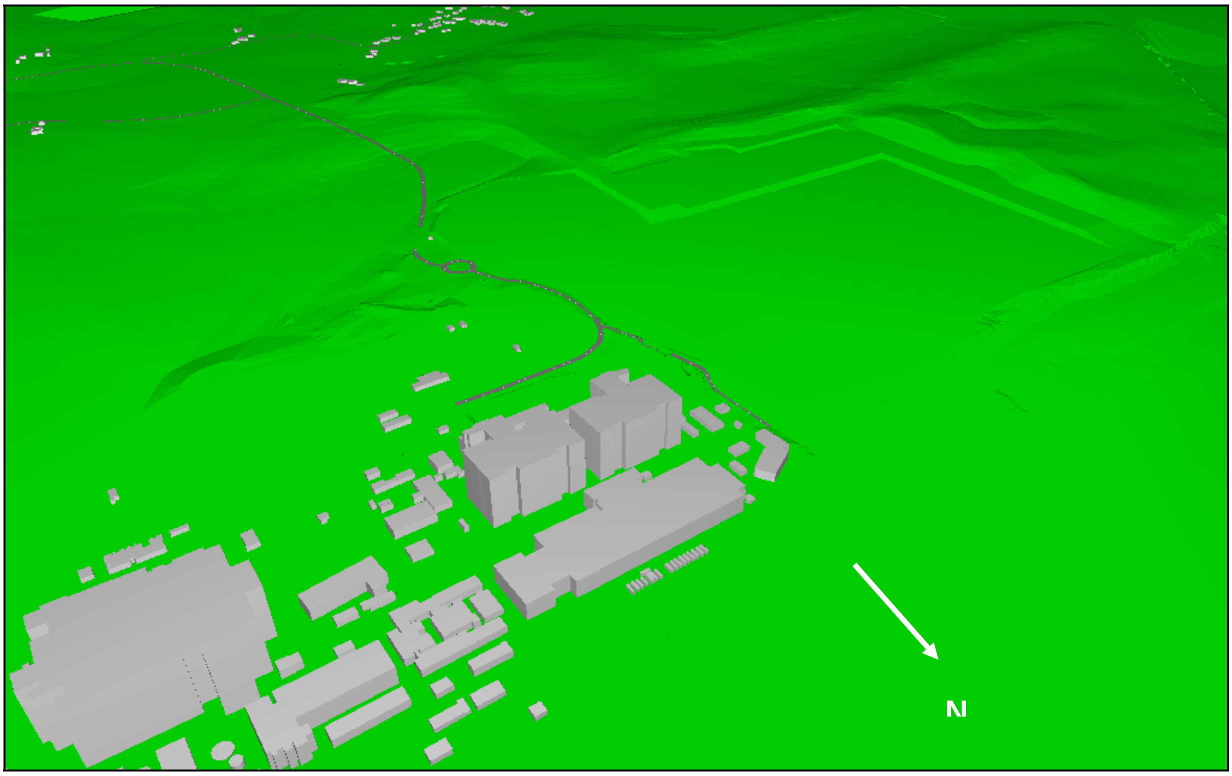
i. *Modelling the topography*

The existing topography of was modelled using 1m LIDAR (Light Detection and Ranging) data. Beyond this area, 10 m Ordnance Survey contours were imported into the model. The local topography of the Hinkley Point C site was adjusted in light of design decisions, including a +14.00m AOD level for the nuclear island platform, and other terracing for permanent ancillary buildings, the landscape restoration plan and site layout plan (see **Volume 2, Chapter 2** of the ES).

Overall, the general gradient change is from the north (sea level) to the south, where the nearest sensitive receptor buildings are located at a level of 20 – 30m AOD. The modelled contours for the site and surrounding land are shown in **Plate 11F.1** and represented in a 3-dimensional view in **Plate 11F.2**.

Plate 11F.1: Topographical model showing proposed development height contours

Plate 11F.2: 3D image of the topography with proposed Built Development Area platforms



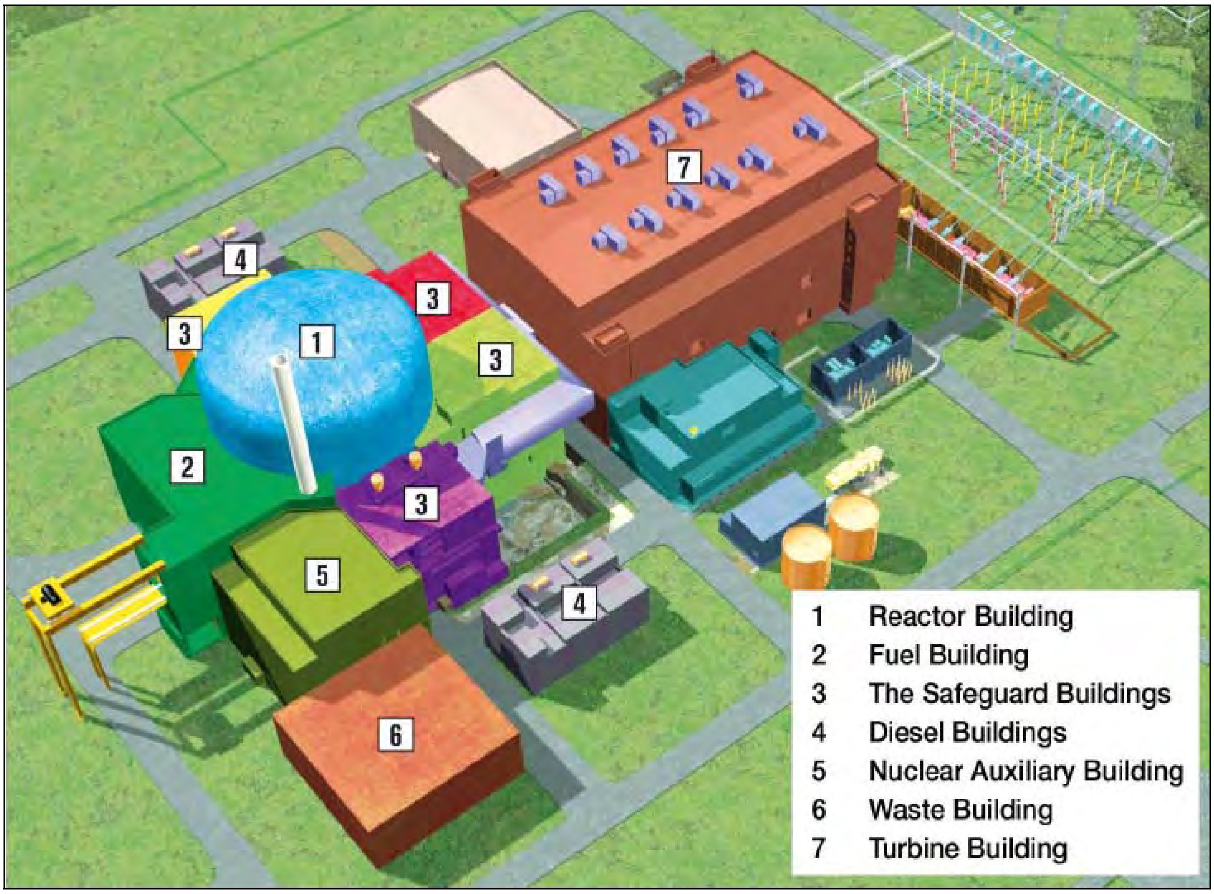
ii. *Modelling buildings and other obstacles*

Existing and proposed buildings and cylinders (including chimney stacks) were incorporated within the model based on the HPC site layout plan as presented in **Chapter 2** of the ES. The location and 2-dimensional extent of existing building were based on the 1:10,000 colour raster Ordnance Survey tile.

The height of buildings located within the existing Hinkley Point Power Station Complex have been estimated, whilst the height of all sensitive receptor buildings have been set to 6 m, allowing for properties up to two storeys.

A typical UK EPR plant configuration image is presented in the Pre-Construction Environmental Report (Sub-Chapter 1.2, Figure 1). This image is replicated in **Plate 11F.3** below. It should be noted however that, as a result of ongoing engineering and architectural studies at this and other EPR construction sites, **Plate 11F.3** does not accurately represent the proposed nuclear island design of HPC UK EPR units (as shown in **Plates 11F.4 and 11F.5**).

Plate 11F.3: Typical UK EPR plant configuration



The full complement of proposed buildings, chimney stacks and tanks associated with the HPC development, including relative height data, is provided in **Tables 11F.1 and 11F.2** below.

Table 11F.1: Hinkley Point C – modelled buildings

ID	Name	Façade Sound Absorption*	Relative Height (m)
C2-HM	Turbine Hall	0.37	45.8
HB-POE	Operational Service Centre	0.37	35.1
C1-HM	Turbine Hall	0.37	45.8
C1-HF	Non Classified Electrical Building	0.37	19.9
C1-HTE	GIS Gear	0.37	14.5
C1-HTP	Main Transformer	0.37	15
C1-HTS	Unit Transformer	0.37	12
C1-HTS	Unit Transformer	0.37	12
C1-HJA	Auxiliary Transformer	0.37	12
HDC/HDD/SBO	Emergency Diesel Buildings	0.37	27.2
HDA/HDB/SBO	Emergency Diesel Buildings	0.37	27.2
HDA/HDB/SBO	Emergency Diesel Buildings	0.37	27.2
C2-HF	Non Classified Electrical Building	0.37	19.9
C2-HTP	Main Transformer	0.37	15
C2-HTE	GIS Gear	0.37	14.5
C2-HTS	Unit Transformer	0.37	12
C2-HTS	Unit Transformer	0.37	12
C2-HZO	Oxygen Store	0.37	3.3
C2-HJA	Auxiliary Transformer	0.37	12
C2-HLB/HLG	Safeguard Mech. buildings - north	0.37	34.1
C2-HLC/HLH	Safeguard Mech. buildings - north	0.37	34.1
C2-HW2	Access Building	0.37	26.5
C2-HLD/HLI	Safeguard Mech. buildings - east	0.37	37.3
C2-HN	Nuclear Auxiliary Building	0.37	34.5
C2-HK	Fuel Building	0.37	35.6
C2-HK-HLA	Connection HLA-HK	0.37	31.9
C2-HLF-HLB	Connection HLF-HLB	0.37	30
C2-HLA/HLF	Safeguard Mech. buildings - west	0.37	36.1
C2-HQC	Radioactive Waste Treatment Building	0.37	12.4
C1-HN	Nuclear Auxiliary Building	0.37	34.5
C1-HK	Fuel Building	0.37	35.6
C1-HLA-HK	Connection HLA-HK	0.37	31.9
C1-HLD/HLI	Safeguard Mech. buildings - east	0.37	37.3
C1-HLA/HLF	Safeguard Mech. buildings - west	0.37	36.1

ID	Name	Façade Sound Absorption*	Relative Height (m)
C1-HW1	Access Building	0.37	26.5
C1-HLB/HLG	Safeguard Mech. buildings - north	0.37	34.1
C1-HLC/HLH	Safeguard Mech. buildings - north	0.37	34.1
HQB	Radioactive Waste Process Building	0.37	13.3
HQA	Radioactive Waste Storage Building	0.37	16.3
HVL	Hot Laundry	0.37	11.4
HDC/HDD/SBO	Emergency Diesel Buildings	0.37	27.2
HXA	KER/TER/SEK Tanks	0.37	15.9
HVD	Hot Workshop/Warehouse Decontamination	0.37	15.9
HVB	Auxiliary Boilers	0.37	17.1
C1-HZO	Oxygen Store	0.37	3.3
C1-HZH	Hyrodgen Store	0.37	3.3
C1-HLC-HLI	Connection HLC-HLI	0.37	30
C2-HZH	Hyrodgen Store	0.37	3.3
C2-HP A-B-C-D	Service Water Pump Building	0.37	17.8
C1-HP A-B-C-D	Service Water Pump Building	0.37	17.8
HOA	EDF Site offices	0.37	9.3
HOA	EDF Site offices	0.37	9.3
HEL	Helipad	0.37	0.2
HOG	Oil & Grease Storage	0.37	9.1
HBW	AREVA Warehouse	0.37	13.8
HBS	Training/Simulator building	0.37	10.5
PIC	Public info centre	0.37	18.5
HZC	Chemical Products Storage	0.37	6.7
HBM	Medical centre	0.37	4.5
HUA HUB	Security and control access	0.37	5
ERB	Entry relay store	0.37	5
HHK	Spent fuel building	0.37	25
HHI	Intermediate level waste store	0.37	16
HY	Demineralisation	0.37	13.6
STP	Sewage treatment plant	0.37	1.7
HHC	Contaminated tools store	0.37	12.9
Subs - Inductor	No.1 Phase Units	0.37	5
Subs - Amenity	Substation - Amenity building	0.37	3.5

ID	Name	Façade Sound Absorption*	Relative Height (m)
Subs - ES	Substation - Earth Store	0.37	3.3
Subs - GHA	Substation - GIS Hall Annex	0.37	4.4
Subs - GIS	Substation - GIS Hall	0.37	14
Subs - DG	Substation - Diesel Generator	0.37	3.3
Subs - DNO	Substation - Distribution Network Operator Transformer	0.37	2.2
TU1	Outage Access	0.37	4
HBG	Garage for handling facilities	0.37	7.8
HUC	Auxiliary Administration Centre	0.37	14.4
HHC	Contaminated tools store	0.37	12.9
CWS	Conventional Waste Store	0.37	7
C2-HKH	HKH	0.37	13.3
C1-HKH	HKH	0.37	13.3
C2-HJO	Fire-fighting Water Building	0.37	6.8
C1-HJO	Fire-fighting Water Building	0.37	6.8
C2-HCA	Outfall Pond	0.37	1
C1-HCA	Outfall Pond	0.37	1
HHK-cooling	Cooling Tower	0.21	0.1
HHK-cooling	Cooling Tower	0.21	0.1
HHK-cooling	Cooling Tower	0.21	0.1
HHK-cooling	Cooling Tower	0.21	0.1
Subs - Inductor	No.1 Phase Units	0.37	5
Subs - Inductor	No.1 Phase Units	0.37	5
Subs - WS	Substation - Workshop	0.37	2.2
Subs - TDG	Substation - Temporary Diesel Generator	0.37	3.3
C2-HPF	Forebay	0.37	3.3
C1-HPF	Forebay	0.37	3.3
C1-HCB	Filtering debris recovery pit	0.37	1.1
HOR	Attenuation Pond	0.37	2.6
HUD	Access Control Building	0.37	4
VSA	Off Site Vehicle Search Area	0.37	3.1

*Notes: * The standard absorption coefficients assumed were 0.37 for structured façades, and 0.21 for smooth (reflecting) façades.*

Table 11F.2: Hinkley Point C – modelled stacks and tanks

ID	Name	Façade Sound Absorption*	Radius (m)	Relative Height (m)
C2-HR	Reactor Building	0.21	28	56.6
C1-HR	Reactor Building	0.21	28	56.6
C2-stack	Main Stack	0.84	1.5	35.5
C1-stack	Main Stack	0.84	1.5	35.5
SER	SER Tank	0.21	15	20
SER	SER Tank	0.21	15	20
SED	SED Tank	0.21	6	13
C2-HR2	HR DOME2	0.21	21	4
C2-HR3	HRDOME3	0.21	15	2
C2-HR4	HRDOME4	0.21	10	1
C1-HR2	HR DOME2	0.21	21	4
C1-HR3	HR DOME3	0.21	15	2
C1-HR4	HR DOME4	0.21	10	1
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
SBO stack	Stand-by Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
SBO stack	Stand-by Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
SBO stack	Stand-by Diesel Generator stack	0.21	0.5	30
EDG stack	Emergency Diesel Generator stack	0.21	0.5	30
SBO stack	Stand-by Diesel Generator stack	0.21	0.5	30
HHK stack	Spent fuel building stack	0.21	2.51	45
C1-HCA	Outfall Pond	0.21	18.17	10.5
C2-HCA	Outfall Pond	0.21	18.15	10.5
HSM	Meteorological Station Mast	0.21	6.13	4.2
HSM	Meteorological Station	0.21	6.98	4.2

*Notes: * The standard absorption coefficient assumed was 0.21 for smooth (reflecting) surfaces.*

The proposed Nuclear Island and Conventional Island buildings as modelled in the assessment are presented in **Plate 11F.4** below. **Plate 11F.5** shows a 3-dimensional graphic of the buildings in the nuclear island.

Plate 11F.4: Building model showing the layout of the proposed HPC nuclear island and ancillary buildings

Plate 11F.5: 3D image of proposed HPC Nuclear Island and ancillary buildings

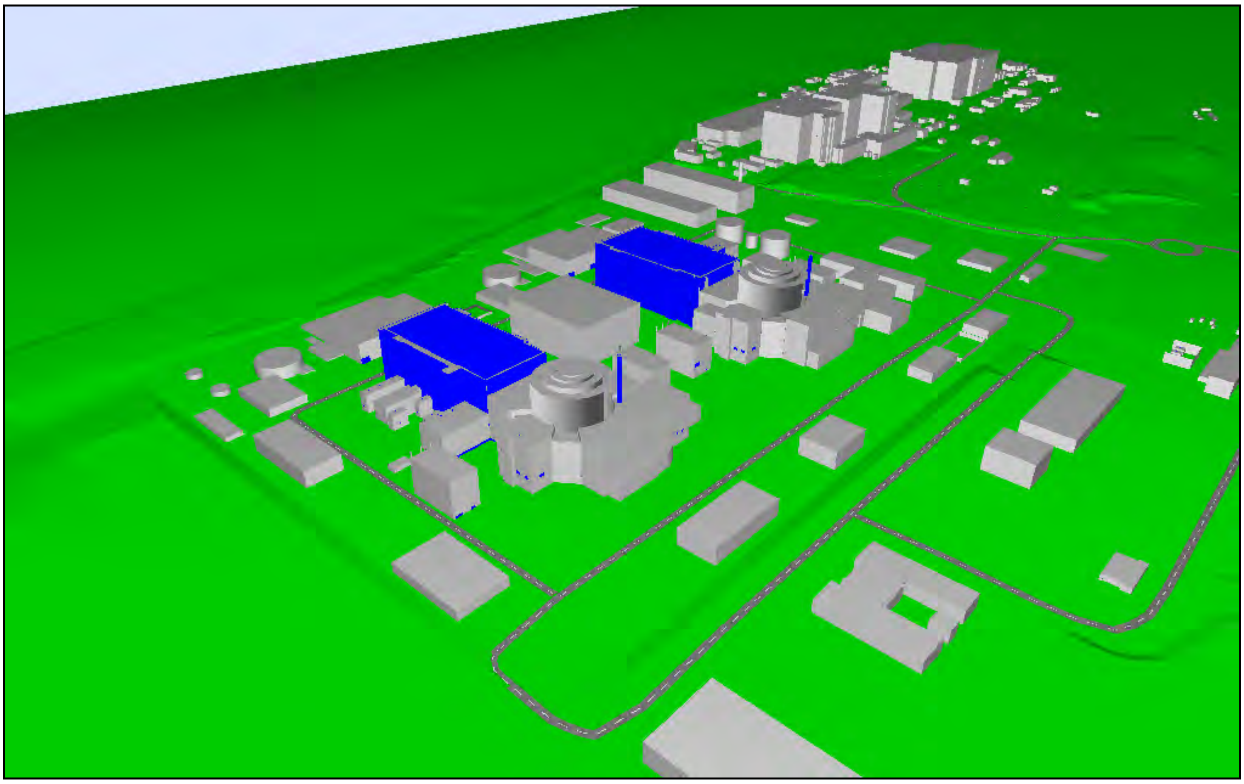
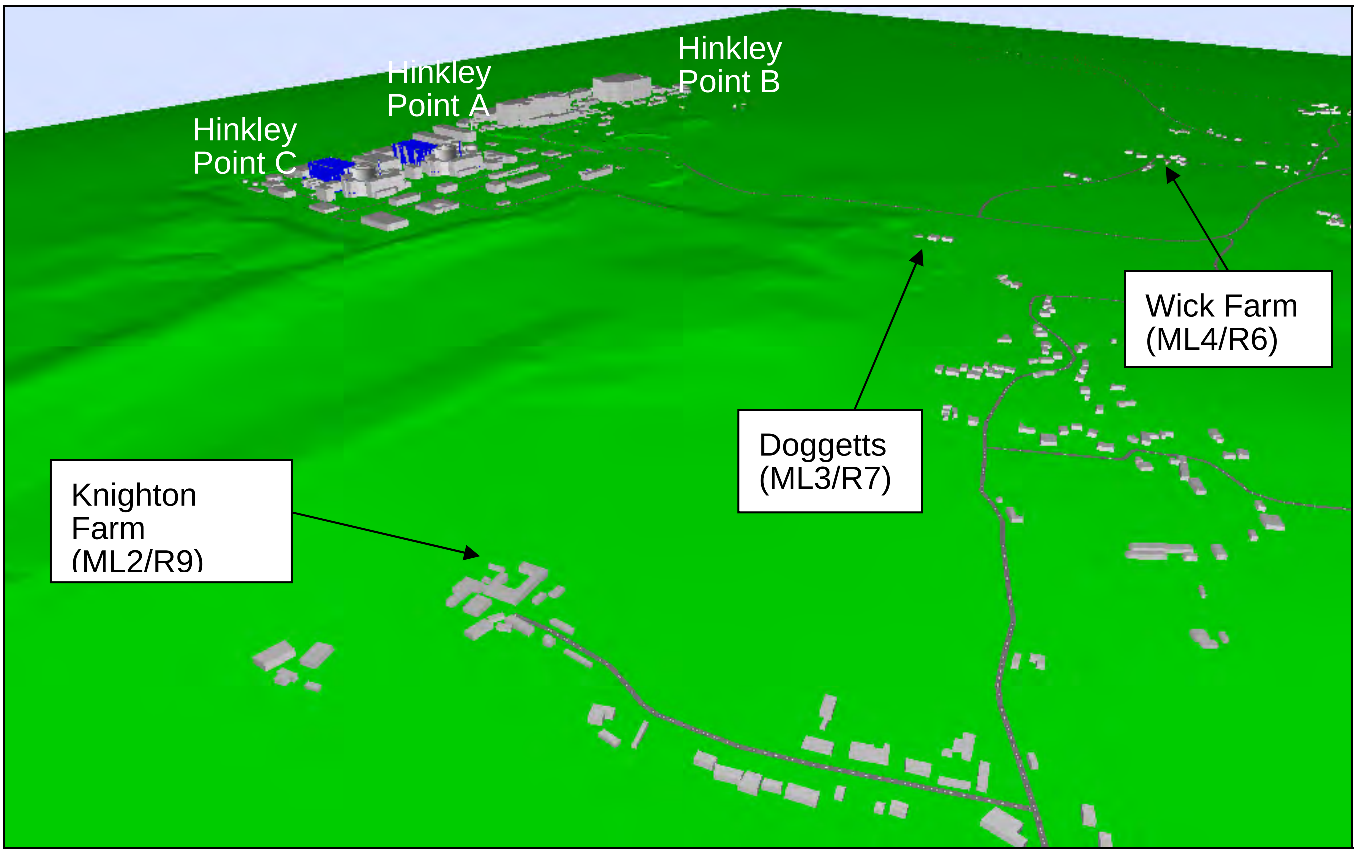


Plate 11F.6 below identifies the location of the noise sensitive receptor (R) and baseline monitoring (ML) locations used in the impact assessment and their respective position relative to the existing and proposed nuclear power generation sites.

Plate 11F.6: 3D image of noise sensitive receptor locations and proposed HPC



iii. *Modelling noise sources (emission points)*

Three types of noise sources were included in the model, including:

- Point sources;
- Area sources – vertical area sources were used to model openings and air vents in building façades;
- Line sources – used for pipelines; and
- The directivity of noise emissions was based upon the source type (e.g. chimney stack exit or building façade) and the source location (openings in building façades).

Octave band noise emission data was derived from 1/3rd octave band data presented in an acoustic assessment report for a proposed EPR development at Penly, France. This report also defined the dimensions and height of each individual noise source. Individual noise sources associated with the proposed Nuclear Island and Conventional Island for a single UK EPR unit are presented in **Table 11F.3** below.

Table 11F.3: Noise sources of a single UK EPR unit

Building			Noise sources	Sound Power Level dB L_{WA}
Nuclear island	Nuclear auxiliaries building	HN	Refrigerant group DER	102.1 per unit
			Hopper HNX	87.7
	Fuel building	HK	Chimney - Chimney stack - Chimney opening	104.9, made up of: 91.3 104.7
	Electrical building	HLA	Hopper	91.3
		HLB	Air inlet	89.9
		HLC	Air inlet	89.9
		HLD	Hopper	88.9
			Air outlet	95
		HLA and HLD	Refrigerant group DEL	101.4 per unit
		HLA and HLC	Hopper	96.3
	Diesel	HDA and HDB	Hopper 01VB	89.4 per opening
			Hopper 01VB	87.7 per opening
			Hopper 03VB	105 per opening
		HDC and HDD	Hopper 01VB	89.4 per opening
			Hopper 01VB	87.7 per opening
			Hopper 03VB	105 per opening
	Above the electrical buildings		Steam piping Division 1	82.6
			Steam piping Division 2	82.4
			Steam piping Division 3	82.4
			Steam piping Division 4	82.6
	Spent fuel building	HHK	Air-water heat exchanger towers (4 towers each containing 2 exchangers)	102.8 per exchanger unit
Conventional island	Turbine hall	HM	Facades and roof	94.1
			Roof vents (40 vents per EPR unit)	91.0
			Lamellae (2 lamellae per EPR unit – NE and SW)	97.4
	Unclassified Electrical Building	HF	Refrigerant group	88.8 per unit
	Pumping station	HP	Pumping station	90.3
	Main transformer	HT	Pole TP	105.2 per unit

Building			Noise sources	Sound Power Level dB L_{WA}
			Ventilation TP	88.2 per unit
	Step down transformer		Pole TS	98 per unit
			Ventilation TS	88.7 per unit
	Auxiliary transformer	HJ	Pole TA	98
			Ventilation TA	88.7 per unit
	POE		Refrigerant group	101.4 per unit
National Grid Substation	Series Inductors		Inductor	100 dB per unit

This broadband sound power level from each building was further distributed between the discrete sound emitting elements. The octave band data for each of these elements as used in the noise prediction model are presented in **Table 11F.4** below.

A number of worst-case assumptions were made regarding operation of some noise sources listed in **Table 11F.3**. Notably, it was assumed that four of the eight emergency diesel generators (EDGs) and two of four Station Black Out (SBO) generators are in operation. This is safety equipment, providing backup power supply in the unlikely event of loss of the main off-site power supply when house load operation fails, so that the EPR unit can be secured and the reactor cooled. These backup generators routinely operate during periodic tests, which represent an estimated 60 hours per year for each of the EDGs and SBO generators. Each EDG and SBO will also be operational for 242.5 hours per year and 738 hours per year, respectively, during the initial commissioning of the plant.

Similarly, it is assumed that eight of the 12 heat exchangers associated with the spent fuel building are in operation. However, ventilation will only be required during periods of high ambient air temperature and/or on occasions of large inventory stored in the cooling ponds. It should be noted that operation of all 12 heat exchangers would only occur in the event of an emergency.

Table 11F.4: Octave sound power data used in the noise prediction model for Hinkley Point C

Source	Level ID	Octave Band Sound Power Level, dBlin L_W										
		31.5	63	125	250	500	1000	2000	4000	8000	dBA	dBlin
HN Ventilation	L01	81.3	77.6	77.4	81.9	76.7	73.9	72.8	54.9	42.5	79.8	86.9
HK Main stack - emission point	L02	106.5	108.4	103.6	105.2	103.3	99.5	94.7	87.3	64.7	104.6	113.1
HK Main stack - stack	L03	102	95.7	90	92	93.7	78.2	75.8	67.5	61.7	91.8	103.9
HLA Hoppers - 2 units	L04	87.3	83.6	83.4	87.9	82.7	79.9	78.8	60.9	48.5	85.8	92.9
HLA Hoppers - 1 unit	L05	89.1	85.4	85.2	89.7	84.5	81.7	80.6	62.7	50.3	87.6	94.7
HLA + HLD Refrigerator	L06	0	0	92	93	101	95	94	89	81	101.4	103.6
HLD Hoppers	L07	87.3	83.6	83.4	87.9	92.7	79.9	78.8	60.9	48.5	90.7	95.6
HLD Air exit	L08	91.2	93.8	82.7	91.5	92.9	91.7	85.7	76.2	61.5	95	99.6
HLB Hopper	L09	84.3	80.6	80.4	84.9	79.7	76.9	75.8	57.9	45.5	82.8	89.9
HLC Hopper	L10	84.3	80.6	80.4	84.9	79.7	76.9	75.8	57.9	45.5	82.8	89.9
HLB+C Ventilation	L11	106.8	102.4	98.6	98.8	94.5	90.9	85.5	78.7	69.7	96.5	109.3
HDA-HDB + HDC-HDD Diesel vent opening V2b	L12	90.8	87.1	86.9	91.4	86.3	83.4	82.4	64.4	52.1	89.3	96.4
HDA-HDB + HDC-HDD Diesel vent opening V2c	L13	89.1	85.4	85.2	89.7	84.5	81.7	80.6	62.7	50.3	87.6	94.7
HDA-HDB + HDC-HDD Diesel air exit	L14	92.8	104.5	100.6	108.2	103.6	99.3	94.2	87.2	80.2	105.2	111.5
Steam pipes - Vapdiv1 + 4	L15	0	0	0	0	86.3	0	0	0	0	83.1	86.3
Steam Pipes - Vapdiv2 + 3	L16	0	0	0	0	86.1	0	0	0	0	82.9	86.1
HF Elec Building - Refrigeration unit	L20	0	96.7	92.7	89.7	87.7	82.7	77.7	70.7	0	88.7	99.2
HP Pumping station	L21	91	86.6	88.8	80.5	89.2	76.1	67.7	60.4	50.3	86.8	95.4
HT Transformer - Pole TP	L22	69	89	103.2	103.7	103.1	100.2	97.5	89.1	79.6	105.1	109.2
HT Transformer - Ventilation plant TP	L23	53.6	64.5	77.9	81.7	83.4	83.4	82.4	77.3	71.9	88.2	89.5
Stepdown transformer - Pole TS	L24	103.9	107	102.2	101.7	94.1	90.4	84.6	78.2	70.7	97.3	110.4

Source	Level ID	Octave Band Sound Power Level, dBlin L_W										
		31.5	63	125	250	500	1000	2000	4000	8000	dBA	dBlin
Stepdown transformer - Ventilation plant TS	L25	54.1	65	78.4	82.2	83.9	83.9	82.9	77.8	72.4	88.7	90
HJ Auxiliary transformer - Pole TA	L26	103.9	107	102.2	101.7	94.1	90.4	84.6	78.2	70.7	97.3	110.4
HJ Auxiliary transformer - Ventilation plant TA	L27	54.1	65	78.4	82.2	83.9	83.9	82.9	77.8	72.4	88.7	90
Substation inductor and cooling	L31	0	0	116.1	0	0	0	0	0	0	100	116.1
Spent fuel cooling plant	L41	39.4	96.2	103.1	102.6	100.2	97	95.8	89	81.1	102.8	108
Turbine Hall north	L42	0	0	97.5	74.1	65	59.3	59.7	49.3	37.2	81.6	97.5
Turbine Hall south	L43	0	0	98.6	69.7	48.3	39.8	32.2	24.2	20.1	82.5	98.6
Turbine Hall east	L44	0	0	104.1	75.2	53.8	45.3	37.7	29.7	25.6	88	104.1
Turbine Hall west	L45	0	0	103.4	75.7	62.2	56.3	56.4	46.1	34.4	87.4	103.4
Turbine Hall roof	L46	0	0	104.8	75.9	54.5	46	38.4	30.4	26.3	88.7	104.8
Turbine Hall roof vent	L47	0	78.2	71.5	77.6	67.9	67	68.9	61	55.9	74.6	82
Turbine Hall lamella	L48	0	0	102.2	96	91	87.5	84.5	80.5	77	94.3	103.6

d) Other modelling parameters

i. *Ground absorption*

All land outside of the Development Site and the existing Hinkley Point Power Station Complex was assigned a sound absorption factor of 1.00 (soft ground) for the purpose of noise propagation calculations. The remaining ground was assigned a ground absorption factor of 0.20, to account for hard surfaces and small obstacles (machinery, vehicles etc). Areas supporting pylons and other electrical plant on the proposed substation site were assigned a ground absorption of 0.5 as these will be covered by stone chippings.

ii. *Meteorological conditions*

Annual hourly sequential meteorological data which was generated using the United Kingdom Meteorological Office (UKMO) Numerical Weather Prediction Model for the Hinkley Point site was used to define meteorological condition in the noise propagation model. This dataset provides sequential hourly of data (from 1 January 2004 to 31 December 2008). The industrial noise calculation utilises the ISO 9613-2 methodology for the determination of meteorological correction (C_{met}).

The following meteorological conditions were assumed:

- Temperature: 10ºC (average temperature 2004 – 2008 inclusive was 11.3ºC). Ambient temperature is used in the prediction and calculation of sound emission directivity from exhaust stacks.
- Relative Humidity: 70% (average relative humidity 2004 – 2008 inclusive was 77.5%).

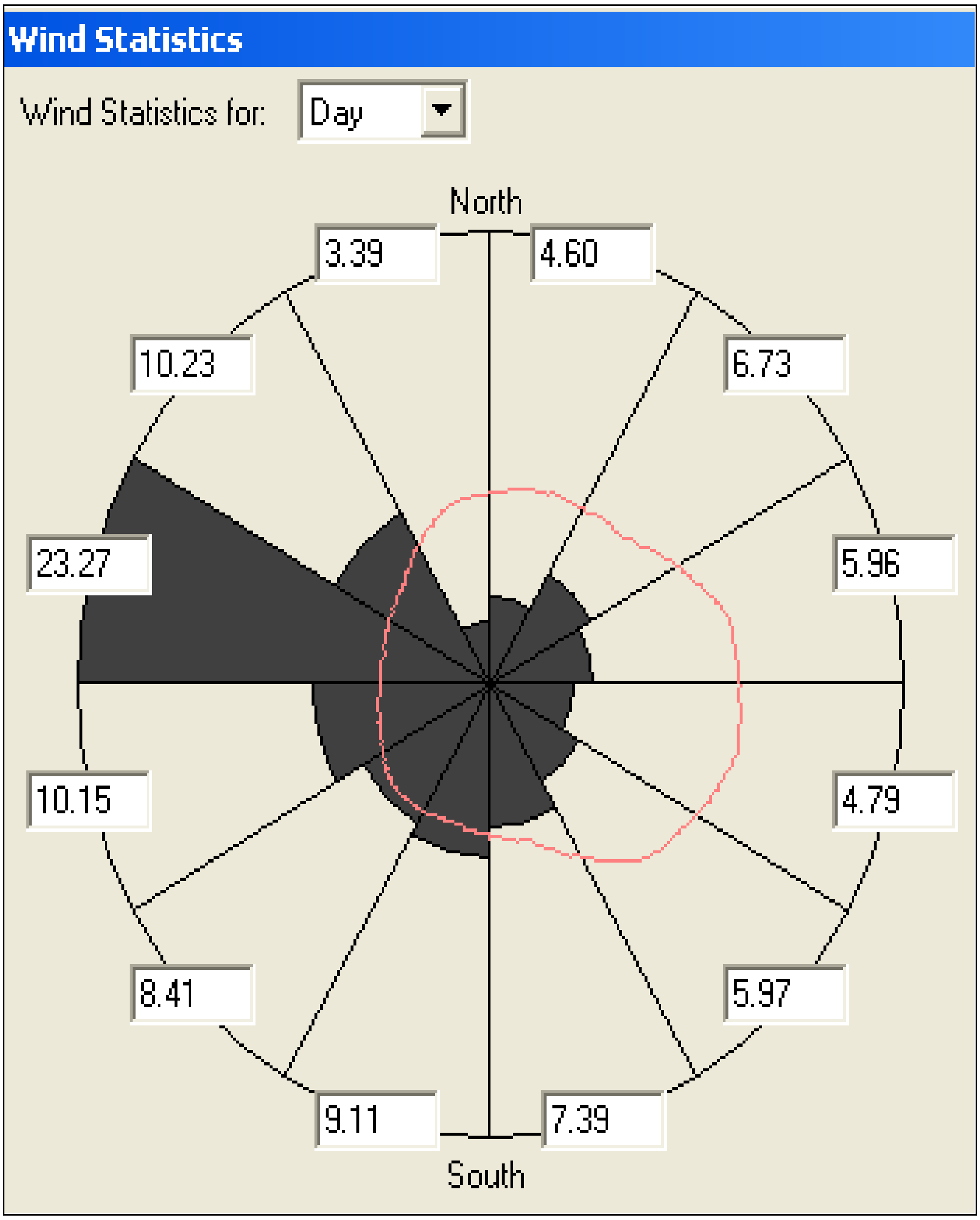
Additional sensitivity testing was undertaken to indicate the effects of wind parameters on predicted noise levels at each receptor location. BS 4142 does not specify a calculation methodology for determining the effects of meteorology on noise propagation, except for a recommendation that the calculation method adopted should be reported and reasoned appropriately. Noise propagation calculations were therefore undertaken using the following methodologies:

1) Average wind direction: The ISO 9613-2 method for determination of C_{met} based on local meteorological conditions provides the most realistic assessment of long-term noise propagation. This uses the proportionality of long-term wind parameter data, presented in **Plate 11F.7** below;

2) Downwind propagation: Noise propagation under downwind conditions was undertaken in accordance with ISO 9613-2: 1996, which assumes:

> *“ - wind direction within and angle of ±45º of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and*
>
> *“ – wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above ground.”*

Plate 11F.7: Proportion of wind direction (Hinkley Point, 2004-2008)



ISO 9613-2 indicates that, whilst meteorological effects might fall in the range of zero to approximately +5dB (C_0), “values in excess of 2 dB are exceptional”. As a typical worst case, a constant C_0 value of +2.0dB was assumed in order to derive the effects of meteorological conditions on downwind noise levels; and

3) Neutral: No wind directionality or speed was assumed.

iii. *Foliage/woodland areas*

Areas of existing foliage have been identified within the model. However, these areas have no acoustic features and are therefore not accounted for within noise propagation calculations.

iv. *Reflections*

Given the distance separation between the Built Development Areas and the nearest noise sensitive receptors, a single order of reflection was permitted within the model.

e) Noise sensitive receptor locations (immission points)

Immission points are positions of noise reception calculation. Modelled prediction calculations determine both the broadband noise and the octave band data at each immission point resulting from operation of the HPC development. The results data also provides the partial noise contributions from each significant modelled noise source.

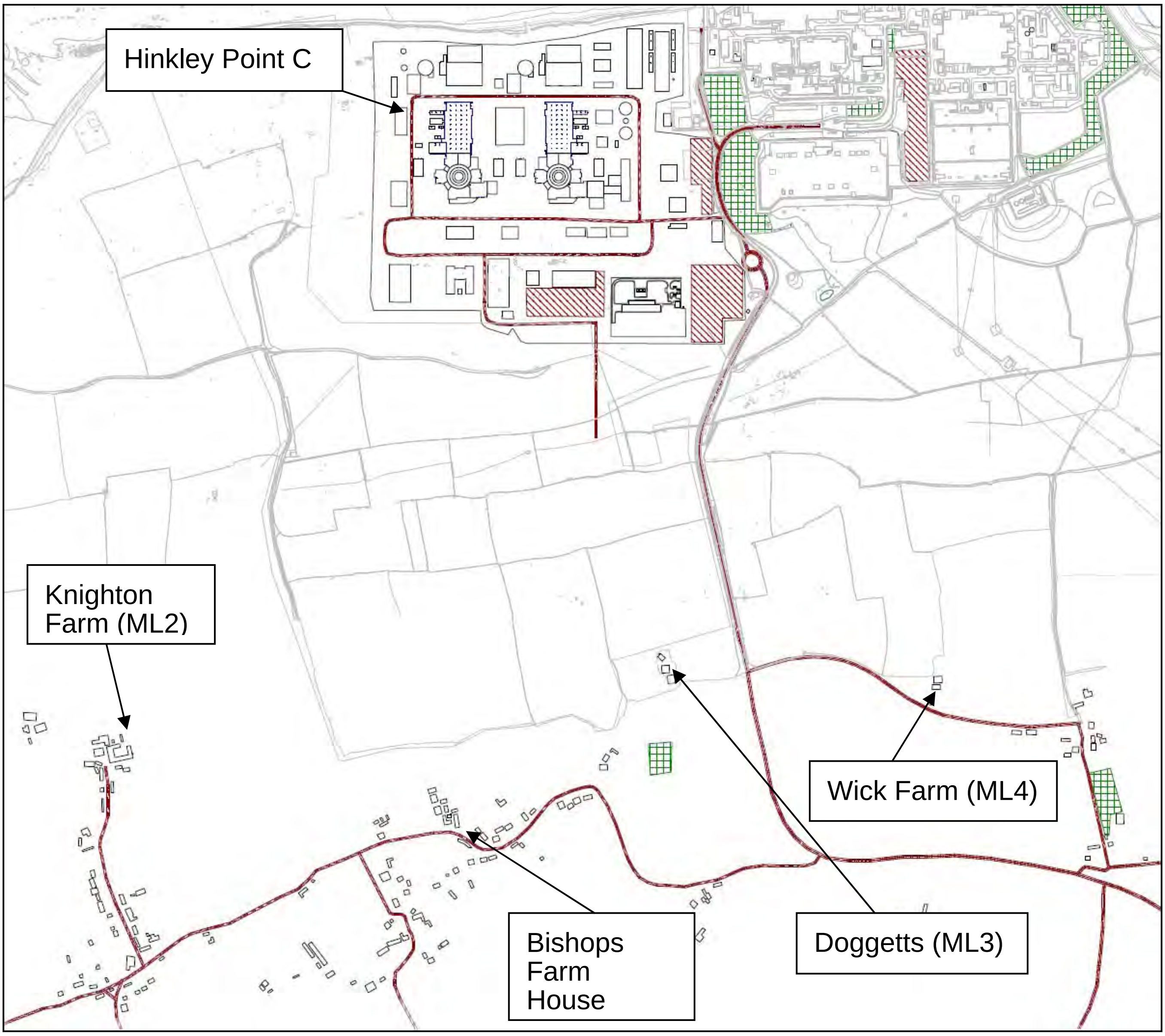
For comparison, immission points were positioned at the nearest façade of the nearest noise sensitive receptor locations for comparison with the measured baseline noise levels described in the Factual Noise Report. These positions are defined in **Table 11F.5** below:

Table 11F.5: Noise Immission Points

Receptor	Ref. (Factual Noise Report baseline data)	Co-ordinates			Position
		x	y	z (relative to local ground level), m	
Knighton Farm	ML2	319387.94	144482.17	4	1 m from Facade
Doggetts	ML3	320601.17	144711.64	1.5	
Wick Farm	ML4	321579.41	144630.40	4	

The location of each of these immission points is identified in **Plate 11F.8**:

Plate 11F.8: Location of noise immission points in relation to the proposed Hinkley Point C nuclear power station



f) Model outputs

A summary of the predicted noise levels at each receptor location under the three meteorological testing scenarios are presented in **Table 11F.6** below. Noise contour grids (10m x 10m interval, at 4 m AOD) calculated using the neutral and average wind scenarios are presented in **Figures 11.8 and 11.9**.

Table 11F.6: Predicted operational noise level at nearest receptor dwellings

Ref.	Receptor	Predicted $L_{Aeq,T}$ Sound Pressure Level, dB (Façade)		
		L_{AT}(LT) (Average wind direction)	L_{AT}(DW) Downwind	L_{AT} Neutral (no wind)
ML2/R9	Knighton Farm	33.7	36.6	35.2
ML3/R7	Doggetts	29.6	32.3	30.9
ML4/R6	Wick Farm	32.2	34.9	33.4

The predicted noise levels are worst case, assuming that all plant and machinery is operating. This includes worst case operation of emergency and stand-by generators, which will only operate for 88 hours per year during down periods.

Tables 11F.7 – 11F.9 show the partial noise levels of the 20 most significant noise sources affecting each receptor location, ranked by the broadband noise contribution under the average wind direction modelling scenario. These also include partial A-weighted octave sound pressure levels at each location attributable to each source.

Table 11F.7: Partial noise levels from the top 20 most significant sources – Knighton Farm (average wind scenario)

Source	ID	Partial Level, dB(A)								
		dB L_{Aeq}	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
HR2 main stack - emission point	S001	28.2	-2.4	12.6	11.3	20.7	25.3	21.9	9	-33.8
HR1 main stack - emission point	S002	27	-3.3	11.6	10.4	19.6	24.1	20.6	6.9	-38.9
2 - HLA Refrigeration plant	S003	22			-3.1	6.4	20.6	15.3	6.5	-33.5
2 - Main transformer pole27	S026	21.4	-44.5	-11.5	3.5	12.8	18.6	16.2	4.9	-41.4
2 - HLD Refrigeration plant	S004	21.2			-7.3	3.6	19.9	14.5	5.4	-35.6
1 - HLA Refrigeration plant	S005	20.7			-4.2	5.3	19.4	13.9	4.3	-38.4
1 - HLD Refrigeration plant	S006	19.8			-8.6	2.1	18.6	12.9	3	-41
2 - Main transformer pole4	S018	18.5	-48.4	-15.3	0.5	10.3	15.6	13.1	1.8	-44.7
2 - Main transformer pole6	S019	18.5	-48.4	-15.3	0.5	10.3	15.6	13.1	1.6	-45.6
2 - Main transformer pole2	S017	17.7	-48.3	-15.3	0.5	9.5	14.8	12.3	1	-45.3
Substation inductor and cooling 3	S067	15.8	-75.6	-74.6	15.8	-82.6	-81.9	-84.9		
2 - Step down transformer pole5	S041	15.3	-9.4	6.7	2.8	11.1	9.9	6.6	-7.6	-51.1
Substation inductor and cooling 2	S066	14.3	-75.6	-75.7	14.3	-83.6	-83.7	-87.7		
2 - steam pipe vapdiv1	S67	14.1		-85.1	-84.7	-77.1	14.1	-70.5	-78.2	
2 - Steam pipe vapdiv2	S69	12.7		-84.9	-85.3	-78	12.7	-71	-78.3	
2 - Step down transformer pole1	S037	12.4	-12.2	3.9	0.7	8.6	6.8	2.6	-13.1	-58.8
2 - Main Stack - stack	S21	12.1	-10.8	-4.1	-7	3.4	11.2	-3.8	-14.2	-58
Substation inductor and cooling 1	S065	11.7	-75.6	-76.8	11.7					
2 - Step down transformer pole6	S042	10.8	-12.3	3.8	0.2	7.1	4.2	-0.7	-16.9	-63.1
1 - Main transformer pole2	S027	8.3	-50	-18.2	-4	2.6	5.4	0.1	-14.6	-66.9

Table 11F.8: Partial noise levels from the top 20 most significant sources – Doggetts (average wind scenario)

Source	ID	Partial Level, dB(A)								
		dB L_{Aeq}	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
HR1 main stack - emission point	S002	22.8	-5.8	9.2	7	13.3	18	19.3	9.5	-23.6
HR2 main stack - emission point	S001	22.2	-6.2	8.8	6.5	12.7	17.4	18.7	8.5	-26.1
1 - HLA Refrigeration plant	S005	16.8			-7	-1	13.4	12.9	6.9	-24.6
2 - HLD Refrigeration plant	S004	16.5			-7.1	-1.2	13.2	12.7	6.4	-26
1 - HLD Refrigeration plant	S006	16.5			-7.3	-1.3	13.1	12.7	6.9	-24.1
2 - HLA Refrigeration plant	S003	15.8			-7.8	-1.8	12.5	11.9	5.5	-27.9
Spent fuel cooling exchanger	S147	15.7	-75.2	-5.4	1.4	6.2	10.4	12.3	4.4	-35.3
Spent fuel cooling exchanger	S147	15.7	-75	-5.1	1.8	6.5	10.6	12.2	4	-35.8
Spent fuel cooling exchanger	S147	15.7	-74.9	-5	1.9	6.6	10.7	12.2	4.1	-35.4
Spent fuel cooling exchanger	S147	15.5	-75.2	-5.4	1.6	6.3	10.4	12	3.7	-36.8
Spent fuel cooling exchanger	S147	15.5	-75.3	-5.5	1.4	6.2	10.3	12.2	4.2	-35.9
Spent fuel cooling exchanger	S147	15.4	-75.3	-5.5	1.5	6.2	10.3	11.9	3.5	-37.2
1 - Main transformer pole2	S027	12.1	-47.3	-15.1	-1.2	2.7	6.2	9.4	-1.9	-43.7
1 - Main transformer pole4	S028	10.5	-47.9	-15.6	-1.6	2.4	6.3	6.3	-4.9	-45.6
Substation inductor and cooling 3	S067	10.1	-74	-76.3	10.1					
Substation inductor and cooling 2	S066	10	-74.1	-76.4	10					
1 - Main transformer pole6	S029	9.4	-48.3	-16.1	-2.4	1.4	5.2	5.1	-6.1	-46.9
Substation inductor and cooling 1	S065	9	-75	-77.4	9					
1 - Main Stack - stack	S22	7.1	-11.4	-4.8	-8.7	-2.2	5.6	-4.6	-11.9	-46
Spent fuel cooling exchanger	S147	6.7	-75.7	-6.5	-1.8	0.6	1.7	0.4	-10.2	-52.1

Table 11F.9: Partial noise levels from the top 20 most significant sources – Wick Farm (average wind scenario)

Source	ID	Partial Level, dB(A)								
		dB L_{Aeq}	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
HR1 main stack - emission point	S002	26.5	-3.9	11	9.9	19.2	23.6	20.1	6.3	-39.7
HR2 main stack - emission point	S001	25.4	-4.6	10.4	9.2	18.3	22.6	18.9	4.1	-45.8
1 - HLD Refrigeration plant	S006	20.1			-7.6	4.6	18.8	13.2	3.5	-40
2 - HLD Refrigeration plant	S004	18.8			-8.9	2.4	17.6	11.7	1	-46.4
1 - Main transformer pole6	S029	18	-46.6	-13.7	2.1	10.5	15.3	12.1	-0.3	-49.7
1 - Main transformer pole2	S027	17.3	-49.4	-16.3	-0.1	9.2	14.5	11.8	-0.4	-49.9
1 - Main transformer pole4	S028	17.3	-47.1	-14.5	1.2	9.6	14.5	11.6	-0.7	-50.1
1 - Main transformer pole23	S035	17.2	-47.2	-14.2	1	9.9	14.7	10.7	-3.1	-54.4
Spent fuel cooling exchanger	S147	15.6	-76	-6.2	-1.4	7.9	12.7	9.8	-0.6	-47.6
Spent fuel cooling exchanger	S147	15.5	-76.1	-6.3	-1.3	7.9	12.7	9.7	-0.8	-48
Spent fuel cooling exchanger	S147	15.3	-76.3	-6.5	-1.3	7.8	12.5	9.4	-1.2	-49.2
1 - HLA Refrigeration plant	S005	15.2			-9.8	-0.3	13.8	8.6	-0.5	-42.7
Substation inductor and cooling 1	S065	15.2	-74.3	-75.1	15.2	-84.2	-84.8			
Spent fuel cooling exchanger	S147	15.2	-76.4	-6.6	-1.5	7.6	12.3	9.2	-1.5	-49.7
2 - HLA Refrigeration plant	S003	13.9			-10.6	-1.3	12.7	7	-2.9	-49.3
Substation inductor and cooling 2	S066	13.8	-74.2	-75	13.8	-83.5	-83.7	-87.9		
1 - Step down transformer pole4	S049	13.2	-11.7	4.5	0.8	9.1	7.8	4.3	-10.8	-57.7
2 - Main transformer pole6	S019	12.8	-49.9	-17.4	-1.7	6.3	10.3	5.5	-9.9	-66.9
1 - Main transformer pole26	S036	12.7	-47	-14.9	-1	6.5	10	4.8	-10	-62
1 - Step down transformer pole1	S046	11.8	-14.2	1.9	-0.9	8.1	6.3	2.8	-12.4	-59.5

References

11F.1 The International Organisation for Standardisation ISO 9613 ‘Attenuation of sound during propagation outdoors’ Part 2: ‘General method of calculation’ (ISO, 1996).

APPENDIX 11G: CONSULTATION LETTER – CONSTRUCTION NOISE LIMITS

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Fax: +44 (0) 1925 675800
www.amec.com

19th March 2010

Our Ref: RC/J1945

Environmental Protection Unit
Sedgemoor District Council
Bridgwater House
King Square
Bridgwater
Somerset
TA6 3AR.

Attention: Mr. Raymond Fox

Dear Ray

Re: Hinkley Point C
Noise assessment criteria
Comments and queries from ARUP (210482-03/PBA)

In response to the questions raised by your advisors (ARUP), please find below further clarifications regarding selection of noise assessment criteria and thresholds.

Construction Noise

ARUP: The presentation references Annex E of BS5228: 2009 which provides examples of thresholds of significant effects at dwellings. The proposed thresholds look to be based on the "ABC Method" but appear to be presented as actual construction limits. Clarification should be sought as to what the numbers in the two tables refer to.

The rationale behind the choice of thresholds in the tables should be sought. The numbers have close correspondence with the example figures in BS5228: 2009 with the exception of the use of 60dB (for evenings, Sundays and Bank Holidays) instead of 55dB.

The noise thresholds for Saturday afternoons are the same as weekly daytime levels. Clarification should be sought as to the reasons for not applying a reduced noise threshold for Saturday afternoons.

Advice is taken from BS5228:2009, but the proposed criteria for works on the Hinkley Point main site (including temporary construction areas) are, in general, more stringent in light of the proposed duration of construction works. If the ABC method had been adopted, the 'Category A' criteria would have been appropriate. These limits are presented in Table 1 below:

Table 1: Comparison of 'ABC Method Category A' limits and proposed Hinkley Point C main site construction noise limits

<table>
<tr><th colspan="2">Assessment Period</th><th colspan="2">Construction Noise Threshold dB $L_{Aeq,T}$ (free-field)* -</th></tr>
<tr><th>Day of Week</th><th>Time of Day</th><th>ABC Method Category A dB $L_{Aeq,T}$</th><th>Proposed Limits for Hinkley Point C Main Site</th></tr>
<tr><td rowspan="3">Monday – Friday</td><td>07.00 – 19.00</td><td>65 dB $L_{Aeq,12h}$</td><td>65 dB $L_{Aeq,1h}$</td></tr>
<tr><td>19.00 – 23.00</td><td>55 dB $L_{Aeq,4h}$</td><td>60 dB $L_{Aeq,1h}$</td></tr>
<tr><td>23.00 – 07:00</td><td>45 dB $L_{Aeq,8h}$</td><td>45 dB $L_{Aeq,1h}$</td></tr>
<tr><td rowspan="4">Saturday</td><td>07.00 – 13.00</td><td>65 dB $L_{Aeq,6h}$</td><td rowspan="2">65 dB $L_{Aeq,1h}$</td></tr>
<tr><td>13:00 – 19:00</td><td rowspan="2">55 dB $L_{Aeq,10h}$</td></tr>
<tr><td>19.00 – 23.00</td><td>60 dB $L_{Aeq,1h}$</td></tr>
<tr><td>23.00 – 07:00</td><td>45 dB $L_{Aeq,8h}$</td><td>45 dB $L_{Aeq,1h}$</td></tr>
<tr><td rowspan="3">Sunday and Bank Holidays</td><td>07.00 – 19.00</td><td rowspan="2">55 dB $L_{Aeq,12h}$</td><td>60 dB $L_{Aeq,1h}$</td></tr>
<tr><td>19.00 – 23.00</td><td>55 dB $L_{Aeq,1h}$</td></tr>
<tr><td>23.00 – 07:00</td><td>45 dB $L_{Aeq,8h}$</td><td>45 dB $L_{Aeq,1h}$</td></tr>
</table>

As the ABC method limits presented in Table 1 are averaged over the reference period (e.g. 12 hours in the case of normal weekdays), there is potential for exceeding these levels within the specified period. The shorter reference period of 1-hour for all periods as proposed would provide a more strict control on construction noise emissions throughout the long-term construction schedule. This is therefore a more stringent control during the week-day periods when the majority of works will be undertaken.

Construction works are proposed to be undertaken on a 24-hour basis, however almost all evening and night-time works will be restricted to the main site which will be floodlit. The movement of spoil, particularly within the spoil storage areas to the south of the main site will be restricted to daylight hours only.

To maintain the schedule, it will be necessary to continue spoil movements on the southern land during Saturday, Sunday and Bank Holiday daytime periods. As the limit proposed uses a 1-hour reference period, this provides a tighter control on noise emissions, and particularly which specific spoil storage areas can be used during these periods.

It should be noted that these are limits rather than target levels. As the majority of works will occur at a significant distance from neighbouring receptors, construction noise levels on the whole are predicted to be well below the proposed threshold values. The most significant impacts are predicted during deposition and compaction of stockpiles in the southernmost areas of the southern construction land. The current proposals are to use spoil to create an earth bund. Whilst this will provide a small degree of acoustic screening, once built, it will also ensure greater distance separation, and therefore greater sound attenuation, for the longer-term works.

Similar to the above, a slightly higher (+5 dB) limit is proposed for week-day evenings to enable continued movement of spoil during daylight periods. Again however, this will be more tightly controlled due to the 1-hour reference period.

The proposed night-time noise limits are as prescribed in Table 1 (BS5228:2009 ABC method) except using a 1-hour reference period for tighter control.

> *ARUP: The term 'short duration' is not defined in terms of a maximum noise level of 75dB(A) for specific noisy works.*

"Short duration" refers to the 1-hour reference period (T), which is stated in the footnote to the table. Specific noisy works, primarily blasting events during site platform construction and nuclear island deep excavations, may occur intermittently during the construction works (approximately 14 months). Planned noisy events will be undertaken during daytime periods only, and neighbouring receptors will be notified at least 48 hours in advance.

> *ARUP: Clarification should be sought for the use of the time periods and the difference in time periods for Hinkley Point C site and Combwich Wharf.*

Construction works associated with the upgrade of Combwich Wharf will be relatively short-term and therefore the standard approach to the designation of construction noise limits has been used, allowing for short-term noisy events within a given period. Given the proximity of residential dwellings to the wharf, significant noise levels are unavoidable during certain activities (notably piling). By adopting noise threshold values averaged over a longer period, other noise impact controls can be utilised, such as managing the duration of very noisy activities within each working day.

Operational Noise

> *ARUP: The presentation states that a number of issues were discussed and agreed with WSC and SDC on 9 December 2008. One of these issues was that "Industrial noise impact assessment should take account of the guidance in BS4142: 1997."*
>
> *The operational noise section states that BS4142: 1997 has not been used on the basis that it is not applicable due to very low background noise levels.*
>
> *Whilst this is the case at two locations during the night, it is not the case during the day.*
>
> *AMEC have proposed a specific noise level threshold of 43dB$L_{Aeq,T}$ (which would give a rating level of 48dB if the noise were tonal for example). This is over 20dB higher than background noise levels in some locations.*

A full rationale should be sought as to the choice of threshold level and reasoning for not using a simplified rating level of 35dBL_{Aeq} for low noise locations, as alluded to in BS4142.

This proposed target noise level would minimise the potential for sleep disturbance in accordance with guidance provided in WHO document ‘Guidelines for Community Noise’ (1999) and British Standard BS 8233: 1999 ‘Sound insulation and noise reduction for buildings – Code of practice’, even with windows open.

The rating noise criterion of 43 dB $L_{Aeq,T}$ is derived based upon achieving an internal noise level of 30 dB $L_{Aeq,night}$ within bedrooms. The WHO Guidelines for Community Noise indicates that this represents the noise level at which it is possible to start detecting effects and below which effects can be assumed to be negligible. This is generally considered a conservative and precautionary approach to noise impact assessment. PPG 24 states that a sound reduction of 13 dB L_A is expected for a partially open window, therefore 30 + 13 = 43 dB $L_{Aeq,T}$ outside a bedroom window.

In terms of potential daytime disturbance, this criterion is 7 dB below the level at which the WHO consider to be the onset of moderate annoyance in a small minority (10 %) of the population (50 dB $L_{Aeq,16hours}$).

BS 4142:1997 does not provide guidance on the approach to calculating specific noise levels for pre-determination of potential nuisance impacts, specifically taking account of meteorological effects. Given the significant impact of meteorological conditions on noise propagation over the distances involved (greater than 1.1 km), it is proposed that the 43 dB $L_{Aeq,T}$ criterion should be met even during worst-case (downwind) conditions which are atypical of the site (northerly winds from 330˚ to 30˚ represented just 8% of the wind direction between 2004 and 2008 inc.).

We hope that the above provides sufficient clarity on the issues that have been raised. If you have further queries, please feel free to contact me.

Yours sincerely
AMEC Earth & Environmental (UK) Ltd,

Ric Cope
Principal Consultant

APPENDIX 11H: CONSULTATION LETTER – OPERATIONAL NOISE MODEL CALCULATION METHOD

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Mr Peter Hulson
The Arup Campus
Blythe Gate
Blythe Valley Park
Solihull
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28th February 2011

Our Ref: RC/J2071

Dear Peter

Re: Hinkley Point C
Operational noise modelling assumptions – Attenuation due to meteorological conditions
Response to technical query from ARUP (consultation meeting on 22/02/11)

In response to a query raised by your advisors at a recent consultation meeting (22 February 2011), please find below further clarifications regarding the assumption to be made regarding the detailed operational noise prediction modelling exercise for the final DCO application for Hinkley Point C.

Background

Within the Stage 2 Consultation documentation, the noise and vibration Environmental Appraisal (chapter (Volume 2 Chapter 10) provided details of the predictive noise modelling exercise undertaken for the operational phase of Hinkley Point C nuclear power station. Appendix 10B of this outlined both the technical methodology and the assumptions used with regard to the model parameters.

In summary, the calculation methodology embedded within the model (CadnaA proprietary software) was in accordance with ISO 9613: Part 2: 1996 "Attenuation of sound during propagation outdoors" (ISO 9613-2). However, within this methodology, there are various options which permit the user to select how meteorological conditions affect noise propagation. At Stage 2, the following methodologies were adopted for assessment of noise propagation under three distinct meteorological scenarios:

1) Average wind direction: The ISO 9613-2 method for determination of C_{met} based on local meteorological conditions provides the most realistic assessment of long-term noise propagation. This uses the proportionality of long term wind parameter data.

2) Downwind propagation: This is based on the CONCAWE methodology (C_{met} was replaced by K_4 in the ISO 9613 calculation), "The propagation of noise

from petroleum and petrochemical complexes to neighbouring communities" (Report No.4/81, 1981). At Stage 2, a northerly 2.5 m/s wind was assumed.

3) Neutral: No wind directionality or speed was assumed.

Proposed Changes

- **Attenuation due to Meteorological Conditions**

The results of the operational noise modelling presented at Stage 2 indicated a significant increase in the noise level at receptor locations under the downwind scenario, using the CONCAWE method (up to + 5.2 dB change).

The CONCAWE study, now 30 years old, was based upon measurements of ambient noise levels under defined meteorological conditions, and subtraction of that measured under neutral conditions in order to derive attenuation curves (K_4) for each octave band frequency. Due to the potential variables introduced by this type of methodology, and in light of more recent published guidance (e.g. ISO 9613-2), it is not considered to be representative. Of note, ISO 9613-2 indicates that, whilst meteorological effects might fall in the range of zero to approximately +5dB (C_0), *"values in excess of 2 dB are exceptional"*.

It is therefore proposed that, rather than using the CONCAWE method to derive the effects of meteorological conditions on downwind noise levels as a worst-case scenario, a constant C_0 value of + 2dB is adopted.

Notwithstanding this, it is proposed that the assessment of impact significance will be based upon the predicted long-term noise levels (L_{AT},(LT)) using annual average meteorological conditions (C_{met}). As presented at the consultation meeting, magnitude criteria (Table 1 below) will be used to determine the significance of predicted long-term average values.

Table 1 Operational noise magnitude assessment criteria

Magnitude	**Sound pressure level (façade) under annual average wind conditions, dB L_{AT}(LT)**
High	> 40
Medium	38 - 40
Low	35 - 38
Very Low	<35

It is therefore proposed that threshold criteria for operational noise at the nearest residential dwellings is reduced from 43 dB $L_{Aeq,T}$ (proposed at Stage 2) to **38 dB $L_{Aeq,T}$ (façade)**. It is the opinion of EDF Energy that this level is reasonable and achievable.

It is assumed that the noise experienced at receptor locations will not include any distinct acoustic features, in accordance with BS4142:1997.

- **Model design and Input Data**

Since the submission of documents to the Stage 2 Consultation, there has been further work on the detailed design of Hinkley Point C. These include revisions to model input data, such as:

- plot plan, including building heights amendments;
- noise emission data, based on experience at other EDF sites;
- substation layout (National Grid design); and
- restoration topography.

These changes will alter the overall operational noise levels predicted at the sensitive receptor locations from those presented at Stage 2.

We hope that the above provides sufficient clarity on this issue. If you have any further queries, please feel free to contact me.

Yours sincerely

AMEC Earth & Environmental (UK) Ltd,

Ric Cope MIOA
Principal Consultant

cc.

APPENDIX 11I: TRAFFIC DATA AND ROAD TRAFFIC NOISE CALCULATION SHEETS

Table 11I.1: Assessed Road Sections

Road Section	
Ref.	**Name**
A	A38 Bristol Road (north of M5 J23)
AA	Western Way NDR (Four Acre Meadow - Chilton Road)
AB	Western Way NDR (Wembdon Rise - Four Acre Meadow)
AC	Rodway (High Street - New Western Bypass rbt)
AD	Wylds Road (The Drove - A38 Bristol Road)
AE	Western Way NDR (Chilton Road - East Quay)
B	A38 Dunball rbt to M5 J23
D	A38 Bristol Road (Wylds Road - Business Park rbt)
E	A38 Bristol Road (The Drove - Wylds Road)
F	A38 Bristol Road (A39 Bath Road - The Drove)
G	A38 Bristol Road (Business Park rbt - Dunball Rbt)
I1	A38 Taunton Road (A39 Broadway - Wills Road)
I2	A38 Taunton Road (Wills Road - Showground Road)
I3	A38 Taunton Road (Showground Road - Marsh Lane)
I4	A38 Taunton Road (Marsh Lane - rbt to M5 J24)
J	A39 Monmouth Street (A372 St John Street - A38 Bristol Road)
K1	A39 Quantock Road (Wembdon Road - Northfield)
K2	A39 Quantock Road (B3339 - Wembdon Road)
K3	A39 Wembdon Road (Northfield - Camden Road)
K4	A39 North Street (Camden Road - West Street)
K5	A39 Broadway (West Street - A38 Taunton Road)
L	A39 Puriton Hill (M5 J23 - A39 Bath Road)
M	A39 Bath Road (east of Puriton Hill)
N1	A39 Bath Road (Bower Lane - A39 Puriton Hill)
N2	A39 Bath Road (Parkway - Bower Lane)
N3	A39 Bath Road (A38 Bristol Road - Parkway)
O1	A39 Broadway (A38 Taunton Road - Salmon Parade)
O2	A39 Broadway (Salmon Parade - A372 St John Street)
P	A39, Cannington (High Street - Main Road)
Q	A39, Cannington (West of High Street)
R	A39, Cannington (Main Road - Sandford Hill)
S	A39 Quantock Road (Sandford Hill - Wembdon Rise)
SA	Alexandra Road, Victoria Road, Kendale Road

Road Section	
Ref.	**Name**
SB	Kendale Road (Feversham Avenue - Chilton Street)
SC	Chilton Street (Kendale Road - Western Way NDR)
SD	Chilton Road (north of Western Way NDR)
SE	Russell Place and Northgate (north of The Clink)
SF	The Clink (East Quay - A38 Bristol Road)
SG	East Quay (The Clink - The Drove)
SH	The Clink (Northgate - East Quay)
SI	Northgate (south of The Clink) and Mount Street
SJ	Premier Inn/Quantock Healthcare/Business Park
SK	East Quay (Salmon Parade - The Clink)
SL	Eastover (Salmon Parade - A39 Monmouth Street)
SM	Salmon Parade (north of A39 Broadway)
SN	A372 St John Street (A39 Broadway - Polden Street)
SO	A372 St John Street (Polden Street - Wellington Road)
SP	A372 Weston Zoyland Road (Wellington Road - Aldemey Road)
SQ	A372 Weston Zoyland Road (Aldemey Road - Dunwear Lane)
SR	A372 Weston Zoyland Road (east of Dunwear Lane)
SS	A38 Taunton Road (south of rbt to M5 J24
T1	B3339 Sandford Hill and Wembdon Hill
T2	B3339 Wembdon Rise
U	High Street, Cannington (A39 - Rodway)
V1	M5 J23 N-bound on-slip
V2	M5 J23 S-bound off-slip
V3	M5 J23 N-bound off-slip
V4	M5 J23 S-bound on-slip
X	M5 Motorway
Y	B3339 (Quantock Road - Wembdon Road)
ZD	Main Road and Fore Street, Cannington
ZE	The Drove (East Quay - A38 Bristol Road)
ST1	A38 rbt to M5 J24 to M5 J24
ST2	M5 J24 N-bound on-slip
ST3	M5 J24 S-bound off-slip
ST4	M5 J24 N-bound off-slip
ST5	M5 J24 S-bound on-slip

Road Section	
Ref.	**Name**
1	B3191 North Street
2	A39 Long Street
3	A39 Fore Street (North Street – Killick Way)
4	A39 Fore Street (Killick Way – High Street)
5	A358 High Street
6	A39 Priest Street (High Street – Bridge Street)
7	A39 (Bridge Street – B3190)
8	B3190 (south of A39)
9	A39 (east of B3190)
10	B3190 (north of A39)
11	Rodway (new western bypass rbt – Combwich Wharf access road)
12	Rodway (EDF access to Combwich wharf – Brookside Road)
Z1	Cannington Bypass
Stogursey	A39 Kilton Road to C182 Rodway (via Stringston and Stogursey)

Table 11I.2: Forecast Road Traffic Data 18-hour AAWT

Ref.	18-hour Annual Average Weekday Traffic (AAWT) Flow							% Change DS 2013 – DN 2013	% Change DS 2016 – DN 2016
	Baseline	DN	DS	DN	DS	DN	DS		
	2009	2013	2013	2016	2016	2021	2021		
A	10751	10881	10878	10847	10843	10840	10857	-0%	-0%
AA	12500	12780	13637	13140	15052	13268	14008	+7%	+15%
AB	10791	11037	11753	11264	13022	11466	12029	+6%	+16%
AC	7034	7133	8985	7110	3616	7165	3023	+26%	-49%
AD	10910	11029	11306	11772	13768	12189	13209	+3%	+17%
AE	16498	16909	17698	17440	19243	17660	18421	+5%	+10%
B	19486	20084	21140	21555	24275	22142	22001	+5%	+13%
D	23113	24352	25107	26891	27317	27335	27717	+3%	+2%
E	13260	14402	14911	16025	14893	16128	15575	+4%	-7%
F	16927	18128	18143	18888	18461	18908	18733	+0%	-2%
G	22120	22713	23565	25100	26344	25040	25463	+4%	+5%
I1	25179	26189	27592	27598	28675	27986	29323	+5%	+4%
I2	22748	23627	24882	24947	25788	25351	26302	+5%	+3%
13	22209	22861	24006	24556	24781	24667	25202	+5%	+1%
14	22344	23111	24390	24036	25229	24538	25671	+6%	+5%
J	20899	22241	22647	23219	24996	23901	26087	+2%	+8%
K1	16070	16303	17439	16947	18388	17137	17746	+7%	+8%
K2	14698	14882	16047	14983	16488	15260	15877	+8%	+10%
K3	16182	16537	17652	17116	18467	17115	17729	+7%	+8%
K4	18025	18505	19537	19035	20244	19377	19677	+6%	+6%
K5	21401	22281	23205	23192	24075	23917	23879	+4%	+4%
L	14832	15815	16144	15214	13883	16940	15000	+2%	-9%
M	17438	17679	17651	17736	17722	18082	18094	-0%	-0%
N1	13630	14154	14434	12526	12557	13673	12881	+2%	+0%
N2	13524	13936	14184	11818	12986	13146	13183	+2%	+10%
N3	18056	19866	19787	16594	18755	19253	21051	-0%	+13%
O1	23347	24257	24783	25455	26821	26147	28105	+2%	+5%
O2	19430	20520	20936	21476	22841	21914	23783	+2%	+6%
P	6705	6816	8373	6957	13979	7161	12373	+23%	+101%
Q	8072	8221	8619	8351	9002	8531	8984	+5%	+8%
R	15159	15391	17395	15497	18946	15642	17162	+13%	+22%

Ref.	18-hour Annual Average Weekday Traffic (AAWT) Flow							% Change DS 2013 – DN 2013	% Change DS 2016 – DN 2016
	Baseline 2009	DN 2013	DS 2013	DN 2016	DS 2016	DN 2021	DS 2021		
S	13576	13777	15964	13928	17680	14056	15739	+16%	+27%
SA	3464	3619	3586	3781	3611	3996	3692	-1%	-5%
SB	2897	3060	3084	3287	3172	3579	3301	+1%	-4%
SC	4130	4271	4428	4519	4572	4743	4577	+4%	+1%
SD	3120	3250	3240	3321	3306	3268	3267	-0%	-0%
SE	4953	5056	5186	5092	5167	5225	5141	+3%	+1%
SF	18691	18905	19091	17662	17822	18377	18051	+1%	+1%
SG	9495	9591	9651	9689	10029	9947	9998	+1%	+4%
SH	14679	14971	15105	15133	15176	15241	15183	+1%	+0%
SI	9998	10134	10103	10347	10290	10415	10285	-0%	-1%
SJ	6182	6238	6208	7068	7026	6965	6962	-0%	-1%
SK	5386	5637	5660	5747	5672	5833	5642	+0%	-1%
SL	7011	7195	6866	7348	6226	7017	6281	-5%	-15%
SM	5067	5074	4941	5050	4567	5121	4633	-3%	-10%
SN	11894	12292	12432	13016	12166	12811	12413	+1%	-7%
SO	14190	14071	14259	14660	14739	14203	14886	+1%	+1%
SP	14153	14208	14522	14938	14572	14571	14841	+2%	-2%
SQ	9964	9849	9984	10901	10409	10299	10543	+1%	-5%
SR	7234	7075	7228	7527	7652	7658	7715	+2%	+2%
SS	16803	17137	17396	18499	18677	19751	19852	+2%	+1%
T1	1607	1637	1485	1612	1350	1607	1444	-9%	-16%
T2	4879	4928	5093	4914	5203	4878	5065	+3%	+6%
U	2254	2291	3747	2278	1969	2285	1880	+64%	-14%
V1	8550	8743	9105	8658	10270	8895	9306	+4%	+19%
V2	8246	8563	8705	8569	10089	8633	9019	+2%	+18%
V3	4255	4485	4709	5247	5067	5721	5153	+5%	-3%
V4	4464	4622	4657	5128	4865	5850	5192	+1%	-5%
X	50225	51582	52657	53963	53344	58834	57791	+2%	-1%
Y	12056	12251	13101	12460	14480	12596	13292	+7%	+16%
ZD	8939	9030	9500	8966	5829	8927	5270	+5%	-35%
ZE	7186	7426	7946	7843	7853	8078	7732	+7%	+0%
ST1	19493	20103	22468	21081	22535	22163	22640	+12%	+7%

Ref.	18-hour Annual Average Weekday Traffic (AAWT) Flow							% Change DS 2013 – DN 2013	% Change DS 2016 – DN 2016
	Baseline	DN	DS	DN	DS	DN	DS		
	2009	2013	2013	2016	2016	2021	2021		
ST2	4577	4745	5277	5131	5034	5464	5211	+11%	-2%
ST3	4950	5147	5709	5394	5164	6094	5754	+11%	-4%
ST4	4991	5064	5687	5261	6113	5252	5760	+12%	+16%
ST5	5169	5330	5964	5473	6409	5564	6103	+12%	+17%
1	5282	5677	5677	5677	5677	5677	5677	+0%	+0%
2	5882	6321	7171	6321	7171	6321	7171	+13%	+13%
3	9402	10104	10955	10104	10955	10104	10955	+8%	+8%
4	9561	10274	11125	10274	11125	10274	11125	+8%	+8%
5	8539	9176	10063	9176	10063	10063	10063	+10%	+10%
6	10170	10930	11780	10930	11780	10930	11780	+8%	+8%
7	10935	12477	12944	12477	12944	12477	12944	+4%	+4%
8	2462	3001	3001	3001	3001	3001	3001	+0%	+0%
9	9758	11285	11475	11285	11475	11285	11475	+2%	+2%
10	1076	1432	1643	1432	1643	1432	1643	+15%	+15%
11	7034	7133	7594	7110	8568	7165	7646	+6%	+20%
12	7034	7133	7594	7110	8718	7165	7646	+6%	+23%
Z1	n/a	n/a	n/a	n/a	6539	n/a	6037	n/a	n/a
Stogursey	2462	3001	7171	6321	7171	3001	7171	+139%	+13%

Note: n/a not applicable

Table 11I.3: Calculated Basic Noise Level (BNL) including corrections for vehicle speed and percentage HGVs

Ref.	Basic Noise Level, dB $L_{A10\ (18\text{-hour})}$ including corrections for vehicle speed and percentage HGV						
	Baseline	DN	DS	DN	DS	DN	DS
	2009	2013	2013	2016	2016	2021	2021
A	69.4	69.5	69.6	69.5	69.3	69.6	69.4
AA	68.4	68.5	70.0	68.6	70.5	68.7	69.5
AB	68.0	68.1	69.6	68.1	70.1	68.3	69.1
AC	65.6	65.7	69.9	65.6	63.0	65.8	62.2
AD	68.3	68.3	68.8	68.5	69.5	68.7	69.2
AE	68.7	68.9	70.1	68.9	70.5	69.0	69.7
B	72.5	72.7	73.3	73.1	73.5	73.3	73.4
D	71.5	71.7	72.3	71.9	72.4	72.1	72.5
E	69.4	69.7	70.4	69.9	70.3	70.0	70.5
F	69.5	69.8	69.8	69.8	69.9	69.9	70.2
G	73.6	73.7	74.1	74.2	74.6	74.3	74.6
I1	71.3	71.7	72.6	71.8	72.2	71.9	72.1
I2	70.7	71.2	72.0	71.3	71.7	71.4	71.5
13	70.4	71.0	71.8	71.1	71.4	71.1	71.3
14	70.5	71.1	72.0	71.1	71.6	71.2	71.5
J	69.6	70.4	70.6	70.3	70.5	70.5	70.7
K1	68.8	68.9	70.3	69.0	70.1	69.1	69.7
K2	68.6	68.7	70.2	68.7	69.9	68.8	69.5
K3	68.8	68.9	70.3	69.0	70.1	69.1	69.7
K4	68.3	68.4	69.9	68.5	69.7	68.7	69.2
K5	69.9	70.1	71.1	70.2	70.9	70.4	70.7
L	71.9	72.6	72.8	72.0	71.6	72.5	71.9
M	72.0	72.1	72.0	72.1	71.9	72.3	72.1
N1	70.1	71.0	71.3	69.9	69.8	70.4	70.0
N2	68.9	69.9	70.3	68.7	68.8	69.1	69.0
N3	69.1	70.0	70.2	69.1	69.6	69.6	70.2
O1	69.9	70.6	71.0	70.5	70.7	70.7	71.0
O2	70.0	70.7	71.0	70.7	70.9	70.8	71.0
P	68.1	68.2	71.3	68.2	72.5	68.4	71.4
Q	68.6	68.7	69.0	68.7	68.9	68.8	68.9
R	73.3	73.4	75.0	73.3	75.2	73.4	74.3

Ref.	Basic Noise Level, dB $L_{A10\ (18\text{-}hour)}$ including corrections for vehicle speed and percentage HGV						
	Baseline	DN	DS	DN	DS	DN	DS
	2009	2013	2013	2016	2016	2021	2021
S	69.8	69.9	72.0	69.8	72.2	70.0	71.2
SA	61.2	61.3	61.3	61.4	61.1	61.8	61.2
SB	60.9	61.0	61.0	61.2	60.8	61.6	61.1
SC	62.0	62.1	62.3	62.3	62.3	62.6	62.3
SD	60.3	60.4	60.5	60.4	60.4	60.6	60.4
SE	65.5	65.6	65.6	65.5	65.3	65.8	65.4
SF	69.2	69.2	69.2	68.9	68.7	69.1	68.8
SG	66.6	66.6	66.6	66.6	66.6	66.8	66.7
SH	67.8	67.9	67.8	67.8	67.5	67.9	67.5
SI	67.6	67.7	67.6	67.7	67.5	67.8	67.5
SJ	66.2	66.2	66.1	66.4	66.1	66.5	66.2
SK	64.3	64.4	64.4	64.4	64.0	64.5	64.0
SL	65.1	65.2	65.0	65.2	64.3	65.1	64.4
SM	64.0	64.0	63.9	63.9	63.4	64.0	63.5
SN	67.0	67.2	67.3	67.2	66.9	67.3	67.0
SO	68.0	67.9	68.1	67.9	68.0	67.9	68.2
SP	68.8	68.8	69.0	68.9	68.7	68.9	68.8
SQ	67.0	67.0	67.0	67.3	67.0	67.2	67.1
SR	66.1	66.1	66.1	66.2	66.1	66.4	66.3
SS	70.8	71.0	71.1	71.3	71.2	71.6	71.5
T1	59.4	59.4	59.0	59.3	58.3	59.3	58.5
T2	62.9	63.0	63.1	62.9	63.0	63.0	63.0
U	62.3	62.4	69.3	62.3	62.2	62.4	61.7
V1	72.3	72.7	73.2	72.7	73.2	72.8	73.1
V2	71.1	71.6	71.7	71.6	72.1	71.6	71.7
V3	67.3	67.7	68.1	68.2	67.9	68.6	68.1
V4	68.3	67.4	67.4	67.8	67.4	68.2	67.8
X	82.2	82.3	82.4	82.5	82.2	82.8	82.6
Y	68.0	68.0	69.5	68.0	70.0	68.1	69.0
ZD	65.5	65.6	65.7	65.4	63.3	65.6	63.1
ZE	65.9	66.1	67.8	66.2	67.7	66.4	66.7
ST1	70.9	71.3	72.1	71.4	71.6	71.7	71.9
ST2	67.5	67.6	68.3	67.9	67.8	68.2	68.0

Ref.	Basic Noise Level, dB $L_{A10\ (18\text{-}hour)}$ including corrections for vehicle speed and percentage HGV						
	Baseline	DN	DS	DN	DS	DN	DS
	2009	2013	2013	2016	2016	2021	2021
ST3	69.0	69.2	70.1	69.4	69.2	69.9	70.0
ST4	67.1	67.9	68.5	67.9	68.5	67.9	68.3
ST5	67.2	67.6	68.2	67.6	68.3	67.8	68.2
1	65.3	65.6	66.0	65.6	66.0	65.6	65.7
2	65.6	65.9	66.6	65.9	66.9	65.9	66.4
3	67.6	67.9	68.2	67.9	68.2	67.9	68.2
4	67.8	68.1	68.4	68.1	68.4	68.1	68.4
5	70.1	70.4	70.7	70.4	70.7	70.7	70.7
6	70.9	71.2	71.5	71.2	71.5	71.2	71.5
7	71.5	72.0	72.1	72.0	72.1	72.0	72.1
8	66.2	66.8	66.8	66.8	66.8	66.8	66.8
9	71.4	71.9	72.0	71.9	72.0	71.9	72.0
10	64.8	65.4	66.1	65.4	66.1	65.4	65.8
11	70.4	70.5	73.2	70.5	73.3	70.5	72.0
12	70.4	70.5	73.2	70.6	72.0	70.5	72.0
Z1	n/a	n/a	n/a	n/a	70.3	n/a	68.7
Stogursey	63.8	64.3	66.3	65.9	66.3	64.3	66.3

Note: n/a not applicable

Table 11I.4: Forecast 1-hour AAWT Traffic Flows Do-Nothing 2009

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 09DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
A	130	336	82	36
AA	96	332	105	39
AB	85	290	90	33
AC	49	176	53	16
AD	111	354	61	25
AE	129	442	138	51
B	237	610	147	65
D	278	722	175	77
E	156	410	102	45
F	206	530	128	56
G	266	691	168	74
I1	283	700	331	129
I2	273	781	245	84
13	283	811	236	91
14	285	815	237	92
J	306	670	223	94
K1	111	408	124	37
K2	102	373	113	34
K3	112	410	124	37
K4	125	456	138	42
K5	149	538	162	49
L	130	358	120	47
M	155	429	141	55
N1	125	347	110	42
N2	124	343	110	42
N3	165	459	146	56
O1	341	744	250	104
O2	287	635	203	87
P	47	170	52	16
Q	56	205	62	19
R	105	385	117	35
S	94	345	105	32
SA	23	69	30	13

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 09DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
SB	19	56	26	10
SC	25	85	44	13
SD	18	63	33	10
SE	25	63	66	23
SF	87	208	155	51
SG	30	101	43	19
SH	68	164	121	40
SI	47	111	83	27
SJ	75	194	47	21
SK	31	76	89	30
SL	39	97	117	39
SM	32	74	80	28
SN	150	362	108	39
SO	148	363	141	47
SP	144	354	142	48
SQ	101	250	100	33
SR	74	183	72	24
SS	213	612	179	69
T1	15	51	9	4
T2	48	156	28	11
U	16	57	17	5
V1	139	405	56	30
V2	83	254	95	51
V3	28	76	33	12
V4	54	154	26	16
X	687	1515	526	320
Y	92	318	102	37
ZD	62	227	69	21
ZE	55	135	50	17
ST1	249	712	207	80
ST2	59	101	53	29
ST3	68	139	57	35
ST4	59	154	65	34
ST5	88	222	57	37

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 09DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
1	25	87	45	10
2	28	97	50	12
3	45	154	80	19
4	46	157	81	19
5	41	140	73	17
6	49	167	86	20
7	64	216	91	34
8	15	52	22	8
9	58	195	83	31
10	8	25	10	4
11	45	220	32	6
12	45	220	32	6
Z1	n/a	n/a	n/a	n/a
Stogursey	15	52	22	8

Note: n/a not applicable

Table 11I.5 Forecast 1-hour AAWT Traffic Flows Do-Nothing 2013

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 13DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	131	340	777	83	36
AA	98	339	828	108	40
AB	88	298	711	92	34
AC	50	178	438	53	16
AD	112	358	793	62	25
AE	132	452	1092	142	52
B	243	628	1435	152	67
D	295	762	1740	184	81
E	172	448	1027	110	48
F	222	570	1297	136	60
G	272	708	1621	173	76
I1	295	726	1819	346	135
I2	285	817	1556	253	87
13	293	837	1430	242	94
14	295	845	1446	245	95
J	326	711	1417	238	100
K1	113	414	1006	126	38
K2	103	377	918	114	34
K3	115	418	1019	126	38
K4	129	467	1140	141	42
K5	155	559	1370	168	51
L	139	383	939	128	50
M	157	434	1054	143	55
N1	130	360	851	115	44
N2	127	353	838	113	43
N3	182	504	1194	161	61
O1	355	773	1547	260	109
O2	303	670	1303	215	92
P	47	173	421	52	16
Q	57	208	507	63	19
R	107	391	950	119	36
S	95	350	851	107	32
SA	24	73	226	32	13

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 13DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	20	60	191	28	11
SC	26	88	268	45	13
SD	19	66	204	34	10
SE	26	65	330	67	23
SF	88	211	1483	156	52
SG	31	102	813	44	19
SH	69	167	1174	123	41
SI	47	113	795	84	28
SJ	76	196	446	47	21
SK	32	79	414	93	32
SL	40	100	526	120	40
SM	32	74	379	80	28
SN	156	375	724	112	40
SO	149	366	854	139	47
SP	147	361	865	141	48
SQ	103	252	599	98	33
SR	75	183	430	70	24
SS	219	626	1072	182	70
T1	16	52	118	9	4
T2	48	157	355	28	11
U	16	58	141	18	5
V1	142	414	569	57	31
V2	86	264	526	98	53
V3	30	80	300	35	13
V4	56	160	275	27	16
X	706	1555	3654	540	328
Y	93	322	795	104	38
ZD	63	230	558	70	21
ZE	56	140	522	52	18
ST1	257	735	1257	213	82
ST2	61	105	260	55	30
ST3	70	144	352	59	36
ST4	60	156	344	66	35
ST5	91	229	337	59	38

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 13DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	27	93	356	48	11
2	30	104	397	54	12
3	48	166	634	86	20
4	49	168	644	87	20
5	44	150	573	78	18
6	53	179	684	93	21
7	69	232	996	98	36
8	17	56	240	24	9
9	63	210	901	89	33
10	8	27	114	11	4
11	46	223	217	32	6
12	46	223	217	32	6
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	17	56	232	24	9

Note: n/a not applicable

Table 11I.6: Forecast 1-hour AAWT Traffic Flows Do-Something 2013

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 13DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	140	348	777	91	39
AA	169	430	882	176	62
AB	157	384	757	160	56
AC	222	386	552	201	86
AD	157	407	813	101	36
AE	202	541	1143	210	74
B	450	851	1511	205	245
D	361	840	1795	230	108
E	193	478	1064	116	63
F	245	593	1298	148	76
G	339	788	1682	219	103
I1	335	788	1916	386	151
I2	324	881	1639	288	100
13	331	901	1502	276	107
14	335	912	1526	281	109
J	345	737	1444	245	114
K1	163	482	1077	174	54
K2	153	446	990	163	50
K3	164	486	1088	175	54
K4	178	533	1204	189	58
K5	203	622	1427	215	66
L	142	391	959	131	51
M	157	433	1052	143	55
N1	132	366	868	117	45
N2	130	359	852	115	44
N3	190	512	1190	169	64
O1	371	798	1580	274	113
O2	318	691	1330	228	96
P	209	364	516	189	83
Q	96	254	532	81	47
R	244	567	1074	253	79
S	234	532	986	242	76
SA	24	72	224	31	13

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 13DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	20	60	192	28	11
SC	26	91	278	47	14
SD	19	66	204	34	10
SE	26	66	338	69	24
SF	89	213	1497	157	52
SG	31	103	818	45	19
SH	70	169	1185	124	41
SI	47	113	792	83	28
SJ	75	194	444	47	21
SK	33	80	416	94	32
SL	39	96	503	114	39
SM	31	72	369	78	27
SN	183	408	730	124	55
SO	176	397	864	151	63
SP	175	395	883	155	64
SQ	118	270	607	102	46
SR	90	201	439	74	37
SS	250	663	1088	197	91
T1	13	46	108	9	3
T2	49	162	368	29	12
U	62	131	232	44	36
V1	148	431	593	60	32
V2	87	269	535	100	54
V3	32	84	315	36	13
V4	57	161	277	27	17
X	720	1588	3730	551	335
Y	163	412	851	173	61
ZD	66	242	587	74	22
ZE	60	150	558	55	19
ST1	394	926	1405	259	193
ST2	68	117	289	61	34
ST3	78	160	390	66	40
ST4	68	175	386	74	39
ST5	101	257	377	65	43

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 13DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	27	93	356	48	11
2	58	140	450	83	19
3	76	202	687	115	26
4	77	204	697	116	26
5	49	164	624	85	20
6	81	215	737	122	28
7	96	263	1033	124	42
8	17	56	240	24	9
9	108	256	916	106	68
10	33	53	131	28	15
11	58	283	272	41	8
12	58	283	272	41	8
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	58	140	304	83	19

Note: n/a not applicable

Table 11I.7: Forecast 1-hour AAWT Traffic Flows Do-Nothing 2016

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 16DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	130	338	774	82	36
AA	101	349	850	111	41
AB	89	304	725	94	34
AC	50	178	437	53	16
AD	122	385	846	65	26
AE	136	466	1126	146	54
B	264	677	1542	162	71
D	326	842	1922	203	90
E	189	496	1142	123	54
F	229	591	1350	143	63
G	304	785	1793	190	84
I1	311	765	1917	364	143
I2	302	864	1642	266	91
13	314	899	1536	260	101
14	306	877	1504	255	99
J	340	743	1480	248	104
K1	118	429	1045	130	39
K2	104	379	924	115	35
K3	119	432	1054	130	39
K4	132	479	1172	144	44
K5	162	581	1425	174	53
L	135	373	906	123	48
M	158	435	1057	144	56
N1	113	314	750	102	39
N2	105	289	704	96	37
N3	150	416	995	135	52
O1	372	811	1623	273	114
O2	317	701	1364	225	96
P	48	176	429	53	16
Q	58	211	515	64	19
R	107	393	957	119	36
S	97	354	860	107	32
SA	25	76	236	33	14

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 16DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	21	64	205	30	12
SC	27	94	284	48	14
SD	20	68	209	35	10
SE	26	65	332	67	24
SF	81	198	1386	143	48
SG	31	103	822	45	19
SH	70	169	1187	124	41
SI	48	115	811	86	29
SJ	86	222	506	53	23
SK	33	80	421	96	32
SL	41	101	537	124	41
SM	32	74	377	80	28
SN	163	394	768	119	42
SO	153	376	892	145	49
SP	152	374	912	150	50
SQ	108	267	668	110	37
SR	78	192	458	75	25
SS	236	675	1157	196	76
T1	15	51	116	9	4
T2	48	157	354	28	11
U	16	58	141	18	5
V1	141	410	564	57	30
V2	86	264	527	98	53
V3	35	93	351	41	15
V4	63	177	305	30	18
X	738	1627	3824	564	343
Y	94	327	809	106	39
ZD	62	228	554	69	21
ZE	59	148	551	55	19
ST1	269	771	1319	223	86
ST2	66	114	281	60	33
ST3	74	151	369	62	38
ST4	63	162	357	68	36
ST5	93	235	346	60	40

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 16DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	27	93	356	48	11
2	30	104	397	54	12
3	48	166	634	86	20
4	49	168	644	87	20
5	49	164	573	85	20
6	53	179	684	93	21
7	69	232	996	98	36
8	17	56	240	24	9
9	63	210	901	89	33
10	8	27	114	11	4
11	46	222	216	32	6
12	46	222	216	32	6
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	17	56	268	24	9

Note: n/a not applicable

Table 11I.8 Forecast 1-hour AAWT Traffic Flows Do-Something 2016

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 16DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	139	347	774	91	38
AA	181	469	973	188	66
AB	166	417	840	171	60
AC	25	90	222	27	8
AD	177	480	992	115	42
AE	214	583	1242	223	79
B	493	954	1738	227	255
D	389	910	1953	246	115
E	198	483	1067	114	62
F	253	607	1324	149	77
G	377	879	1884	239	112
I1	348	817	1992	401	157
I2	336	914	1698	298	103
13	341	928	1550	285	110
14	345	941	1578	290	112
J	380	815	1592	269	125
K1	169	506	1134	181	56
K2	156	457	1017	166	51
K3	170	506	1138	181	56
K4	183	550	1247	194	60
K5	210	643	1480	221	68
L	124	342	828	113	43
M	158	435	1056	144	56
N1	113	312	751	102	39
N2	116	319	774	105	41
N3	178	477	1122	161	62
O1	401	864	1710	296	122
O2	346	754	1451	248	105
P	248	505	862	231	96
Q	99	263	555	83	48
R	255	606	1169	265	82
S	246	575	1092	256	80
SA	24	72	226	32	13

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 16DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	20	61	198	29	11
SC	28	95	287	48	14
SD	20	68	208	35	10
SE	26	66	337	68	24
SF	83	199	1398	147	49
SG	32	107	850	46	20
SH	70	169	1190	125	42
SI	48	115	807	85	28
SJ	86	221	502	53	23
SK	33	79	416	94	32
SL	36	87	457	103	35
SM	29	67	341	72	25
SN	178	395	716	122	55
SO	176	399	897	158	65
SP	171	387	890	158	64
SQ	120	275	635	107	48
SR	94	210	465	79	39
SS	265	708	1168	211	97
T1	11	40	98	8	3
T2	49	164	376	30	12
U	14	50	122	15	5
V1	167	486	669	67	36
V2	101	311	620	116	62
V3	34	90	339	39	14
V4	59	168	289	28	17
X	730	1608	3781	557	339
Y	173	448	940	185	65
ZD	40	149	361	46	14
ZE	58	148	551	54	19
ST1	396	930	1409	259	193
ST2	64	111	276	59	32
ST3	71	145	353	60	37
ST4	73	188	415	79	42
ST5	109	276	405	70	46

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 16DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	27	93	356	48	11
2	58	140	450	83	19
3	76	202	687	115	26
4	77	204	697	116	26
5	49	164	624	85	20
6	81	215	737	122	28
7	96	263	1033	124	42
8	17	56	240	24	9
9	108	256	916	106	68
10	33	53	131	28	15
11	65	323	307	46	9
12	65	323	307	46	9
Z1	123	125	478	119	39
Stogursey	58	140	304	83	19

Note: n/a not applicable

Table 11I.9 Forecast 1-hour AAWT Traffic Flows Do-Nothing 2021

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 21DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	130	338	774	82	36
AA	103	354	858	111	41
AB	90	308	739	96	35
AC	50	179	440	54	16
AD	123	395	877	68	28
AE	138	472	1141	148	54
B	267	692	1582	168	74
D	329	853	1952	207	91
E	191	500	1150	123	54
F	229	592	1351	143	63
G	300	780	1787	191	84
I1	316	776	1944	370	145
I2	307	878	1669	271	93
13	316	905	1543	261	101
14	312	895	1535	261	101
J	350	764	1523	255	107
K1	119	434	1057	131	40
K2	106	386	941	117	35
K3	119	431	1054	130	39
K4	135	487	1192	147	44
K5	167	599	1470	180	54
L	149	411	1006	137	53
M	160	442	1077	147	57
N1	125	346	821	111	42
N2	119	329	787	107	41
N3	177	491	1159	156	59
O1	382	833	1668	280	117
O2	324	714	1392	230	98
P	49	184	444	56	17
Q	59	216	526	65	20
R	109	397	965	120	36
S	97	357	868	108	33
SA	27	80	250	35	15

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 21DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	23	70	223	32	13
SC	28	98	298	50	15
SD	19	67	205	34	10
SE	27	67	341	69	24
SF	85	205	1441	151	50
SG	32	106	843	46	20
SH	71	170	1195	126	42
SI	49	116	816	87	29
SJ	86	219	499	52	23
SK	33	81	428	97	33
SL	39	97	512	118	40
SM	32	75	382	81	28
SN	161	388	756	117	42
SO	148	364	864	141	47
SP	148	363	890	146	49
SQ	106	261	628	103	35
SR	81	198	465	76	26
SS	253	723	1235	209	81
T1	15	51	116	9	4
T2	47	155	352	28	11
U	16	58	141	18	5
V1	145	421	579	58	31
V2	87	266	531	99	53
V3	38	102	383	44	16
V4	71	202	348	34	21
X	805	1774	4168	616	374
Y	96	331	817	107	39
ZD	62	227	551	69	21
ZE	60	152	567	56	19
ST1	282	809	1386	235	91
ST2	70	121	299	64	35
ST3	83	171	417	70	43
ST4	62	162	357	68	36
ST5	95	239	352	61	40

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 21DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	27	93	356	48	11
2	30	104	397	54	12
3	48	166	634	86	20
4	49	168	644	87	20
5	49	164	624	85	20
6	53	179	684	93	21
7	69	232	996	98	36
8	17	56	240	24	9
9	63	210	901	89	33
10	8	27	114	11	4
11	46	224	217	32	6
12	46	224	217	32	6
Stogursey	17	56	130	24	9

Note: n/a not applicable

Table 11I.10 Forecast 1-hour AAWT Traffic Flows Do-Something 2021

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 21DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	130	340	775	83	36
AA	110	389	904	117	43
AB	93	334	777	101	37
AC	21	75	185	22	7
AD	129	429	952	75	30
AE	146	509	1187	154	56
B	273	716	1576	165	72
D	340	882	1984	208	92
E	195	496	1117	116	51
F	234	598	1344	140	61
G	312	810	1822	192	84
I1	331	817	2037	388	152
I2	319	917	1731	280	96
13	323	928	1576	266	103
14	327	942	1606	272	105
J	382	837	1662	278	117
K1	123	457	1095	136	41
K2	110	409	979	122	37
K3	123	455	1092	135	41
K4	137	503	1211	149	45
K5	166	605	1467	179	54
L	134	370	895	122	47
M	161	443	1077	147	57
N1	115	319	769	104	40
N2	116	321	784	107	42
N3	191	530	1262	171	65
O1	411	898	1792	301	126
O2	351	777	1511	249	107
P	86	340	763	95	29
Q	62	232	554	69	21
R	119	459	1059	132	40
S	109	424	972	121	37
SA	25	74	231	32	13

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 21DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	21	64	206	30	12
SC	28	95	287	48	14
SD	19	67	205	34	10
SE	26	66	335	68	24
SF	84	201	1415	149	50
SG	32	106	847	45	20
SH	70	169	1191	125	42
SI	48	114	806	85	28
SJ	86	219	498	52	23
SK	32	79	414	94	32
SL	35	87	460	105	35
SM	29	68	345	74	26
SN	158	383	731	113	40
SO	154	382	907	148	50
SP	150	372	907	149	50
SQ	107	265	644	106	35
SR	81	201	469	76	26
SS	254	730	1242	210	81
T1	13	44	105	8	3
T2	48	160	366	29	12
U	13	48	116	15	4
V1	151	441	606	61	32
V2	91	278	554	103	55
V3	34	92	345	40	15
V4	63	179	309	30	18
X	791	1743	4094	604	368
Y	101	364	862	113	41
ZD	36	135	326	41	12
ZE	56	146	542	53	18
ST1	289	838	1416	240	93
ST2	67	115	285	61	33
ST3	79	161	393	66	41
ST4	68	178	391	75	40
ST5	104	263	386	67	44

Ref.	1-hour Annual Average Weekday Traffic (AAWT) Flow 21DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	27	93	356	48	11
2	34	122	450	61	14
3	52	184	687	93	22
4	53	187	697	94	22
5	49	164	624	85	20
6	57	197	737	100	23
7	72	245	1033	102	38
8	17	56	240	24	9
9	64	219	916	90	34
10	9	34	131	13	5
11	58	287	274	41	8
12	58	287	274	41	8
Z1	0	24	400	0	0
Stogursey	34	122	304	61	14

Note: n/a not applicable

Table 11I.11 Calculated 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) Do-Nothing 2009

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\,(1\text{-hour})}$ 09DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
A	62.8	66.9	60.8	57.3
AA	60.0	65.4	60.5	56.1
AB	59.6	65.0	59.9	55.6
AC	56.8	62.4	57.2	52.0
AD	60.9	66.0	58.4	54.4
AE	60.4	65.7	60.6	56.3
B	65.8	69.9	63.7	60.2
D	64.8	69.0	62.8	59.3
E	62.8	66.9	60.8	57.2
F	63.1	67.2	61.0	57.4
G	66.9	71.0	64.9	61.3
I1	64.4	68.4	65.1	61.0
I2	64.1	68.7	63.7	59.1
13	64.2	68.7	63.4	59.3
14	64.3	68.9	63.6	59.4
J	64.1	67.5	62.7	58.9
K1	60.1	65.7	60.6	55.3
K2	59.9	65.5	60.3	55.1
K3	60.1	65.7	60.5	55.3
K4	59.5	65.2	60.0	54.8
K5	61.1	66.7	61.5	56.3
L	63.9	68.3	63.5	59.4
M	64.1	68.5	63.6	59.5
N1	62.4	66.9	61.9	57.7
N2	61.2	65.7	60.7	56.5
N3	61.3	65.8	60.8	56.6
O1	64.3	67.7	62.9	59.1
O2	64.6	68.0	63.1	59.4
P	59.2	64.8	59.7	54.4
Q	59.7	65.3	60.1	54.9
R	64.5	70.1	65.0	59.8
S	60.9	66.5	61.4	56.2

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\,(1\text{-hour})}$ 09DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
SA	52.1	56.9	53.4	49.5
SB	51.6	56.4	53.1	49.1
SC	52.7	58.1	55.1	49.7
SD	50.7	56.2	53.3	48.0
SE	54.9	58.9	59.0	54.5
SF	58.4	62.2	60.9	56.1
SG	54.4	59.6	56.0	52.3
SH	56.5	60.4	59.0	54.2
SI	56.8	60.7	59.3	54.5
SJ	59.2	63.4	57.3	53.7
SK	53.9	57.8	58.5	53.8
SL	54.9	58.9	59.7	55.0
SM	54.5	58.2	58.6	54.0
SN	60.2	64.0	59.2	54.6
SO	60.5	64.4	60.4	55.6
SP	61.3	65.3	61.4	56.6
SQ	59.7	63.6	59.8	55.0
SR	58.7	62.7	58.8	54.1
SS	64.6	69.2	63.8	59.7
T1	51.3	56.5	49.1	45.2
T2	55.5	60.6	53.1	49.2
U	53.5	59.2	54.0	48.8
V1	67.1	71.7	63.1	60.4
V2	63.7	68.6	64.3	61.6
V3	58.1	62.3	58.7	54.4
V4	61.6	66.1	58.4	56.3
X	76.2	79.6	75.0	72.8
Y	59.4	64.8	59.8	55.4
ZD	56.4	62.1	56.9	51.7
ZE	57.3	61.3	57.0	52.3
ST1	64.4	69.0	63.7	59.5
ST2	61.1	63.5	60.7	58.1
ST3	63.1	66.2	62.3	60.2
ST4	60.6	64.8	61.1	58.3

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 09DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
ST5	62.2	66.2	60.3	58.5
1	54.7	60.0	57.2	50.8
2	55.5	60.9	58.0	51.7
3	57.5	62.8	60.0	53.6
4	57.7	63.0	60.2	53.8
5	59.9	65.3	62.4	56.0
6	60.9	66.2	63.3	57.0
7	62.2	67.5	63.7	59.4
8	56.8	62.2	58.7	54.4
9	62.0	67.2	63.5	59.2
10	54.4	59.8	56.7	52.3
11	61.4	68.3	59.9	52.9
12	61.4	68.3	59.9	52.9
Z1	n/a	n/a	n/a	n/a
Stogursey	60.8	71.1	65.0	56.6

Note: n/a not applicable

Table 11I.12 Calculated 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) Do-Nothing 2013

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 13DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	62.9	67.1	70.7	60.9	57.4
AA	60.1	65.5	69.4	60.6	56.2
AB	59.7	65.1	68.9	60.0	55.7
AC	56.9	62.4	66.3	57.2	52.0
AD	60.9	66.0	69.5	58.4	54.4
AE	60.5	65.8	69.6	60.8	56.4
B	66.0	70.1	73.7	63.9	60.3
D	65.0	69.2	72.8	63.0	59.4
E	63.1	67.2	70.8	61.1	57.5
F	63.3	67.4	71.0	61.2	57.7
G	67.0	71.1	74.7	65.0	61.4
I1	65.0	68.9	72.9	65.6	61.6
I2	64.7	69.3	72.1	64.3	59.6
13	64.8	69.4	71.7	64.0	59.9
14	64.9	69.5	71.8	64.1	60.0
J	64.9	68.3	71.3	63.5	59.7
K1	60.2	65.8	69.7	60.7	55.4
K2	60.0	65.6	69.5	60.4	55.2
K3	60.2	65.8	69.7	60.7	55.4
K4	59.7	65.3	69.2	60.1	54.9
K5	61.3	66.9	70.8	61.7	56.5
L	64.7	69.1	73.0	64.3	60.2
M	64.2	68.6	72.5	63.8	59.7
N1	63.4	67.8	71.6	62.9	58.7
N2	62.3	66.7	70.5	61.8	57.6
N3	62.3	66.7	70.5	61.8	57.6
O1	65.0	68.4	71.4	63.7	59.9
O2	65.3	68.7	71.6	63.8	60.1
P	59.3	64.9	68.8	59.8	54.5
Q	59.8	65.4	69.3	60.2	55.0
R	64.6	70.2	74.1	65.1	59.8
S	61.0	66.6	70.5	61.5	56.3

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 13DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	52.2	57.0	62.0	53.5	49.6
SB	51.8	56.6	61.6	53.2	49.2
SC	52.9	58.2	62.9	55.2	49.8
SD	50.9	56.3	61.3	53.5	48.2
SE	55.0	59.0	66.1	59.2	54.6
SF	58.4	62.3	70.7	60.9	56.1
SG	54.4	59.7	68.7	56.0	52.4
SH	56.6	60.5	68.9	59.1	54.4
SI	56.9	60.7	69.2	59.4	54.6
SJ	59.3	63.4	67.0	57.3	53.7
SK	54.1	58.0	65.2	58.7	54.0
SL	55.1	59.0	66.3	59.9	55.1
SM	54.5	58.2	65.3	58.6	54.0
SN	60.5	64.4	67.3	59.2	54.7
SO	60.5	64.4	68.2	60.3	55.6
SP	61.4	65.4	69.3	61.4	56.7
SQ	59.8	63.7	67.6	59.8	55.0
SR	58.8	62.7	66.6	58.8	54.0
SS	64.8	69.3	71.7	64.0	59.8
T1	51.4	56.6	60.2	49.2	45.2
T2	55.5	60.7	64.2	53.2	49.2
U	53.6	59.2	63.1	54.1	48.8
V1	67.5	72.1	73.5	63.5	60.8
V2	64.1	69.0	72.0	64.7	62.0
V3	58.3	62.6	68.4	59.0	54.6
V4	61.8	66.2	68.7	58.6	56.4
X	76.3	79.7	83.4	75.1	72.9
Y	59.5	64.8	68.7	59.9	55.5
ZD	56.5	62.1	66.0	57.0	51.8
ZE	57.4	61.4	67.2	57.1	52.5
ST1	64.9	69.5	71.9	64.2	60.0
ST2	61.3	63.6	67.6	60.8	58.3
ST3	63.5	66.6	70.5	62.8	60.6
ST4	61.2	65.4	68.9	61.7	58.9

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 13DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	62.8	66.8	68.5	60.9	59.1
1	55.0	60.3	66.2	57.5	51.1
2	55.8	61.2	67.0	58.3	52.0
3	57.8	63.1	69.0	60.3	53.9
4	58.0	63.3	69.2	60.5	54.1
5	60.3	65.6	71.4	62.7	56.4
6	61.2	66.5	72.3	63.6	57.3
7	62.5	67.8	74.1	64.0	59.7
8	57.2	62.5	69.0	59.0	54.7
9	62.3	67.6	73.9	63.9	59.6
10	54.7	60.1	66.8	57.0	52.6
11	61.4	68.4	68.2	59.9	52.9
12	61.4	68.4	68.2	59.9	52.9
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	54.6	59.9	66.3	56.6	52.2

Note: n/a not applicable

Table 11I.13 Calculated 1-hour LA10 Basic Noise Level (including speed and HGV correction) Do-Something 2013

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 13DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	64.6	67.8	70.7	63.3	58.9
AA	68.8	70.5	70.4	68.7	63.9
AB	68.6	70.3	70.1	68.6	63.8
AC	71.3	72.1	69.2	71.1	66.4
AD	67.2	69.0	69.6	66.3	61.3
AE	68.6	70.4	70.5	68.5	63.7
B	68.6	71.6	74.2	66.0	64.9
D	68.8	71.2	73.3	67.5	63.2
E	64.2	68.1	71.6	61.9	58.8
F	64.9	68.1	71.0	63.3	59.9
G	70.2	72.8	75.2	68.8	64.6
I1	67.6	70.3	73.3	67.8	63.8
I2	67.4	70.6	72.6	67.0	62.6
13	67.5	70.7	72.2	66.9	62.8
14	67.6	70.8	72.3	67.0	62.9
J	65.0	68.3	71.3	63.6	60.1
K1	67.1	69.2	70.4	67.0	62.2
K2	67.1	69.1	70.3	67.0	62.1
K3	67.1	69.1	70.4	67.0	62.1
K4	66.9	68.9	70.0	66.9	62.0
K5	67.3	69.6	71.3	67.3	62.4
L	64.8	69.2	73.1	64.4	60.3
M	64.2	68.6	72.4	63.8	59.6
N1	63.5	67.9	71.7	63.0	58.8
N2	62.4	66.9	70.6	61.9	57.8
N3	64.0	67.4	70.5	63.6	59.4
O1	66.2	69.0	71.5	65.1	60.9
O2	66.2	69.2	71.7	65.1	60.9
P	72.0	72.9	70.9	71.8	67.1
Q	63.6	66.9	69.4	63.3	59.5
R	73.5	75.1	75.2	73.5	68.5
S	71.5	72.8	72.0	71.4	66.5

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 13DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	52.2	57.0	62.0	53.5	49.6
SB	51.8	56.6	61.6	53.2	49.3
SC	53.0	58.3	63.1	55.4	50.0
SD	50.9	56.4	61.3	53.5	48.2
SE	55.1	59.1	66.1	59.2	54.7
SF	58.5	62.3	70.8	61.0	56.2
SG	54.5	59.7	68.7	56.1	52.4
SH	56.7	60.5	69.0	59.2	54.4
SI	56.9	60.7	69.2	59.3	54.6
SJ	59.2	63.4	67.0	57.3	53.7
SK	54.2	58.0	65.2	58.8	54.1
SL	54.9	58.8	66.0	59.6	54.9
SM	54.4	58.1	65.2	58.6	53.9
SN	63.2	65.7	67.4	62.4	57.7
SO	63.4	65.8	68.2	63.1	58.2
SP	63.7	66.5	69.3	63.5	58.9
SQ	60.3	63.9	67.6	59.9	56.2
SR	59.4	63.0	66.7	58.9	55.5
SS	66.2	69.9	71.7	65.4	61.5
T1	50.7	56.1	59.8	48.8	44.9
T2	55.6	60.8	64.4	53.4	49.4
U	63.0	66.0	68.2	62.7	58.9
V1	67.8	72.5	73.8	63.8	61.1
V2	64.3	69.1	72.1	64.8	62.1
V3	58.7	62.9	68.8	59.4	55.0
V4	61.8	66.3	68.7	58.6	56.5
X	76.4	79.8	83.5	75.2	73.1
Y	68.5	70.1	69.8	68.4	63.6
ZD	56.6	62.3	66.1	57.1	51.9
ZE	58.8	63.1	68.8	58.7	54.1
ST1	66.7	70.7	72.8	65.3	63.1
ST2	62.2	64.6	68.5	61.8	59.2
ST3	64.3	67.4	71.2	63.5	61.4
ST4	61.9	66.0	69.5	62.3	59.5

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 13DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	63.4	67.4	69.1	61.5	59.7
1	55.0	60.3	66.2	57.5	51.1
2	64.3	65.5	67.4	64.5	57.7
3	64.7	66.3	69.2	65.1	58.3
4	64.7	66.4	69.4	65.1	58.4
5	60.6	65.9	71.7	63.0	56.7
6	66.7	68.9	72.5	67.4	60.7
7	67.1	69.6	74.2	67.5	62.0
8	57.2	62.5	69.0	59.0	54.7
9	65.6	68.8	74.0	65.8	62.6
10	64.1	64.9	67.1	63.8	58.1
11	63.7	70.8	70.5	62.3	55.4
12	63.7	70.8	70.5	62.3	55.4
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	64.3	65.5	65.7	64.5	57.7

Note: n/a not applicable

Table 11I.14 Calculated 1-hour LA10 Basic Noise Level (including speed and HGV correction) Do-Nothing 2016

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 16DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	62.9	67.1	70.7	61.0	57.4
AA	60.2	65.6	69.5	60.6	56.3
AB	59.8	65.1	68.9	60.1	55.7
AC	56.8	62.4	66.3	57.2	52.0
AD	61.3	66.3	69.7	58.6	54.7
AE	60.6	65.9	69.7	60.8	56.5
B	66.5	70.6	74.2	64.5	60.9
D	65.4	69.5	73.1	63.3	59.8
E	63.3	67.5	71.1	61.4	57.8
F	63.4	67.5	71.1	61.4	57.8
G	67.7	71.8	75.4	65.7	62.1
I1	65.1	69.0	73.0	65.8	61.7
I2	64.8	69.4	72.3	64.4	59.7
13	64.9	69.5	71.9	64.2	60.0
14	65.0	69.5	71.9	64.2	60.1
J	64.9	68.3	71.3	63.5	59.7
K1	60.3	65.9	69.8	60.7	55.5
K2	60.0	65.6	69.4	60.4	55.2
K3	60.3	65.9	69.8	60.7	55.5
K4	59.8	65.4	69.3	60.2	55.0
K5	61.4	67.0	70.9	61.8	56.6
L	64.1	68.5	72.4	63.7	59.6
M	64.2	68.7	72.5	63.8	59.7
N1	62.3	66.7	70.5	61.8	57.6
N2	60.9	65.4	69.2	60.5	56.3
N3	61.4	65.9	69.6	60.9	56.7
O1	65.0	68.4	71.4	63.6	59.9
O2	65.3	68.7	71.6	63.8	60.1
P	59.4	65.0	68.9	59.8	54.6
Q	59.9	65.5	69.3	60.3	55.1
R	64.6	70.2	74.1	65.1	59.8
S	61.0	66.7	70.5	61.5	56.3

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 16DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	52.4	57.2	62.1	53.6	49.8
SB	52.0	56.8	61.8	53.4	49.4
SC	53.1	58.4	63.2	55.4	50.0
SD	51.0	56.4	61.3	53.5	48.2
SE	55.0	59.0	66.1	59.2	54.6
SF	58.1	62.0	70.4	60.6	55.8
SG	54.5	59.7	68.7	56.2	52.5
SH	56.7	60.5	69.0	59.2	54.4
SI	57.0	60.8	69.3	59.5	54.7
SJ	59.6	63.8	67.4	57.6	54.1
SK	54.1	58.0	65.2	58.8	54.1
SL	55.1	59.1	66.3	60.0	55.2
SM	54.5	58.2	65.3	58.6	54.0
SN	60.6	64.5	67.5	59.4	54.9
SO	60.5	64.4	68.2	60.4	55.6
SP	61.5	65.4	69.4	61.6	56.8
SQ	60.0	63.9	68.0	60.2	55.4
SR	59.0	62.9	66.8	59.0	54.2
SS	65.1	69.7	72.0	64.3	60.2
T1	51.3	56.5	60.1	49.1	45.1
T2	55.5	60.6	64.2	53.2	49.2
U	53.6	59.2	63.1	54.0	48.8
V1	67.4	72.1	73.5	63.5	60.8
V2	64.1	69.0	71.9	64.7	62.0
V3	59.0	63.2	69.0	59.7	55.3
V4	62.2	66.7	69.1	59.0	56.9
X	76.5	79.9	83.6	75.3	73.1
Y	59.5	64.9	68.8	59.9	55.6
ZD	56.4	62.1	65.9	56.9	51.7
ZE	57.6	61.6	67.3	57.3	52.6
ST1	65.1	69.6	72.0	64.3	60.2
ST2	61.6	64.0	67.9	61.2	58.6
ST3	63.6	66.8	70.6	62.9	60.8
ST4	61.3	65.5	68.9	61.7	59.0

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 16DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	62.8	66.9	68.5	60.9	59.1
1	55.0	60.3	66.2	57.5	51.1
2	55.8	61.2	67.0	58.3	52.0
3	57.8	63.1	69.0	60.3	53.9
4	58.0	63.3	69.2	60.5	54.1
5	60.6	65.9	71.4	63.0	56.7
6	61.2	66.5	72.3	63.6	57.3
7	62.5	67.8	74.1	64.0	59.7
8	57.2	62.5	69.0	59.0	54.7
9	62.3	67.6	73.9	63.9	59.6
10	54.7	60.1	66.8	57.0	52.6
11	61.4	68.3	68.3	59.9	52.9
12	61.4	68.3	68.3	59.9	52.9
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	54.6	59.9	65.3	56.6	52.2

Note: n/a not applicable

Table 11I.15 Calculated 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) Do-Something 2016

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 16DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	64.6	67.8	70.7	63.3	58.9
AA	68.8	70.6	70.8	68.8	64.0
AB	68.7	70.4	70.3	68.6	63.8
AC	53.8	59.4	63.3	54.1	48.9
AD	67.4	69.3	70.3	66.5	61.4
AE	68.6	70.5	70.8	68.6	63.8
B	69.0	72.0	74.8	66.5	65.2
D	68.9	71.3	73.5	67.7	63.3
E	64.1	68.1	71.6	61.9	58.8
F	64.9	68.2	71.1	63.4	59.9
G	70.5	73.3	75.8	69.1	65.0
I1	67.6	70.3	73.4	67.9	63.8
I2	67.4	70.6	72.6	67.0	62.6
13	67.5	70.7	72.2	66.9	62.8
14	67.6	70.8	72.4	67.0	62.9
J	65.2	68.5	71.5	63.7	60.2
K1	67.1	69.2	70.6	67.1	62.2
K2	67.1	69.1	70.3	67.0	62.1
K3	67.1	69.2	70.5	67.1	62.2
K4	66.9	68.9	70.0	66.9	62.0
K5	67.3	69.7	71.4	67.3	62.4
L	63.9	68.3	72.1	63.5	59.3
M	64.2	68.6	72.5	63.8	59.7
N1	62.3	66.7	70.5	61.8	57.6
N2	61.2	65.7	69.5	60.8	56.6
N3	63.6	67.0	70.0	63.3	59.1
O1	66.2	69.1	71.6	65.2	60.9
O2	66.4	69.3	71.8	65.2	61.1
P	72.1	73.4	72.4	72.0	67.3
Q	63.7	67.0	69.6	63.4	59.5
R	73.6	75.3	75.4	73.5	68.6
S	71.6	72.9	72.2	71.5	66.5

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 16DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	52.2	57.0	62.0	53.5	49.6
SB	51.8	56.6	61.7	53.3	49.3
SC	53.1	58.4	63.2	55.5	50.1
SD	51.0	56.4	61.3	53.5	48.2
SE	55.0	59.0	66.1	59.2	54.6
SF	58.2	62.0	70.5	60.7	55.9
SG	54.6	59.8	68.8	56.2	52.5
SH	56.7	60.5	69.0	59.1	54.4
SI	56.9	60.7	69.2	59.4	54.6
SJ	59.6	63.7	67.3	57.6	54.0
SK	54.1	58.0	65.2	58.8	54.0
SL	54.5	58.4	65.6	59.2	54.5
SM	54.0	57.8	64.9	58.2	53.6
SN	63.1	65.6	67.2	62.3	57.6
SO	63.3	65.8	68.3	63.2	58.3
SP	63.6	66.4	69.3	63.5	58.9
SQ	60.4	64.0	67.8	60.1	56.3
SR	59.6	63.2	66.9	59.2	55.7
SS	66.4	70.2	72.0	65.7	61.7
T1	50.0	55.5	59.4	48.5	44.5
T2	55.6	60.8	64.4	53.4	49.5
U	52.9	58.5	62.4	53.4	48.2
V1	68.2	72.8	74.2	64.2	61.5
V2	64.9	69.8	72.7	65.4	62.8
V3	58.9	63.1	68.9	59.5	55.2
V4	62.0	66.5	68.9	58.8	56.7
X	76.4	79.9	83.6	75.3	73.1
Y	68.5	70.2	70.2	68.5	63.6
ZD	54.4	60.1	63.9	54.9	49.7
ZE	58.9	63.0	68.7	58.6	54.0
ST1	66.5	70.4	72.4	65.0	62.9
ST2	61.7	64.1	68.0	61.3	58.7
ST3	63.6	66.7	70.5	62.8	60.7
ST4	62.0	66.2	69.6	62.4	59.7

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 16DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	63.6	67.6	69.3	61.7	59.9
1	55.0	60.3	66.2	57.5	51.1
2	64.3	65.5	67.4	64.5	57.7
3	64.7	66.3	69.2	65.1	58.3
4	64.7	66.4	69.4	65.1	58.4
5	60.6	65.9	71.7	63.0	56.7
6	66.7	68.9	72.5	67.4	60.7
7	67.1	69.6	74.2	67.5	62.0
8	57.2	62.5	69.0	59.0	54.7
9	65.6	68.8	74.0	65.8	62.6
10	64.1	64.9	67.1	63.8	58.1
11	63.8	70.9	70.6	62.4	55.5
12	63.8	70.9	70.6	62.4	55.5
Z1	71.4	71.4	70.3	71.2	66.3
Stogursey	64.3	65.5	65.7	64.5	57.7

Note: n/a not applicable

Table 11I.16 Calculated 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) Do-Nothing 2021

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 21DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	62.9	67.1	69.1	61.0	57.5
AA	60.1	65.6	68.9	60.7	56.4
AB	59.6	65.1	68.1	60.2	55.9
AC	57.0	62.6	65.5	57.4	52.1
AD	61.4	66.4	68.9	58.8	54.9
AE	60.5	65.9	69.0	61.0	56.6
B	65.8	70.4	71.9	64.6	61.1
D	65.3	69.6	71.4	63.5	59.9
E	63.1	67.5	69.1	61.6	58.0
F	63.4	67.6	69.3	61.5	58.0
G	67.5	71.8	73.4	65.7	62.2
I1	65.1	69.1	71.6	65.8	61.8
I2	64.8	69.5	70.9	64.5	59.8
13	64.9	69.5	70.6	64.2	60.1
14	65.0	69.6	70.9	64.3	60.2
J	65.0	68.4	69.1	63.7	59.9
K1	60.2	66.0	69.1	60.9	55.7
K2	59.9	65.7	68.7	60.6	55.3
K3	60.2	65.9	69.0	60.8	55.6
K4	59.8	65.5	68.6	60.3	55.1
K5	61.5	67.2	70.4	62.0	56.8
L	64.6	69.0	71.1	64.2	60.1
M	64.4	68.8	70.9	64.0	59.9
N1	62.7	67.2	69.7	62.2	58.0
N2	61.5	65.9	68.3	60.9	56.8
N3	61.9	66.4	68.8	61.4	57.2
O1	65.1	68.6	69.3	63.8	60.0
O2	65.4	68.8	70.1	63.9	60.2
P	58.5	64.7	67.7	60.1	54.9
Q	59.6	65.5	68.2	60.4	55.2
R	64.3	70.2	73.5	65.2	59.9
S	60.5	66.5	69.4	61.6	56.4

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 21DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	52.8	57.5	61.6	54.0	50.1
SB	52.4	57.2	61.1	53.8	49.9
SC	53.3	58.6	63.0	55.7	50.3
SD	50.2	55.9	60.2	53.5	48.2
SE	55.3	59.3	63.0	59.4	54.9
SF	58.3	62.2	69.8	60.8	56.1
SG	54.6	59.9	68.4	56.3	52.6
SH	56.8	60.6	68.0	59.3	54.5
SI	57.1	60.9	68.5	59.6	54.8
SJ	59.7	63.8	65.2	57.7	54.1
SK	54.2	58.1	64.1	58.9	54.2
SL	54.9	58.9	65.4	59.8	55.1
SM	54.6	58.3	64.0	58.7	54.1
SN	60.5	64.4	66.0	59.5	54.9
SO	60.3	64.3	66.4	60.4	55.7
SP	61.4	65.4	68.3	61.6	56.8
SQ	59.9	63.9	66.7	60.0	55.3
SR	59.0	63.0	65.7	59.2	54.4
SS	65.4	70.0	71.4	64.7	60.5
T1	51.3	56.5	59.8	49.1	45.1
T2	55.5	60.7	63.8	53.2	49.3
U	53.7	59.3	62.2	54.1	48.9
V1	67.6	72.3	71.8	63.7	60.9
V2	64.2	69.1	70.2	64.8	62.1
V3	59.4	63.6	67.8	60.0	55.6
V4	62.8	67.3	67.2	59.6	57.4
X	76.9	80.3	82.2	75.7	73.5
Y	59.2	64.8	67.8	60.0	55.7
ZD	56.5	62.2	64.8	57.0	51.8
ZE	57.2	61.5	66.3	57.5	52.9
ST1	64.9	69.7	70.4	64.6	60.4
ST2	61.9	64.3	67.1	61.5	58.9
ST3	64.2	67.3	70.1	63.5	61.3
ST4	61.3	65.5	67.6	61.8	59.0

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 21DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	63.0	67.0	67.5	61.0	59.2
1	55.0	60.3	64.7	57.5	51.1
2	55.0	60.8	65.2	58.1	51.8
3	57.2	62.9	67.2	60.2	53.8
4	57.5	63.1	67.3	60.4	54.0
5	60.6	65.9	70.7	63.0	56.7
6	60.8	66.3	71.1	63.6	57.2
7	62.2	67.6	72.8	64.0	59.7
8	57.2	62.5	66.6	59.0	54.7
9	61.7	67.3	72.3	63.8	59.5
10	52.6	58.8	63.4	56.7	52.3
11	61.6	68.3	67.8	60.3	53.7
12	61.6	68.3	67.8	60.3	53.7
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	54.6	59.9	60.3	56.6	52.2

Note: n/a not applicable

Table 11I.17 Calculated 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) Do-Something 2021

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 21DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	62.9	67.1	70.8	61.2	57.8
AA	61.0	67.4	70.1	61.2	57.1
AB	60.1	66.8	69.8	60.9	56.8
AC	53.2	58.6	62.7	53.6	49.0
AD	61.4	67.2	70.2	59.2	55.5
AE	61.2	67.5	70.3	61.4	57.3
B	66.9	71.0	74.8	65.1	61.8
D	65.9	70.3	75.0	64.1	60.7
E	64.1	68.1	73.7	62.2	58.9
F	63.8	68.0	71.7	62.0	58.7
G	68.0	72.3	76.8	66.2	62.8
I1	65.2	69.3	76.9	66.0	62.3
I2	65.0	69.7	76.6	64.6	60.4
13	65.1	69.7	76.5	64.3	60.6
14	65.2	69.9	76.6	64.5	60.7
J	65.0	68.4	74.7	64.0	60.7
K1	60.8	67.0	74.1	61.4	56.7
K2	60.5	66.7	73.9	61.1	56.5
K3	60.8	66.9	74.0	61.3	56.7
K4	60.3	66.5	73.8	60.8	56.1
K5	61.8	67.8	74.5	62.3	57.5
L	64.0	68.4	72.6	63.8	60.2
M	64.2	68.5	72.7	64.0	60.3
N1	62.3	66.6	70.7	62.0	58.2
N2	61.2	65.5	69.7	60.9	57.2
N3	62.4	67.0	72.7	62.2	58.4
O1	65.3	68.7	75.0	64.3	61.0
O2	65.5	68.9	74.7	64.3	60.9
P	62.1	69.3	75.0	62.6	58.1
Q	60.1	65.8	69.7	60.7	56.1
R	65.3	72.0	77.2	65.9	61.2
S	61.9	69.0	74.8	62.6	58.1

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-}hour)}$ 21DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	52.3	57.0	62.1	53.7	50.2
SB	51.9	56.7	61.9	53.7	50.1
SC	53.1	58.4	63.3	55.6	50.4
SD	50.8	56.2	61.3	53.5	48.7
SE	55.0	58.8	66.3	59.4	55.7
SF	58.2	61.9	70.5	60.8	56.3
SG	54.6	59.8	68.9	56.2	52.8
SH	56.6	60.4	69.0	59.3	54.9
SI	56.9	60.7	69.3	59.5	55.1
SJ	59.4	63.6	67.5	57.8	54.5
SK	54.0	57.8	65.2	58.8	54.8
SL	54.5	58.3	65.7	59.3	55.0
SM	54.0	57.6	65.0	58.4	54.5
SN	60.4	64.5	67.4	59.4	55.5
SO	60.6	64.7	68.8	61.0	57.1
SP	61.4	65.5	69.5	61.7	57.4
SQ	59.9	63.8	68.0	60.2	55.9
SR	59.1	63.0	67.0	59.2	55.0
SS	65.4	70.0	72.4	64.7	60.8
T1	50.5	55.9	59.6	48.7	44.8
T2	55.5	60.7	64.4	53.4	49.6
U	52.7	58.3	62.3	53.4	48.6
V1	67.7	72.3	74.0	64.0	61.4
V2	64.2	69.0	72.3	65.1	62.6
V3	58.8	63.0	69.1	59.8	55.7
V4	62.1	66.5	69.3	59.2	57.2
X	76.6	80.0	84.0	75.7	73.6
Y	60.3	66.8	69.5	60.6	56.5
ZD	54.0	59.6	63.7	54.7	50.1
ZE	57.7	62.1	68.1	57.8	53.8
ST1	65.5	70.0	72.8	65.0	61.3
ST2	61.9	64.3	68.5	61.6	59.2
ST3	64.1	67.2	71.2	63.5	61.5
ST4	61.7	65.8	69.4	62.3	59.6

Ref.	Predicted Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 21DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	63.3	67.3	69.1	61.5	59.9
1	55.0	60.2	66.2	57.5	52.3
2	56.2	62.5	67.4	58.7	53.7
3	58.0	64.0	69.3	60.5	55.5
4	58.3	64.2	69.4	60.8	55.8
5	60.6	65.8	71.7	63.0	57.5
6	61.4	67.1	72.6	63.9	58.5
7	62.5	68.1	74.2	64.2	60.2
8	57.0	62.2	69.0	59.0	55.3
9	62.2	67.7	73.9	63.9	60.0
10	54.8	61.5	67.1	57.2	53.6
11	63.0	69.7	70.0	61.4	55.1
12	63.0	69.7	70.0	61.4	55.1
Z1	0	64.3	73.9	0	0
Stogursey	56.2	62.5	64.0	58.7	53.7

Note: n/a not applicable

Table 11I.18: Predicted change in 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) between the Do-Nothing scenarios in 2016 and 2021

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-}hour)}$ Do-Nothing 2016 - 2021				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	0.0	0.1	-1.5	0.1	0.1
AA	-0.1	0.0	-0.6	0.1	0.1
AB	-0.2	0.0	-0.8	0.1	0.1
AC	0.1	0.1	-0.8	0.1	0.1
AD	0.1	0.1	-0.8	0.2	0.2
AE	-0.1	0.0	-0.7	0.1	0.1
B	-0.7	-0.2	-2.4	0.2	0.2
D	-0.1	0.1	-1.7	0.2	0.2
E	-0.2	0.0	-2.0	0.2	0.2
F	0.0	0.1	-1.8	0.1	0.1
G	-0.2	-0.1	-2.0	0.1	0.1
I1	0.0	0.0	-1.4	0.1	0.1
I2	0.0	0.1	-1.4	0.1	0.1
13	0.0	0.0	-1.2	0.0	0.0
14	0.0	0.1	-1.0	0.1	0.1
J	0.1	0.1	-2.2	0.2	0.2
K1	-0.1	0.1	-0.7	0.1	0.1
K2	-0.1	0.1	-0.8	0.2	0.2
K3	-0.1	0.0	-0.7	0.1	0.1
K4	0.0	0.1	-0.6	0.2	0.2
K5	0.1	0.2	-0.5	0.2	0.2
L	0.5	0.5	-1.3	0.5	0.5
M	0.2	0.2	-1.6	0.2	0.2
N1	0.5	0.5	-0.8	0.4	0.4
N2	0.5	0.5	-0.8	0.4	0.4
N3	0.5	0.5	-0.8	0.5	0.5
O1	0.1	0.1	-2.1	0.2	0.2
O2	0.1	0.1	-1.5	0.1	0.1
P	-0.8	-0.3	-1.2	0.3	0.3
Q	-0.3	0.0	-1.2	0.2	0.2
R	-0.3	-0.1	-0.6	0.1	0.1
S	-0.5	-0.2	-1.1	0.1	0.1

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ Do-Nothing 2016 - 2021				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	0.3	0.3	-0.5	0.3	0.3
SB	0.5	0.5	-0.7	0.5	0.5
SC	0.2	0.2	-0.2	0.3	0.3
SD	-0.8	-0.5	-1.1	0.0	0.0
SE	0.2	0.2	-3.2	0.2	0.2
SF	0.2	0.2	-0.6	0.2	0.2
SG	0.1	0.1	-0.4	0.1	0.1
SH	0.1	0.1	-1.0	0.1	0.1
SI	0.1	0.1	-0.8	0.1	0.1
SJ	0.0	0.1	-2.2	0.1	0.1
SK	0.1	0.1	-1.2	0.1	0.1
SL	-0.2	-0.2	-0.9	-0.1	-0.2
SM	0.1	0.1	-1.3	0.1	0.1
SN	-0.1	0.0	-1.5	0.1	0.1
SO	-0.2	-0.1	-1.8	0.1	0.1
SP	-0.1	-0.1	-1.1	0.0	0.0
SQ	-0.1	0.0	-1.2	-0.1	-0.1
SR	0.0	0.1	-1.1	0.1	0.1
SS	0.3	0.3	-0.6	0.3	0.4
T1	0.0	0.0	-0.3	0.0	0.0
T2	0.0	0.1	-0.4	0.1	0.1
U	0.1	0.1	-0.9	0.1	0.1
V1	0.2	0.2	-1.7	0.2	0.2
V2	0.1	0.1	-1.8	0.1	0.1
V3	0.4	0.3	-1.2	0.4	0.4
V4	0.6	0.6	-1.9	0.6	0.6
X	0.4	0.4	-1.4	0.4	0.4
Y	-0.2	0.0	-0.9	0.1	0.1
ZD	0.1	0.1	-1.1	0.1	0.1
ZE	-0.3	-0.1	-1.0	0.2	0.2
ST1	-0.2	0.1	-1.6	0.3	0.3
ST2	0.3	0.3	-0.9	0.3	0.3
ST3	0.5	0.5	-0.6	0.5	0.5
ST4	0.0	0.0	-1.3	0.0	0.0

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ Do-Nothing 2016 - 2021				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	0.1	0.1	-1.1	0.1	0.1
1	0.0	0.0	-1.4	0.0	0.0
2	-0.8	-0.4	-1.8	-0.2	-0.2
3	-0.6	-0.3	-1.7	-0.1	-0.1
4	-0.6	-0.3	-1.9	-0.1	-0.1
5	0.4	0.3	-0.7	0.3	0.3
6	-0.4	-0.2	-1.2	-0.1	-0.1
7	-0.3	-0.1	-1.3	0.0	0.0
8	0.0	0.0	-2.4	0.0	0.0
9	-0.6	-0.2	-1.6	0.0	0.0
10	-2.0	-1.3	-3.5	-0.3	-0.3
11	0.0	-0.1	-0.5	0.3	0.7
12	0.0	-0.2	-0.5	0.3	0.6
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	-1.2	-1.3	-5.0	-1.8	0.2

Note: n/a not applicable

Table 11I.19: Predicted change in 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) between the Do-Something and Do-Nothing scenarios in 2013

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-}hour)}$ 2013				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	+1.6	+0.7	-0.0	+2.4	+1.5
AA	+8.7	+5.0	+1.0	+8.1	+7.7
AB	+8.9	+5.2	+1.2	+8.6	+8.1
AC	+14.4	+9.6	+2.8	+13.9	+14.3
AD	+6.3	+3.0	+0.1	+8.0	+6.8
AE	+8.1	+4.6	+0.9	+7.7	+7.3
B	+2.6	+1.5	+0.6	+2.1	+4.6
D	+3.8	+2.0	+0.6	+4.5	+3.8
E	+1.1	+0.9	+0.8	+0.8	+1.3
F	+1.5	+0.7	+0.0	+2.1	+2.2
G	+3.2	+1.7	+0.5	+3.8	+3.2
I1	+2.6	+1.4	+0.5	+2.2	+2.2
I2	+2.7	+1.3	+0.5	+2.7	+3.0
13	+2.7	+1.3	+0.5	+2.9	+2.9
14	+2.7	+1.3	+0.5	+2.8	+2.9
J	+0.1	+0.0	+0.0	+0.0	+0.3
K1	+6.9	+3.3	+0.8	+6.4	+6.7
K2	+7.1	+3.5	+0.8	+6.6	+6.9
K3	+6.9	+3.3	+0.7	+6.4	+6.7
K4	+7.2	+3.5	+0.8	+6.7	+7.1
K5	+6.0	+2.7	+0.5	+5.6	+5.9
L	+0.1	+0.1	+0.1	+0.1	+0.1
M	-0.0	-0.0	-0.0	-0.0	-0.0
N1	+0.1	+0.1	+0.1	+0.2	+0.2
N2	+0.2	+0.2	+0.2	+0.2	+0.2
N3	+1.7	+0.7	+0.0	+1.9	+1.9
O1	+1.1	+0.6	+0.0	+1.5	+1.0
O2	+1.0	+0.5	+0.0	+1.3	+0.8
P	+12.6	+8.0	+2.1	+12.0	+12.6
Q	+3.8	+1.5	+0.1	+3.1	+4.5
R	+8.9	+4.9	+1.1	+8.4	+8.7
S	+10.5	+6.2	+1.5	+10.0	+10.3

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 2013				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	-0.0	-0.0	-0.0	-0.0	-0.0
SB	+0.0	+0.0	+0.0	+0.0	+0.0
SC	+0.1	+0.1	+0.2	+0.1	+0.2
SD	+0.0	+0.0	+0.0	+0.0	+0.0
SE	+0.0	+0.0	+0.0	+0.0	+0.0
SF	+0.0	+0.0	+0.0	+0.0	+0.0
SG	+0.0	+0.0	+0.0	+0.1	+0.0
SH	+0.0	+0.1	+0.1	+0.0	+0.0
SI	-0.0	-0.0	-0.0	-0.0	-0.0
SJ	-0.0	-0.0	-0.0	-0.0	-0.0
SK	+0.1	+0.1	+0.0	+0.0	+0.0
SL	-0.2	-0.2	-0.2	-0.2	-0.2
SM	-0.1	-0.1	-0.1	-0.1	-0.1
SN	+2.7	+1.4	+0.0	+3.1	+2.9
SO	+2.9	+1.4	+0.0	+2.8	+2.7
SP	+2.3	+1.1	+0.1	+2.1	+2.2
SQ	+0.5	+0.2	+0.0	+0.1	+1.2
SR	+0.6	+0.3	+0.0	+0.2	+1.5
SS	+1.4	+0.6	+0.0	+1.5	+1.6
T1	-0.7	-0.5	-0.4	-0.3	-0.3
T2	+0.1	+0.1	+0.2	+0.2	+0.2
U	+9.4	+6.8	+5.1	+8.6	+10.1
V1	+0.4	+0.4	+0.3	+0.3	+0.3
V2	+0.1	+0.1	+0.2	+0.1	+0.1
V3	+0.3	+0.3	+0.4	+0.4	+0.4
V4	+0.0	+0.0	+0.0	+0.0	+0.0
X	+0.1	+0.1	+0.1	+0.1	+0.1
Y	+9.0	+5.3	+1.1	+8.5	+8.1
ZD	+0.2	+0.2	+0.2	+0.2	+0.2
ZE	+1.4	+1.6	+1.6	+1.6	+1.6
ST1	+1.7	+1.2	+0.9	+1.1	+3.0
ST2	+0.9	+0.9	+0.9	+0.9	+0.9
ST3	+0.8	+0.8	+0.8	+0.8	+0.8
ST4	+0.6	+0.6	+0.6	+0.6	+0.6

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 2013				
	05:00-06:00	**06:00-07:00**	**12:00-13:00**	**23:00-00:00**	**00:00-01:00**
ST5	+0.6	+0.6	+0.6	+0.6	+0.6
1	+0.0	+0.0	+0.0	+0.0	+0.0
2	+8.5	+4.3	+0.4	+6.2	+5.7
3	+6.9	+3.1	+0.2	+4.8	+4.4
4	+6.7	+3.0	+0.2	+4.6	+4.2
5	+0.4	+0.3	+0.3	+0.3	+0.3
6	+5.6	+2.4	+0.3	+3.7	+3.4
7	+4.6	+1.9	+0.1	+3.5	+2.2
8	+0.0	+0.0	+0.0	+0.0	+0.0
9	+3.3	+1.3	+0.1	+1.9	+3.1
10	+9.5	+4.8	+0.3	+6.8	+5.5
11	+2.3	+2.4	+2.3	+2.4	+2.5
12	+2.3	+2.4	+2.3	+2.4	+2.5
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	+9.7	+5.5	-0.6	+7.9	+5.5

Note: n/a not applicable

Table 11I.20: Predicted change in 1-hour L_{A10} Basic Noise Level (including speed and percentage HGV correction) between the 2016 Do-Nothing and 2016 Do-Something scenarios

Ref.	**Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-}hour)}$ DS 2016 – DM 2016**				
	05:00-06:00	**06:00-07:00**	**12:00-13:00**	**23:00-00:00**	**00:00-01:00**
A	+1.7	+0.7	-0.0	+2.4	+1.5
AA	+8.6	+5.0	+1.3	+8.1	+7.7
AB	+8.9	+5.3	+1.4	+8.6	+8.1
AC	-3.0	-3.1	-3.0	-3.1	-3.1
AD	+6.1	+3.0	+0.6	+7.9	+6.8
AE	+8.0	+4.6	+1.1	+7.7	+7.3
B	+2.4	+1.4	+0.6	+2.0	+4.3
D	+3.5	+1.9	+0.5	+4.3	+3.6
E	+0.8	+0.6	+0.5	+0.5	+1.0
F	+1.5	+0.6	-0.0	+2.0	+2.1
G	+2.8	+1.5	+0.4	+3.5	+2.9
I1	+2.5	+1.3	+0.4	+2.1	+2.1
I2	+2.6	+1.2	+0.4	+2.6	+2.9
13	+2.5	+1.2	+0.3	+2.7	+2.8
14	+2.6	+1.3	+0.5	+2.8	+2.8
J	+0.3	+0.3	+0.2	+0.2	+0.5
K1	+6.8	+3.3	+0.8	+6.3	+6.6
K2	+7.1	+3.5	+0.8	+6.6	+6.9
K3	+6.8	+3.3	+0.8	+6.3	+6.6
K4	+7.2	+3.5	+0.8	+6.7	+7.0
K5	+5.9	+2.7	+0.5	+5.5	+5.8
L	-0.2	-0.2	-0.3	-0.3	-0.3
M	-0.0	-0.0	-0.0	-0.0	-0.0
N1	-0.0	-0.0	+0.0	+0.0	+0.0
N2	+0.3	+0.3	+0.3	+0.3	+0.3
N3	+2.2	+1.1	+0.4	+2.4	+2.4
O1	+1.2	+0.7	+0.1	+1.6	+1.0
O2	+1.1	+0.6	+0.2	+1.4	+0.9
P	+12.7	+8.4	+3.5	+12.2	+12.7
Q	+3.8	+1.5	+0.2	+3.1	+4.5
R	+9.0	+5.0	+1.3	+8.5	+8.7

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ DS 2016 – DM 2016				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
S	+10.5	+6.3	+1.7	+10.0	+10.3
SA	-0.2	-0.2	-0.2	-0.1	-0.2
SB	-0.2	-0.2	-0.1	-0.1	-0.2
SC	+0.0	+0.0	+0.0	+0.0	+0.0
SD	-0.0	-0.0	-0.0	-0.0	-0.0
SE	-0.0	-0.0	-0.0	-0.0	-0.0
SF	+0.1	+0.0	+0.0	+0.1	+0.1
SG	+0.1	+0.1	+0.1	-0.0	+0.1
SH	-0.0	-0.0	-0.0	-0.0	-0.0
SI	-0.1	-0.1	-0.1	-0.1	-0.1
SJ	-0.1	-0.1	-0.1	-0.1	-0.1
SK	-0.0	-0.0	-0.1	-0.1	-0.1
SL	-0.6	-0.7	-0.7	-0.8	-0.7
SM	-0.4	-0.4	-0.4	-0.4	-0.4
SN	+2.5	+1.1	-0.2	+2.9	+2.7
SO	+2.9	+1.4	+0.1	+2.8	+2.7
SP	+2.1	+1.0	-0.1	+2.0	+2.1
SQ	+0.4	+0.1	-0.2	-0.1	+1.0
SR	+0.6	+0.3	+0.0	+0.1	+1.5
SS	+1.3	+0.5	+0.0	+1.4	+1.5
T1	-1.3	-1.0	-0.7	-0.6	-0.6
T2	+0.1	+0.2	+0.2	+0.3	+0.3
U	-0.6	-0.7	-0.7	-0.7	-0.7
V1	+0.7	+0.7	+0.7	+0.7	+0.7
V2	+0.7	+0.7	+0.7	+0.7	+0.7
V3	-0.1	-0.1	-0.1	-0.1	-0.1
V4	-0.2	-0.2	-0.2	-0.2	-0.2
X	-0.0	-0.0	-0.0	-0.0	-0.0
Y	+9.0	+5.3	+1.4	+8.5	+8.1
ZD	-2.0	-2.0	-2.0	-2.0	-2.0
ZE	+1.3	+1.4	+1.4	+1.4	+1.4
ST1	+1.4	+0.8	+0.4	+0.7	+2.7
ST2	+0.1	+0.1	+0.1	+0.1	+0.1
ST3	-0.1	-0.1	-0.1	-0.1	-0.1

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-}hour)}$ DS 2016 – DM 2016				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST4	+0.7	+0.7	+0.7	+0.7	+0.7
ST5	+0.8	+0.8	+0.7	+0.7	+0.8
1	+0.0	+0.0	+0.0	+0.0	+0.0
2	+8.5	+4.3	+0.4	+6.2	+5.7
3	+6.9	+3.1	+0.2	+4.8	+4.4
4	+6.7	+3.0	+0.2	+4.6	+4.2
5	+0.4	+0.3	+0.3	+0.3	+0.3
6	+5.6	+2.4	+0.3	+3.7	+3.4
7	+4.6	+1.9	+0.1	+3.5	+2.2
8	+0.0	+0.0	+0.0	+0.0	+0.0
9	+3.3	+1.3	+0.1	+1.9	+3.1
10	+9.5	+4.8	+0.3	+6.8	+5.5
11	+2.3	+2.5	+2.3	+2.4	+2.5
12	+2.2	+2.4	+2.3	+2.3	+2.5
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	+8.5	+4.3	+0.4	+6.2	+5.7

Note: n/a not applicable

Table 11I.21: Predicted change in 1-hour L_{A10} Basic Noise Level (including speed and HGV correction) between the 2021 Do-Nothing and 2021 Do-Something scenarios

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 2021 DS – 2021 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	-0.1	-0.0	+0.0	+0.1	+0.3
AA	+0.7	+1.7	+0.6	+0.5	+0.7
AB	+0.2	+1.6	+0.7	+0.7	+1.0
AC	-3.8	-3.9	-3.7	-3.7	-3.2
AD	+0.0	+0.8	+0.3	+0.4	+0.7
AE	+0.5	+1.5	+0.5	+0.4	+0.7
B	+0.2	+0.2	+0.4	+0.4	+0.7
D	+0.4	+0.6	+1.7	+0.6	+0.8
E	+0.6	+0.4	+2.4	+0.7	+0.9
F	+0.3	+0.3	+0.5	+0.5	+0.7
G	+0.3	+0.4	+1.3	+0.4	+0.7
I1	+0.1	+0.2	+3.9	+0.1	+0.5
I2	+0.1	+0.2	+4.3	+0.2	+0.6
13	+0.1	+0.2	+4.6	+0.1	+0.5
14	+0.2	+0.3	+4.6	+0.2	+0.5
J	+0.0	-0.1	+3.3	+0.3	+0.8
K1	+0.4	+0.9	+4.1	+0.5	+1.0
K2	+0.4	+1.0	+4.3	+0.6	+1.1
K3	+0.4	+0.9	+4.2	+0.5	+1.1
K4	+0.3	+1.0	+4.4	+0.5	+1.0
K5	+0.2	+0.6	+3.4	+0.3	+0.7
L	-0.6	-0.7	-0.3	-0.4	+0.1
M	-0.2	-0.3	+0.1	+0.0	+0.5
N1	-0.5	-0.5	-0.2	-0.2	+0.1
N2	-0.3	-0.3	+0.0	-0.0	+0.4
N3	+0.5	+0.6	+2.6	+0.8	+1.3
O1	+0.1	+0.1	+3.5	+0.5	+0.9
O2	+0.1	+0.1	+3.0	+0.3	+0.7
P	+2.5	+4.0	+5.9	+2.5	+3.2
Q	+0.0	+0.2	+0.2	+0.2	+0.8
R	+0.6	+1.7	+3.0	+0.7	+1.2
S	+0.8	+2.2	+4.1	+1.0	+1.7

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-}hour)}$ 2021 DS – 2021 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	-0.5	-0.5	-0.4	-0.2	+0.1
SB	-0.5	-0.6	-0.3	-0.1	+0.2
SC	-0.2	-0.2	-0.2	-0.1	+0.1
SD	-0.1	-0.2	-0.1	-0.0	+0.4
SE	-0.3	-0.5	-0.0	-0.0	+0.8
SF	-0.2	-0.2	-0.1	-0.0	+0.3
SG	-0.0	-0.1	-0.0	-0.1	+0.2
SH	-0.2	-0.2	-0.0	+0.0	+0.4
SI	-0.2	-0.2	-0.1	-0.1	+0.3
SJ	-0.2	-0.3	+0.0	+0.1	+0.3
SK	-0.2	-0.4	-0.1	-0.1	+0.6
SL	-0.4	-0.6	-0.5	-0.5	-0.0
SM	-0.5	-0.7	-0.4	-0.3	+0.4
SN	-0.3	-0.0	-0.1	-0.1	+0.6
SO	+0.1	+0.3	+0.5	+0.6	+1.4
SP	-0.1	+0.1	+0.1	+0.1	+0.6
SQ	-0.1	-0.1	+0.1	+0.2	+0.7
SR	-0.1	-0.1	+0.0	+0.1	+0.6
SS	-0.1	-0.1	+0.0	-0.0	+0.2
T1	-0.8	-0.6	-0.5	-0.4	-0.3
T2	+0.0	+0.0	+0.2	+0.2	+0.4
U	-0.9	-1.0	-0.8	-0.8	-0.3
V1	+0.1	+0.0	+0.3	+0.4	+0.5
V2	+0.0	-0.0	+0.3	+0.3	+0.5
V3	-0.5	-0.5	-0.3	-0.2	+0.1
V4	-0.7	-0.8	-0.4	-0.5	-0.3
X	-0.2	-0.3	+0.0	+0.0	+0.1
Y	+0.7	+1.8	+0.6	+0.5	+0.8
ZD	-2.5	-2.6	-2.4	-2.3	-1.8
ZE	-0.1	+0.2	+0.5	+0.3	+0.9
ST1	+0.2	+0.1	+0.5	+0.4	+0.9
ST2	-0.0	-0.1	+0.3	+0.1	+0.3
ST3	-0.1	-0.1	+0.0	+0.0	+0.2
ST4	+0.4	+0.3	+0.5	+0.5	+0.6

Ref.	Predicted Change in Basic Noise Level (including speed and HGV correction), dB $L_{A10\ (1\text{-hour})}$ 2021 DS – 2021 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	+0.4	+0.3	+0.5	+0.5	+0.7
1	+0.0	-0.1	+0.0	+0.0	+1.2
2	+0.4	+1.3	+0.4	+0.4	+1.7
3	+0.2	+0.9	+0.3	+0.2	+1.6
4	+0.2	+0.8	+0.3	+0.3	+1.6
5	+0.0	-0.1	+0.0	+0.0	+0.9
6	+0.3	+0.7	+0.3	+0.3	+1.2
7	+0.0	+0.4	+0.1	+0.1	+0.5
8	-0.2	-0.3	+0.0	-0.0	+0.6
9	-0.1	+0.1	+0.0	+0.1	+0.5
10	+0.2	+1.3	+0.3	+0.2	+0.9
11	+1.5	+1.4	+1.8	+1.0	+1.4
12	+1.5	+1.4	+1.8	+1.0	+1.4
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	+1.6	+2.6	+3.1	+2.1	+1.5

Note: n/a not applicable

Table 11I.22: Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Nothing 2009

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2009 DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
A	55.2	59.4	53.3	49.7
AA	52.5	57.8	52.9	48.5
AB	52.3	57.7	52.7	48.3
AC	49.7	55.3	50.2	44.9
AD	53.6	58.7	51.1	47.2
AE	53.8	59.1	54.0	49.7
B	58.9	63.0	56.8	53.3
D	58.6	62.8	56.6	53.1
E	56.7	60.8	54.7	51.1
F	57.1	61.2	55.0	51.5
G	59.1	63.2	57.1	53.5
I1	57.8	61.7	58.4	54.4
I2	57.5	62.1	57.1	52.5
13	57.4	61.9	56.6	52.5
14	57.2	61.8	56.5	52.4
J	58.4	61.8	57.0	53.2
K1	53.2	58.8	53.6	48.4
K2	52.9	58.5	53.4	48.1
K3	53.2	58.8	53.6	48.4
K4	53.3	59.0	53.8	48.6
K5	54.2	59.8	54.6	49.4
L	55.9	60.4	55.5	51.4
M	56.4	60.8	55.9	51.8
N1	54.2	58.7	53.7	49.5
N2	54.0	58.4	53.4	49.2
N3	55.0	59.4	54.4	50.2
O1	58.6	62.0	57.2	53.4
O2	58.1	61.5	56.6	52.9
P	50.9	56.5	51.3	46.1
Q	51.5	57.1	51.9	46.7
R	53.6	59.2	54.1	48.9
S	53.3	58.9	53.7	48.5
SA	46.1	50.9	47.4	43.5

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-hour})}$ 2009 DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
SB	45.7	50.5	47.2	43.2
SC	46.2	51.5	48.5	43.1
SD	44.9	50.4	47.5	42.2
SE	47.6	51.6	51.7	47.2
SF	52.0	55.8	54.4	49.7
SG	47.1	52.3	48.7	45.0
SH	50.8	54.6	53.3	48.5
SI	49.4	53.3	51.9	47.2
SJ	53.2	57.4	51.3	47.7
SK	47.9	51.8	52.6	47.8
SL	48.3	52.3	53.2	48.4
SM	48.2	51.9	52.4	47.8
SN	54.5	58.3	53.5	48.9
SO	54.8	58.7	54.6	49.9
SP	54.5	58.4	54.6	49.9
SQ	52.9	56.9	53.1	48.3
SR	51.8	55.7	52.0	47.2
SS	56.4	61.0	55.6	51.5
T1	43.7	49.0	41.6	37.7
T2	48.8	54.0	46.5	42.5
U	45.2	50.9	45.7	40.5
V1	58.1	62.8	55.9	53.1
V2	54.4	59.3	55.0	52.3
V3	49.6	53.9	50.2	45.9
V4	52.0	56.5	48.8	46.7
X	64.9	68.3	63.7	61.6
Y	52.8	58.1	53.1	48.7
ZD	50.6	56.3	51.1	45.9
ZE	50.6	54.7	50.3	45.7
ST1	57.8	62.3	57.0	52.9
ST2	51.8	54.2	51.4	48.8
ST3	52.4	55.5	51.6	49.5
ST4	51.6	55.7	52.0	49.2
ST5	52.5	56.6	50.6	48.8

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2009 DN			
	05:00-06:00	06:00-07:00	23:00-00:00	00:00-01:00
1	47.9	53.2	50.3	44.0
2	48.8	54.2	51.3	45.0
3	50.7	56.1	53.3	46.9
4	51.1	56.4	53.5	47.2
5	50.1	55.5	52.6	46.3
6	51.2	56.5	53.7	47.3
7	52.7	58.0	54.2	49.9
8	48.1	53.4	50.2	45.8
9	52.7	58.0	54.3	50.0
10	46.0	51.5	48.7	44.3
11	49.3	56.4	47.9	41.0
12	49.3	56.4	47.9	41.0
Z1	n/a	n/a	n/a	n/a
Stogursey	50.7	56.0	52.6	47.6

Note: n/a not applicable

Table 11I.23: Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Nothing 2013

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2013 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	55.4	59.5	63.1	53.4	49.9
AA	52.5	57.9	61.8	53.0	48.6
AB	52.4	57.8	61.6	52.7	48.4
AC	49.8	55.4	59.3	50.2	45.0
AD	53.7	58.7	62.2	51.1	47.2
AE	53.9	59.3	63.1	54.2	49.8
B	59.1	63.2	66.8	57.0	53.4
D	58.8	62.9	66.5	56.8	53.2
E	57.0	61.1	64.7	55.0	51.4
F	57.4	61.5	65.0	55.3	51.7
G	59.2	63.3	66.9	57.2	53.6
I1	58.5	62.4	66.4	59.1	55.1
I2	58.3	62.8	65.7	57.9	53.2
13	58.2	62.8	65.1	57.4	53.3
14	58.0	62.6	65.0	57.3	53.2
J	59.2	62.6	65.6	57.9	54.1
K1	53.3	58.9	62.8	53.7	48.5
K2	53.0	58.7	62.5	53.5	48.3
K3	53.3	58.9	62.8	53.8	48.6
K4	53.5	59.1	63.0	53.9	48.7
K5	54.4	60.0	63.9	54.8	49.6
L	57.0	61.5	65.3	56.6	52.5
M	56.6	61.0	64.8	56.2	52.0
N1	55.7	60.1	63.9	55.2	51.0
N2	55.5	59.9	63.7	55.0	50.8
N3	56.1	60.5	64.3	55.6	51.4
O1	59.3	62.7	65.7	58.0	54.2
O2	58.9	62.4	65.3	57.5	53.8
P	51.0	56.6	60.5	51.4	46.2
Q	51.6	57.2	61.1	52.0	46.8
R	53.7	59.4	63.2	54.2	49.0
S	53.4	59.0	62.9	53.9	48.7
SA	46.2	51.0	56.0	47.4	43.6

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2013 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	45.9	50.7	55.7	47.3	43.3
SC	46.3	51.6	56.4	48.6	43.3
SD	45.1	50.5	55.5	47.6	42.3
SE	47.7	51.7	58.8	51.8	47.3
SF	52.0	55.8	64.3	54.5	49.7
SG	47.1	52.3	61.3	48.7	45.1
SH	50.9	54.7	63.2	53.4	48.6
SI	49.6	53.5	61.9	52.1	47.3
SJ	53.3	57.4	61.0	51.3	47.8
SK	48.1	52.0	59.2	52.8	48.0
SL	48.5	52.5	59.7	53.3	48.6
SM	48.2	51.9	59.1	52.4	47.8
SN	54.8	58.6	61.6	53.5	49.0
SO	54.7	58.6	62.4	54.6	49.8
SP	54.6	58.5	62.5	54.7	49.9
SQ	53.0	56.9	60.9	53.1	48.3
SR	51.9	55.8	59.8	52.0	47.2
SS	56.6	61.2	63.5	55.8	51.7
T1	43.9	49.1	52.6	41.6	37.6
T2	48.9	54.0	57.6	46.5	42.6
U	45.3	50.9	54.8	45.7	40.5
V1	58.9	63.6	65.5	56.8	54.1
V2	55.2	60.1	63.1	55.8	53.1
V3	49.9	54.1	59.9	50.5	46.1
V4	52.2	56.8	59.1	49.0	46.9
X	65.0	68.4	72.2	63.9	61.7
Y	52.8	58.2	62.0	53.2	48.8
ZD	50.7	56.3	60.2	51.2	46.0
ZE	50.7	54.8	60.5	50.4	45.8
ST1	58.4	63.0	65.4	57.7	53.6
ST2	52.0	54.3	58.3	51.6	49.0
ST3	52.5	55.7	59.5	51.8	49.7
ST4	52.7	56.8	60.3	53.1	50.3
ST5	53.8	57.8	59.5	51.9	50.1

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2013 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	48.2	53.5	59.3	50.6	44.3
2	49.1	54.5	60.3	51.6	45.3
3	51.0	56.4	62.3	53.6	47.2
4	51.4	56.7	62.5	53.8	47.5
5	50.4	55.8	61.6	52.9	46.6
6	51.5	56.8	62.6	54.0	47.6
7	53.0	58.3	64.6	54.6	50.3
8	48.4	53.7	60.3	50.5	46.1
9	53.0	58.3	64.7	54.6	50.3
10	46.3	51.8	58.7	49.0	44.6
11	49.4	56.5	56.2	48.0	41.1
12	49.4	56.5	56.2	48.0	41.1
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	48.4	53.7		50.5	46.1

Note: n/a not applicable

Table 11I.24: Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Something 2013

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2013 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	57.7	60.6	63.1	56.7	52.0
AA	63.1	64.5	63.3	63.0	58.1
AB	63.0	64.4	63.3	63.0	58.1
AC	64.3	63.4	59.4	64.4	58.4
AD	61.5	62.7	62.3	60.7	55.5
AE	63.3	64.8	64.2	63.1	58.3
B	61.7	64.7	67.5	59.4	57.5
D	63.2	65.4	67.2	62.0	57.5
E	58.2	62.2	65.7	55.9	52.7
F	59.1	62.2	65.1	57.7	54.1
G	63.3	65.6	67.6	62.1	57.7
I1	61.7	64.1	66.9	61.9	57.8
I2	61.5	64.4	66.3	61.2	56.8
13	61.5	64.4	65.7	61.0	56.9
14	61.5	64.3	65.6	60.9	56.9
J	59.3	62.7	65.6	57.9	54.4
K1	61.5	63.2	63.7	61.5	56.6
K2	61.5	63.1	63.6	61.4	56.6
K3	61.5	63.2	63.8	61.5	56.6
K4	61.6	63.2	63.9	61.5	56.6
K5	61.7	63.6	64.6	61.6	56.8
L	57.2	61.6	65.4	56.7	52.6
M	56.6	61.0	64.8	56.1	52.0
N1	55.9	60.3	64.1	55.4	51.2
N2	55.7	60.1	63.9	55.2	51.0
N3	58.2	61.4	64.3	57.8	53.6
O1	60.5	63.3	65.8	59.4	55.1
O2	60.1	62.9	65.3	59.1	54.8
P	65.7	66.4	63.4	65.5	60.7
Q	56.3	59.1	61.2	56.2	51.6
R	65.8	66.8	65.1	65.7	60.8
S	65.8	66.8	64.9	65.7	60.7
SA	46.2	51.0	56.0	47.4	43.6

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2013 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	45.9	50.7	55.7	47.3	43.3
SC	46.4	51.7	56.5	48.8	43.4
SD	45.1	50.5	55.5	47.6	42.3
SE	47.8	51.8	58.8	51.9	47.4
SF	52.0	55.8	64.3	54.5	49.7
SG	47.2	52.4	61.4	48.8	45.1
SH	50.9	54.8	63.3	53.4	48.7
SI	49.5	53.4	61.9	52.0	47.3
SJ	53.2	57.4	61.0	51.3	47.7
SK	48.2	52.1	59.3	52.8	48.1
SL	48.3	52.3	59.5	53.1	48.3
SM	48.2	51.9	59.0	52.4	47.7
SN	57.6	60.0	61.7	56.8	52.0
SO	57.5	60.0	62.4	57.3	52.4
SP	57.5	60.0	62.5	57.3	52.5
SQ	53.4	57.1	60.9	53.1	49.3
SR	52.4	56.0	59.8	52.1	48.5
SS	58.6	62.0	63.5	58.0	53.7
T1	43.1	48.5	52.3	41.3	37.4
T2	48.9	54.1	57.7	46.7	42.8
U	56.4	59.3	61.4	56.3	51.7
V1	59.4	64.1	66.0	57.1	54.4
V2	55.2	60.1	63.1	55.8	53.1
V3	50.6	54.9	60.6	51.3	46.9
V4	52.2	56.8	59.1	49.0	46.9
X	65.2	68.6	72.3	64.0	61.9
Y	63.1	64.5	63.5	63.0	58.2
ZD	50.8	56.5	60.3	51.3	46.1
ZE	52.6	56.9	62.6	52.5	47.9
ST1	60.1	64.3	66.4	58.9	56.3
ST2	53.0	55.4	59.3	52.6	50.0
ST3	54.1	57.3	61.1	53.4	51.3
ST4	53.4	57.5	61.0	53.8	51.0
ST5	54.6	58.6	60.3	52.7	50.9

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-hour})}$ 2013 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	48.2	53.5	59.3	50.6	44.3
2	58.8	59.6	60.6	58.8	52.0
3	59.1	60.3	62.4	59.3	52.5
4	59.1	60.4	62.7	59.4	52.6
5	50.7	56.0	61.8	53.1	46.8
6	59.1	60.5	62.8	59.4	52.6
7	59.4	61.1	64.7	59.6	53.6
8	48.4	53.7	60.3	50.5	46.1
9	56.9	59.9	64.7	57.4	53.3
10	56.9	57.3	58.9	56.5	50.1
11	53.5	60.7	60.3	52.2	45.3
12	53.5	60.7	60.3	52.2	45.3
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	53.9	56.7	60.6	54.9	52.3

Note: n/a not applicable

Table 11I.25: Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Nothing 2016

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2016 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	55.4	59.5	63.1	53.4	49.9
AA	52.6	58.0	61.9	53.1	48.7
AB	52.4	57.8	61.6	52.8	48.4
AC	49.8	55.4	59.3	50.2	45.0
AD	54.0	59.0	62.5	51.4	47.4
AE	54.0	59.3	63.1	54.3	49.9
B	59.7	63.8	67.4	57.7	54.1
D	59.1	63.2	66.8	57.1	53.5
E	57.1	61.3	64.9	55.2	51.7
F	57.4	61.5	65.1	55.4	51.8
G	60.0	64.1	67.7	58.0	54.5
I1	58.5	62.5	66.5	59.2	55.1
I2	58.3	62.9	65.8	57.9	53.3
13	58.3	62.8	65.2	57.5	53.4
14	58.0	62.6	65.0	57.3	53.2
J	59.2	62.6	65.6	57.8	54.1
K1	53.4	59.0	62.9	53.8	48.6
K2	53.0	58.6	62.5	53.4	48.2
K3	53.4	59.0	62.9	53.8	48.6
K4	53.6	59.2	63.0	54.0	48.7
K5	54.5	60.1	64.0	54.9	49.7
L	56.2	60.6	64.4	55.7	51.6
M	56.6	61.1	64.9	56.2	52.1
N1	54.3	58.7	62.5	53.8	49.6
N2	53.9	58.4	62.1	53.4	49.3
N3	55.3	59.7	63.4	54.7	50.5
O1	59.3	62.7	65.7	57.9	54.2
O2	58.9	62.3	65.2	57.4	53.7
P	51.1	56.6	60.5	51.4	46.2
Q	51.6	57.2	61.1	52.0	46.8
R	53.7	59.4	63.2	54.2	49.0
S	53.4	59.0	62.9	53.9	48.6
SA	46.4	51.2	56.1	47.6	43.8

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2016 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	46.1	50.8	55.9	47.5	43.5
SC	46.5	51.8	56.6	48.8	43.4
SD	45.2	50.6	55.5	47.7	42.4
SE	47.7	51.7	58.8	51.9	47.3
SF	51.6	55.5	64.0	54.1	49.4
SG	47.2	52.4	61.4	48.9	45.2
SH	51.0	54.8	63.3	53.5	48.7
SI	49.7	53.5	62.0	52.1	47.4
SJ	53.6	57.7	61.3	51.6	48.0
SK	48.1	52.1	59.3	52.8	48.1
SL	48.6	52.5	59.8	53.4	48.7
SM	48.2	51.9	59.0	52.4	47.8
SN	54.9	58.8	61.8	53.7	49.2
SO	54.8	58.7	62.5	54.7	49.9
SP	54.7	58.6	62.6	54.8	50.0
SQ	53.2	57.1	61.2	53.4	48.6
SR	52.0	55.9	60.0	52.2	47.4
SS	57.0	61.5	63.9	56.2	52.0
T1	43.8	49.0	52.6	41.5	37.6
T2	48.8	54.0	57.5	46.5	42.6
U	45.2	50.9	54.7	45.7	40.5
V1	58.9	63.6	65.6	56.8	54.1
V2	55.3	60.1	63.1	55.8	53.1
V3	50.5	54.7	60.5	51.1	46.7
V4	52.7	57.2	59.6	49.5	47.4
X	65.2	68.6	72.3	64.0	61.9
Y	52.8	58.2	62.1	53.2	48.8
ZD	50.6	56.3	60.1	51.1	45.9
ZE	50.8	54.9	60.6	50.6	45.9
ST1	58.6	63.1	65.5	57.8	53.7
ST2	52.3	54.7	58.6	51.9	49.3
ST3	52.8	55.9	59.8	52.1	49.9
ST4	52.7	56.8	60.2	53.1	50.3
ST5	53.8	57.8	59.5	51.9	50.0

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-hour})}$ 2016 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	48.2	53.5	59.3	50.6	44.3
2	49.1	54.5	60.3	51.6	45.3
3	51.0	56.4	62.3	53.6	47.2
4	51.4	56.7	62.5	53.8	47.5
5	50.7	56.0	61.6	53.1	46.8
6	51.5	56.8	62.6	54.0	47.6
7	53.0	58.3	64.6	54.6	50.3
8	48.4	53.7	60.3	50.5	46.1
9	53.0	58.3	64.7	54.6	50.3
10	46.3	51.8	58.7	49.0	44.6
11	49.4	56.5	56.4	48.0	41.1
12	49.4	56.5	56.6	48.0	41.1
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	48.4	53.7	58.6	50.5	46.1

Note: n/a not applicable

Table 11I.26: Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Something 2016

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2016 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	57.7	60.6	63.1	56.7	52.0
AA	63.1	64.5	63.6	63.0	58.2
AB	63.1	64.5	63.4	63.0	58.2
AC	46.7	52.3	56.2	47.1	41.9
AD	61.5	62.9	62.9	60.8	55.7
AE	63.3	64.9	64.5	63.2	58.3
B	62.0	65.2	68.1	59.9	57.8
D	63.2	65.5	67.4	62.1	57.6
E	58.1	62.1	65.6	55.9	52.8
F	59.1	62.3	65.1	57.7	54.2
G	63.6	66.1	68.3	62.4	58.0
I1	61.7	64.1	66.9	61.9	57.8
I2	61.6	64.4	66.2	61.1	56.8
13	61.5	64.4	65.7	60.9	56.9
14	61.5	64.3	65.6	60.9	56.8
J	59.5	62.9	65.8	58.1	54.5
K1	61.6	63.2	63.8	61.5	56.6
K2	61.5	63.1	63.5	61.4	56.5
K3	61.6	63.2	63.8	61.5	56.6
K4	61.6	63.3	63.9	61.5	56.6
K5	61.7	63.6	64.7	61.6	56.8
L	56.0	60.4	64.2	55.6	51.4
M	56.6	61.0	64.9	56.2	52.0
N1	54.3	58.7	62.5	53.8	49.6
N2	54.2	58.6	62.4	53.7	49.5
N3	57.8	60.9	63.7	57.5	53.3
O1	60.5	63.4	65.9	59.5	55.2
O2	60.2	63.0	65.4	59.1	54.8
P	65.8	66.7	64.4	65.6	60.8
Q	56.4	59.2	61.3	56.2	51.7
R	65.8	66.8	65.2	65.7	60.8
S	65.8	66.8	65.0	65.7	60.8
SA	46.2	51.0	56.0	47.5	43.6

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2016 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	45.9	50.7	55.7	47.4	43.3
SC	46.5	51.8	56.6	48.9	43.5
SD	45.2	50.6	55.5	47.7	42.3
SE	47.7	51.7	58.8	51.9	47.3
SF	51.7	55.5	64.0	54.2	49.4
SG	47.3	52.5	61.5	48.9	45.2
SH	50.9	54.8	63.2	53.4	48.6
SI	49.5	53.4	61.9	52.0	47.3
SJ	53.5	57.7	61.3	51.5	48.0
SK	48.1	52.0	59.2	52.8	48.0
SL	47.9	51.8	59.1	52.6	47.9
SM	47.8	51.5	58.7	52.1	47.4
SN	57.5	59.9	61.5	56.7	52.0
SO	57.5	60.0	62.6	57.4	52.5
SP	57.4	59.9	62.6	57.4	52.5
SQ	53.5	57.2	61.1	53.3	49.5
SR	52.6	56.2	60.0	52.3	48.6
SS	58.9	62.3	63.9	58.2	53.9
T1	42.5	48.0	51.8	40.9	37.0
T2	48.9	54.2	57.8	46.8	42.8
U	44.6	50.2	54.1	45.0	39.8
V1	59.7	64.4	66.3	57.6	54.8
V2	56.0	60.8	63.8	56.5	53.8
V3	50.4	54.6	60.4	51.0	46.6
V4	52.6	57.1	59.5	49.4	47.2
X	65.2	68.6	72.4	64.0	61.9
Y	63.1	64.6	63.8	63.1	58.2
ZD	48.6	54.3	58.1	49.1	43.9
ZE	52.7	56.8	62.5	52.4	47.8
ST1	59.8	63.9	66.0	58.5	56.0
ST2	52.5	54.9	58.8	52.1	49.5
ST3	53.0	56.1	60.0	52.2	50.1
ST4	53.4	57.5	60.9	53.7	51.0
ST5	54.6	58.6	60.3	52.7	50.9

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2016 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	48.2	53.5	59.3	50.6	44.3
2	58.8	59.6	60.6	58.8	52.0
3	59.1	60.3	62.4	59.3	52.5
4	59.1	60.4	62.7	59.4	52.6
5	50.7	56.0	61.8	53.1	46.8
6	59.1	60.5	62.8	59.4	52.6
7	59.4	61.1	64.7	59.6	53.6
8	48.4	53.7	60.3	50.5	46.1
9	56.9	59.9	64.7	57.4	53.3
10	56.9	57.3	58.9	56.5	50.1
11	53.1	60.3	59.9	51.8	45.0
12	53.1	60.3	59.9	51.8	45.0
Z1	65.3	65.4	62.8	65.2	60.3
Stogursey	58.8	59.6	58.9	58.8	52.0

Note: n/a not applicable

Table 11I.27: Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Nothing 2021

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2021 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	55.5	59.7	63.3	53.6	50.0
AA	52.8	58.2	62.0	53.2	48.8
AB	52.6	58.0	61.8	53.0	48.6
AC	50.0	55.6	59.5	50.4	45.2
AD	54.1	59.2	62.7	51.6	47.6
AE	54.2	59.5	63.3	54.4	50.1
B	59.9	64.0	67.6	57.9	54.3
D	59.3	63.4	67.0	57.3	53.7
E	57.4	61.5	65.1	55.4	51.9
F	57.6	61.7	65.3	55.6	52.0
G	60.1	64.2	67.8	58.1	54.6
I1	58.6	62.6	66.5	59.3	55.2
I2	58.4	63.0	65.9	58.0	53.3
13	58.3	62.9	65.3	57.6	53.4
14	58.2	62.7	65.1	57.4	53.3
J	59.4	62.8	65.8	58.0	54.2
K1	53.5	59.2	63.0	54.0	48.8
K2	53.2	58.8	62.7	53.6	48.4
K3	53.5	59.1	63.0	53.9	48.7
K4	53.8	59.4	63.2	54.2	49.0
K5	54.8	60.3	64.2	55.1	49.9
L	56.7	61.1	64.9	56.3	52.2
M	56.9	61.3	65.1	56.4	52.3
N1	54.8	59.2	63.0	54.2	50.1
N2	54.4	58.9	62.6	53.9	49.7
N3	55.7	60.2	63.9	55.1	50.9
O1	59.5	62.9	65.9	58.1	54.3
O2	59.0	62.4	65.4	57.5	53.8
P	51.3	57.0	60.8	51.8	46.6
Q	51.8	57.5	61.3	52.3	47.1
R	53.9	59.5	63.4	54.4	49.2
S	53.6	59.2	63.1	54.1	48.8
SA	46.8	51.5	56.5	48.0	44.1

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2021 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	46.5	51.3	56.3	47.9	44.0
SC	46.8	52.1	56.9	49.1	43.8
SD	45.1	50.6	55.5	47.7	42.4
SE	47.9	51.9	59.0	52.1	47.5
SF	51.9	55.7	64.2	54.4	49.6
SG	47.4	52.6	61.6	49.0	45.3
SH	51.0	54.9	63.3	53.5	48.8
SI	49.8	53.6	62.1	52.3	47.5
SJ	53.6	57.8	61.4	51.7	48.2
SK	48.2	52.2	59.4	52.9	48.2
SL	48.4	52.4	59.6	53.3	48.5
SM	48.3	52.1	59.2	52.6	47.9
SN	55.0	58.8	61.8	53.8	49.2
SO	54.8	58.7	62.6	54.7	50.0
SP	54.7	58.6	62.7	54.9	50.1
SQ	53.2	57.2	61.2	53.4	48.6
SR	52.2	56.2	60.2	52.4	47.6
SS	57.4	62.0	64.3	56.6	52.5
T1	43.8	49.0	52.6	41.5	37.6
T2	48.9	54.1	57.7	46.6	42.7
U	45.4	51.1	54.9	45.9	40.7
V1	59.2	63.9	65.8	57.0	54.3
V2	55.4	60.2	63.2	56.0	53.2
V3	50.9	55.1	60.9	51.5	47.1
V4	53.2	57.7	60.1	50.0	47.9
X	65.6	69.0	72.8	64.4	62.3
Y	53.0	58.3	62.2	53.4	49.0
ZD	50.7	56.4	60.2	51.3	46.0
ZE	51.1	55.2	60.9	50.8	46.2
ST1	58.8	63.4	65.8	58.1	54.0
ST2	52.7	55.1	59.0	52.3	49.7
ST3	53.4	56.5	60.4	52.6	50.5
ST4	52.7	56.8	60.2	53.1	50.3
ST5	53.9	58.0	59.6	52.0	50.2

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-hour})}$ 2021 DN				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	48.2	53.5	59.3	50.6	44.3
2	49.1	54.5	60.3	51.6	45.3
3	51.0	56.4	62.3	53.6	47.2
4	51.4	56.7	62.5	53.8	47.5
5	50.7	56.0	61.8	53.1	46.8
6	51.5	56.8	62.6	54.0	47.6
7	53.0	58.3	64.6	54.6	50.3
8	48.4	53.7	60.3	50.5	46.1
9	53.0	58.3	64.7	54.6	50.3
10	46.3	51.8	58.7	49.0	44.6
11	49.7	56.3	56.3	49.0	42.9
12	49.7	56.3	56.3	49.0	42.9
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	48.4	53.7	53.5	50.5	46.1

Note: n/a not applicable

Table 11I.28 Predicted absolute road traffic noise level $L_{Aeq\ 1hour\ (free\text{-}field)}$ Do-Something 2021

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2021 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	54.8	61.0	67.3	52.2	47.9
AA	53.4	62.5	66.2	53.2	48.3
AB	52.1	61.5	66.5	53.1	47.9
AC	44.9	50.7	55.6	45.1	39.8
AD	53.8	61.9	66.4	51.0	46.7
AE	54.9	64.0	67.9	54.5	49.6
B	61.7	68.7	75.7	58.0	52.7
D	61.7	68.8	77.6	58.1	53.2
E	58.7	65.0	74.6	55.0	50.2
F	58.7	65.2	71.9	55.5	50.8
G	62.3	69.5	78.1	58.7	53.5
I1	59.5	66.3	80.5	60.7	55.4
I2	59.6	67.2	79.7	58.9	52.9
13	59.4	66.9	79.1	58.3	53.0
14	59.3	66.7	79.2	58.2	53.0
J	60.7	66.0	77.2	59.1	54.1
K1	53.5	62.3	74.8	54.1	48.2
K2	53.0	61.8	74.4	53.6	47.8
K3	53.5	62.2	74.8	54.1	48.2
K4	53.8	62.5	75.2	54.4	48.6
K5	54.9	63.6	76.2	55.4	49.5
L	55.2	62.0	69.6	54.9	49.7
M	56.1	62.9	70.6	55.8	50.6
N1	53.4	59.5	66.3	53.0	48.3
N2	53.3	59.3	66.0	53.0	48.3
N3	56.2	63.1	73.5	55.8	50.7
O1	61.0	66.6	77.5	59.4	54.4
O2	60.1	65.7	76.6	58.3	53.5
P	52.4	63.4	73.6	53.0	46.9
Q	50.3	57.9	64.0	51.0	45.2
R	54.0	64.9	75.1	54.7	48.5
S	53.6	64.5	74.7	54.3	48.1
SA	45.5	50.5	56.3	46.8	42.9

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2021 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SB	44.9	50.0	56.0	46.5	42.3
SC	46.0	51.6	57.0	48.5	43.0
SD	44.4	50.0	55.5	46.9	41.5
SE	46.0	50.4	60.0	50.7	45.7
SF	51.2	55.4	67.8	54.2	48.9
SG	46.6	52.1	63.5	48.3	44.5
SH	50.3	54.6	66.5	53.2	48.0
SI	48.6	52.8	64.7	51.4	46.3
SJ	52.2	57.7	63.9	49.8	45.7
SK	46.9	51.0	60.6	52.1	47.0
SL	47.2	51.3	60.3	52.3	47.3
SM	46.5	50.5	60.2	51.1	46.1
SN	54.9	60.4	64.6	53.1	48.1
SO	54.7	60.3	66.7	54.9	49.3
SP	54.4	59.9	66.2	54.7	49.2
SQ	52.6	57.4	63.8	52.9	47.5
SR	51.3	56.0	62.0	51.3	46.1
SS	57.7	64.6	69.0	56.7	51.6
T1	42.6	48.0	51.9	40.7	36.8
T2	48.4	54.0	58.3	46.2	42.2
U	42.7	48.7	53.4	43.3	37.9
V1	60.0	68.6	73.2	57.1	52.5
V2	54.9	63.1	69.5	56.4	52.2
V3	48.3	54.2	64.6	49.5	44.2
V4	51.7	58.5	63.2	47.7	45.2
X	70.0	76.4	84.6	68.6	64.8
Y	53.2	62.5	66.5	53.2	48.2
ZD	47.3	53.5	58.6	47.9	42.5
ZE	49.7	55.0	64.2	49.5	44.5
ST1	60.0	67.6	72.8	59.2	53.4
ST2	51.5	54.9	62.5	51.3	48.0
ST3	53.4	58.2	65.5	52.5	49.6
ST4	52.2	58.4	64.9	53.0	49.3
ST5	54.3	60.5	64.1	51.8	49.5

Ref.	Predicted Absolute road traffic noise level, dB $L_{Aeq\ (1\text{-}hour)}$ 2021 DS				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
1	46.2	52.3	60.6	49.0	42.3
2	47.4	55.0	62.8	50.3	43.5
3	49.5	57.3	65.9	52.6	45.6
4	49.7	57.5	66.2	52.8	45.7
5	49.1	55.5	64.7	51.9	45.0
6	50.0	57.7	66.4	53.0	45.9
7	51.4	59.4	69.6	53.5	48.3
8	44.3	50.6	61.0	46.4	41.5
9	51.0	58.6	69.5	53.2	47.9
10	41.5	48.7	57.6	43.5	38.7
11	50.4	58.6	60.3	48.2	40.8
12	50.4	58.6	60.3	48.2	40.8
Z1	0	50.5	70.4	0	0
Stogursey	47.4	55.0	56.3	50.3	43.5

Note: n/a not applicable

NOT PROTECTIVELY MARKED

Table 11I.29 Magnitude of 1-hour Road Traffic Noise Impact between the Do-Something and Do-Nothing 2013 Scenarios

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise) 2013				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	Very low	Very low	No change	Very low	Very low
AA	Medium	High	Low	Medium	Medium
AB	Medium	High	Low	Medium	Medium
AC	High	High	Low	High	High
AD	Medium	Medium	Very low	Medium	Medium
AE	High	Medium	Very low	High	High
B	Low	Low	Very low	Low	Medium
D	Medium	Low	Very low	Medium	Low
E	Very low	Very low	Very low	Very low	Very low
F	Low	Very low	No change	Low	Low
G	Medium	Low	Very low	Medium	Low
I1	Low	Low	Very low	Low	Low
I2	Low	Low	Very low	Low	Low
13	Low	Low	Very low	Low	Low
14	Low	Low	Very low	Low	Low
J	Very low	No change	No change	No change	Very low
K1	Medium	Medium	Very low	Medium	Medium
K2	Medium	Medium	Very low	Medium	Medium
K3	Medium	Medium	Very low	Medium	Medium
K4	Medium	Medium	Very low	Medium	Medium
K5	High	Low	Very low	High	Medium
L	Very low	Very low	Very low	Very low	Very low
M	No change	No change	No change	No change	No change
N1	Very low	Very low	Very low	Very low	Very low
N2	Very low	Very low	Very low	Very low	Very low
N3	Very low	Very low	No change	Very low	Very low
O1	Low	Very low	No change	Low	Low
O2	Low	Very low	No change	Low	Very low
P	High	High	Low	High	High
Q	Low	Low	Very low	Low	Low
R	High	Medium	Low	High	Medium
S	High	High	Low	High	High

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise) 2013				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
SA	No change	No change	No change	No change	No change
SB	No change	No change	No change	No change	No change
SC	Very low	Very low	Very low	Very low	Very low
SD	No change	No change	No change	No change	No change
SE	No change	No change	No change	No change	No change
SF	No change	No change	No change	No change	No change
SG	No change	No change	No change	Very low	No change
SH	No change	Very low	Very low	No change	No change
SI	No change	No change	No change	No change	No change
SJ	No change	No change	No change	No change	No change
SK	Very low	Very low	No change	No change	No change
SL	Very low	Very low	Very low	Very low	Very low
SM	Very low	Very low	Very low	Very low	Very low
SN	Low	Low	No change	Low	Low
SO	Low	Low	No change	Low	Low
SP	Low	Low	Very low	Low	Low
SQ	Very low	Very low	No change	Very low	Very low
SR	Very low	Very low	No change	Very low	Very low
SS	Low	Very low	No change	Very low	Very low
T1	No change	No change	No change	No change	No change
T2	Very low	Very low	Very low	Very low	Very low
U	Medium#	Medium	High	Medium#	Medium#
V1	Very low	Very low	Very low	Very low	Very low
V2	Very low	Very low	Very low	Very low	Very low
V3	Very low	Very low	Very low	Very low	Very low
V4	No change	No change	No change	No change	No change
X	Very low	Very low	Very low	Very low	Very low
Y	Medium	High	Low	Medium	Medium
ZD	Very low	Very low	Very low	Very low	Very low
ZE	Very low	Very low	Low	Very low	Very low
ST1	Low	Low	Very low	Low	Low
ST2	Very low	Very low	Very low	Very low	Very low
ST3	Very low	Very low	Very low	Very low	Very low
ST4	Very low	Very low	Very low	Very low	Very low

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise) 2013				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
ST5	Very low	Very low	Very low	Very low	Very low
1	No change	No change	No change	No change	No change
2	Medium	Low	Very low	Medium	Medium#
3	Medium	Medium	Very low	Low	Low
4	Medium	Medium	Very low	Low	Low
5	Very low	Very low	Very low	Very low	Very low
6	Medium	Low	Very low	Low	Low
7	Low	Low	Very low	Low	Low
8	No change	No change	No change	No change	No change
9	Low	Low	Very low	Very low	Low
10	Medium	Medium	Very low	Medium	Medium#
11	Low	Low	Low	Low	Low
12	Low	Low	Low	Low	Low
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	Medium#	Medium	No change	Medium#	Medium#

Note: n/a not applicable

 # denotes medium or high magnitude change, but predicted $L_{Aeq\ 1hour}$ below 55dB therefore significance of impact assessed is minor.

Table 11I.30: Magnitude of 1-hour Road Traffic Noise Impact between the Do-Something and Do-Nothing 2016 Scenarios

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise) 2016				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	Very low	Very low	No change	Low	Very low
AA	Medium	High	Low	Medium	Medium
AB	Medium	High	Low	Medium	Medium
AC	Low beneficial	Medium beneficial[#]	Medium beneficial	Low beneficial	Low beneficial
AD	Medium	Low	Very low	Medium	Medium
AE	High	Medium	Low	High	Medium
B	Low	Low	Very Low	Low	Medium
D	Medium	Low	Very low	Medium	Low
E	Very low	Very low	Very low	Very low	Very low
F	Low	Very low	No change	Low	Low
G	Low	Low	Very low	Medium	Low
I1	Low	Low	Very low	Low	Low
I2	Low	Low	Very low	Low	Low
13	Low	Low	Very low	Low	Low
14	Low	Low	Very low	Low	Low
J	Very low	Very low	Very low	Very low	Very low
K1	Medium	Medium	Very low	Medium	Medium
K2	Medium	Medium	Very low	Medium	Medium
K3	Medium	Medium	Very low	Medium	Medium
K4	Medium	Medium	Very low	Medium	Medium
K5	High	Low	Very low	High	High
L	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
M	No change	No change	No change	No change	No change
N1	No change	No change	No change	No change	No change
N2	Very low	Very low	Very low	Very low	Very low
N3	Low	Low	Very low	Low	Low
O1	Low	Very low	Very low	Low	Very low
O2	Low	Very low	Very low	Low	Very low
P	High	High	Low	High	High
Q	Low	Low	Very low	Low	Low
R	High	High	Low	High	Medium

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise) 2016				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
S	High	High	Low	High	High
SA	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
SB	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
SC	No change	No change	No change	No change	No change
SD	No change	No change	No change	No change	No change
SE	No change	No change	No change	No change	No change
SF	Very low	No change	No change	Very low	Very low
SG	Very low	Very low	Very low	No change	Very low
SH	No change	No change	No change	No change	No change
SI	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
SJ	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
SK	No change	No change	Very low beneficial	Very low beneficial	Very low beneficial
SL	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
SM	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
SN	Low	Low	Very low beneficial	Low	Low
SO	Low	Low	Very low	Low	Low
SP	Low	Low	Very low beneficial	Low	Low
SQ	Very low	Very low	Very low beneficial	Very low beneficial	Very low
SR	Very low	Very low	No change	Very low	Very low
SS	Low	Very low	No change	Low	Very low
T1	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
T2	Very low	Very low	Very low	Very low	Very low
U	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
V1	Very low	Very low	Very low	Very low	Very low
V2	Very low	Very low	Very low	Very low	Very low
V3	Very low	Very low	Very low	Very low	Very low

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise) 2016				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
	beneficial	beneficial	beneficial	beneficial	beneficial
V4	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
X	No change	No change	No change	No change	No change
Y	Medium	High	Low	Medium	Medium
ZD	Low beneficial	Low beneficial	Low beneficial	Low beneficial	Low beneficial
ZE	Very low	Very low	Low	Very low	Very low
ST1	Low	Very low	Very low	Very low	Low
ST2	Very low	Very low	Very low	Very low	Very low
ST3	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
ST4	Very low	Very low	Very low	Very low	Very low
ST5	Very low	Very low	Very low	Very low	Very low
1	No change	No change	No change	No change	No change
2	Medium	Low	Very low	Medium	Medium#
3	Medium	Medium	Very low	Low	Low
4	Medium	Medium	Very low	Low	Low
5	Very low	Very low	Very low	Very low	Very low
6	Medium	Low	Very low	Low	Low
7	Low	Low	Very low	Low	Low
8	No change	No change	No change	No change	No change
9	Low	Low	Very low	Very low	Low
10	Medium	Low	Very low	Medium	Medium#
11	Low	Low	Low	Low	Low
12	Low	Low	Low	Low	Low
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	Medium	Low	Very low	Medium	Medium#

Note: n/a not applicable

 # denotes medium or high magnitude change, but predicted $L_{Aeq\ 1hour}$ below 55dB therefore significance of impact assessed is minor

Table 11I.31: Magnitude of 1-hour Road Traffic Noise Impact between the Do-Something and Do-Nothing 2021 Scenarios

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise)				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
A	Very low beneficial	No change	No change	Very low	Very low
AA	Very low	Low	Very low	Very low	Very low
AB	Very low	Low	Very low	Very low	Very low
AC	Low beneficial	Low beneficial	Low beneficial	Low beneficial	Low beneficial
AD	No change	Very low	Very low	Very low	Very low
AE	Very low	Low	Very low	Very low	Very low
B	Very low	Very low	Very low	Very low	Very low
D	Very low	Very low	Low	Very low	Very low
E	Very low	Very low	Low	Very low	Very low
F	Very low	Very low	Very low	Very low	Very low
G	Very low	Very low	Low	Very low	Very low
I1	Very low	Very low	Medium	Very low	Very low
I2	Very low	Very low	Medium	Very low	Very low
13	Very low	Very low	Medium	Very low	Very low
14	Very low	Very low	Medium	Very low	Very low
J	No change	Very low beneficial	Medium	Very low	Very low
K1	Very low	Very low	Medium	Very low	Very low
K2	Very low	Low	Medium	Very low	Very low
K3	Very low	Very low	Medium	Very low	Very low
K4	Very low	Low	Medium	Very low	Very low
K5	Very low	Very low	Medium	Very low	Very low
L	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
M	Very low beneficial	Very low beneficial	Very low	No change	Very low
N1	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
N2	Very low beneficial	Very low beneficial	No change	No change	Very low
N3	Very low	Very low	Low	Very low	Very low
O1	Very low	Very low	Medium	Very low	Very low
O2	Very low	Very low	Medium	Very low	Very low
P	Low	Medium	High	Low	Low

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise)				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
Q	No change	Very low	Very low	Very low	Very low
R	Very low	Low	Medium	Very low	Very low
S	Very low	Low	Medium	Very low	Very low
SA	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
SB	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
SC	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
SD	Very low beneficial	Very low beneficial	Very low beneficial	No change	Very low
SE	Very low beneficial	Very low beneficial	No change	No change	Very low
SF	Very low beneficial	Very low beneficial	Very low beneficial	No change	Very low
SG	Very low beneficial	Very low beneficial	No change	Very low beneficial	Very low
SH	Very low beneficial	Very low beneficial	No change	Very low beneficial	Very low
SI	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
SJ	Very low beneficial	Very low beneficial	No change	Very low	Very low
SK	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
SL	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	No change
SM	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
SN	Very low beneficial	No change	Very low beneficial	Very low beneficial	Very low
SO	Very low	Very low	Very low	Very low	Very low
SP	Very low beneficial	Very low	Very low	Very low	Very low
SQ	Very low beneficial	Very low beneficial	Very low	Very low	Very low
SR	Very low beneficial	Very low beneficial	No change	Very low	Very low
SS	Very low beneficial	Very low beneficial	No change	No change	Very low

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise)				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
T1	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
T2	No change	No change	Very low	Very low	Very low
U	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
V1	Very low	No change	Very low	Very low	Very low
V2	No change	No change	Very low	Very low	Very low
V3	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low
V4	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial	Very low beneficial
X	Very low beneficial	Very low beneficial	No change	No change	Very low
Y	Very low	Low	Very low	Very low	Very low
ZD	Low beneficial	Low beneficial	Low beneficial	Low beneficial	Low beneficial
ZE	Very low beneficial	Very low	Very low	Very low	Very low
ST1	Very low	Very low	Very low	Very low	Very low
ST2	No change	Very low beneficial	Very low	Very low	Very low
ST3	Very low beneficial	Very low beneficial	No change	No change	Very low
ST4	Very low	Very low	Very low	Very low	Very low
ST5	Very low	Very low	Very low	Very low	Very low
1	No change	Very low beneficial	No change	No change	Very low
2	Very low	Very low	Very low	Very low	Very low
3	Very low	Very low	Very low	Very low	Very low
4	Very low	Very low	Very low	Very low	Very low
5	No change	Very low beneficial	No change	No change	Very low
6	Very low	Very low	Very low	Very low	Very low
7	Very low	Very low	Very low	Very low	Very low
8	Very low beneficial	Very low beneficial	No change	No change	Very low
9	Very low beneficial	Very low	No change	Very low	Very low
10	Very low	Very low	Very low	Very low	Very low

Ref.	Magnitude of 1-hour Road Traffic Noise Impact (Adverse, unless stated otherwise)				
	05:00-06:00	06:00-07:00	12:00-13:00	23:00-00:00	00:00-01:00
11	Very low	Low	Low	Very low	Very low
12	Very low	Low	Low	Very low	Very low
Z1	n/a	n/a	n/a	n/a	n/a
Stogursey	Very low	Very low	Medium	Low	Very low

Note: n/a not applicable

 # denotes medium or high magnitude change, but predicted $L_{Aeq\ 1hour}$ below 55dB therefore significance of impact assessed is minor

APPENDIX 12A: INTRODUCTION TO AIR POLLUTION

APPENDIX 12A: INTRODUCTION TO AIR POLLUTION

12A.1.1 This appendix is designed to provide further information on the key air pollutants considered in this study.

a) Nitrogen Dioxide (NO_2) and Nitrogen Oxides (NO_x)

12A.1.2 Nitrogen dioxide (NO2) and nitric oxide (NO) are both oxides of nitrogen and together they are both referred to as NOx. All combustion processes in air produce NOx, although NO, a colourless gas, usually predominates. The conversion of NO to the red-brown gas NO2 takes place in the atmosphere via reaction with chemically active species such as ozone. It is NO2 which is associated with adverse health effects on human health. The main source of NOx in the UK is road transport.

b) Sulphur Dioxide (SO_2)

12A.1.3 Sulphur dioxide (SO2) is a gas at ambient temperature and pressure but readily dissolves in water (or rain) to give an acidic solution which is oxidised to sulphuric acid. In the UK, the predominant source of SO2 is from the combustion of sulphur containing fossil fuels, particularly coal and heavy fuel oil, and is generally a function of the sulphur content of the fuel. SO2 is an irritant when inhaled and can also lead to adverse effects on vegetation.

12A.1.4 SO2 emissions have reduced significantly in the later part of the 20th century, and are currently dominated by a relatively small number of large emitters such as coal fired power stations and refineries.

c) Particulate Matter (PM_{10} and $PM_{2.5}$)

12A.1.5 Particulate Matter is generally categorised on the basis of the size of the particles (for example $PM_{2.5}$ is particles with a diameter of less than 2.5µm). PM is made up of a wide range of materials and arises from a variety of sources. Concentrations of PM comprise primary particles emitted directly into the atmosphere from combustion sources and secondary particles formed by chemical reactions in the air. PM derives from both human-made and natural sources (such as sea spray and Saharan dust). In the UK the biggest human-made sources are stationary fuel combustion and transport.

12A.1.6 Road transport gives rise to primary particles from engine emissions, tyre and brake wear and other non-exhaust emissions. Other primary sources include quarrying, construction and non-road mobile sources. Secondary PM is formed from emissions of ammonia, sulphur dioxide and oxides of nitrogen as well as from emissions of organic compounds from both combustion sources and vegetation.

12A.1.7 Both short-term and long-term exposure to ambient levels of PM are consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. The associations are believed to be causal. PM_{10} roughly equates to the mass of particles less than 10 micrometres in diameter that are likely to be inhaled into the thoracic region of the respiratory tract. Recent reviews by the World Health Organisation (WHO) and the Committee on the Medical Effects of Air

Pollutants (COMEAP) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill-health effects, but also warn that there is evidence that the coarse fraction between ($PM_{2.5}$ - PM_{10}) also has some effects on health.

APPENDIX 12B: AIR QUALITY GUIDELINES, TARGET VALUES, STANDARDS, OBJECTIVES AND ENVIRONMENTAL ASSESSMENT LEVELS

NOT PROTECTIVELY MARKED

APPENDIX 12B AIR QUALITY GUIDELINES, TARGET VALUES, STANDARDS, OBJECTIVES AND ENVIRONMENTAL ASSESSMENT LEVELS

Table 12B.1: World Health Organisation (WHO) Air Quality Guideline (AQG) and Interim Target (IT) Values

WHO Interim Target or Guideline	Concentration Measured As	Interim Target or Guideline Value ($\mu g/m^3$)
$PM_{2.5}$		
Interim Target-1 (IT-1)	Annual mean	35
	24-hour mean (99th percentile)	75
Interim Target-2 (IT-2)	Annual mean	25
	24-hour mean (99th percentile)	50
Interim Target-3 (IT-3)	Annual mean	15
	24-hour mean (99th percentile)	37.5
Air Quality Guideline	Annual mean	10
	24-hour mean (99th percentile)	25
PM_{10}		
Interim Target-1 (IT-1)	Annual mean	70
	24-hour mean (99th percentile)	150
Interim Target-2 (IT-2)	Annual mean	50
	24-hour mean (99th percentile)	100
Interim Target-3 (IT-3)	Annual mean	30
	24-hour mean (99th percentile)	75
Air Quality Guideline	Annual mean	20
	24-hour mean (99th percentile)	50
O_3		
High Levels	Daily maximum 8-hour mean	240
Interim Target-1 (IT-1)	Daily maximum 8-hour mean	160
Air Quality Guideline	Daily maximum 8-hour mean	100
NO_2		
Air Quality Guideline	Annual mean	40
	1-hour mean	200

WHO Interim Target or Guideline	Concentration Measured As	Interim Target or Guideline Value ($\mu g/m^3$)
SO_2		
Interim Target-1 (IT-1)	24-hour mean	125
	10-minute mean	-
Interim Target-2 (IT-2)	24-hour mean	50
	10-minute mean	-
Air Quality Guideline	24-hour mean	20
	10-minute mean	500

Table 12B.2: European Union Air Quality Standards and Objectives

Pollutant	Concentration (µg/m³ unless otherwise stated)	Averaging Period	Date to be Achieved and Maintained Thereafter	Permitted Exceedences Each Year
$PM_{2.5}$	25 ***	1 year	Target value enters into force 1/1/2010. Limit value enters into force 1/1/2015.	n/a
SO_2	350	1 hour	Limit value enters into force 1/1/2005.	24
	125	24 hours	Limit value enters into force 1/1/2005.	3
NO_2	200	1 hour	Limit value enters into force 1/1/2010.	18
	40	1 year	Limit value enters into force 1/1/2010.*	n/a
PM_{10}	50	24 hours	Limit value enters into force 1/1/2005.**	35
	40	1 year	Limit value enters into force 1/1/2005. **	n/a
Lead	0.5	1 year	Limit value enters into force 1/1/2005 (or 1/1/2010 in the immediate vicinity of specific, notified industrial sources; and a 1.0 µg/m³ limit value applies from 1/1/2005 to 31/12/2009).	n/a
CO	10 mg/m³	Maximum daily 8 hour mean	Limit value enters into force 1/1/2005.	n/a
Benzene	5	1 year	Limit value enters into force 1/1/2010. **	n/a
Ozone	120	Maximum daily 8 hour mean	Target value enters into force 1/1/2010.	25 days averaged over 3 years
Arsenic	6 ng/m³	1 year	Target value enters into force 1/1/2012.	n/a

Pollutant	Concentration ($\mu g/m^3$ unless otherwise stated)	Averaging Period	Date to be Achieved and Maintained Thereafter	Permitted Exceedences Each Year
Cadmium	5 ng/m^3	1 year	Target value enters into force 1/1/2012.	n/a
Nickel	20 ng/m^3	1 year	Target value enters into force 1/1/2012.	n/a
Polycyclic Aromatic Hydrocarbons	1 ng/m^3 (expressed as concentration of Benzo(a)pyrene)	1 year	Target value enters into force 1/1/2012.	n/a

** Under the new Directive the member State can apply for an extension of up to five years (i.e. maximum up to 2015) in a specific zone. Request is subject to assessment by the Commission. In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (48 $\mu g/m^3$ for annual NO_2 limit value).*

*** Under the new Directive the Member State can apply for an extension until three years after the date of entry into force of the new Directive (i.e. May 2011) in a specific zone. Request is subject to assessment by the Commission. In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (35 days at 75$\mu g/m^3$ for daily PM_{10} limit value, 48 $\mu g/m^3$ for annual PM_{10} limit value).*

**** Standard introduced by the new Directive.*

Table 12B.3: National Air Quality Objectives

Pollutant	Applies	National Air Quality Objective	Concentration Measured as	Date to be Achieved by and Maintained Thereafter
For the Protection of Human Health				
Particles (PM_{10})	UK	50 µg/m^3 not to be exceeded more than 35 times a year	24 hour mean	31 December 2004
	UK	40 µg/m^3	Annual mean	31 December 2004
Particles ($PM_{2.5}$)	UK (except Scotland)	25 µg/m^3	Annual mean	1 January 2015
NO_2	UK	200 µg/m^3 not to be exceeded more than 18 times a year	1 hour mean	31 December 2005
	UK	40 µg/m^3	Annual mean	31 December 2005
O_3	UK	120 µg/m^3 not to be exceeded on more than 25 days per calendar year averaged over 3 years	Maximum daily 8 hour mean	31 December 2005
SO_2	UK	266 µg/m^3 not to be exceeded more than 35 times a year	15 minute mean	31 December 2005
	UK	350 µg/m^3 not to be exceeded more than 24 times a year	1 hour mean	31 December 2004
	UK	125 µg/m^3 not to be exceeded more than 3 times a year	24 hour mean	31 December 2004
Polycyclic aromatic hydrocarbons	UK	0.25 ng/m^3 B[a]P	As annual average	31 December 2010
Benzene	England and Wales	5 µg/m^3	Annual average	31 December 2010
1,3 Butadiene	UK	2.25 µg/m^3	Running annual mean	31 December 2003
CO	UK	10 mg/m^3	Maximum daily running 8 hour mean	31 December 2003
Lead	UK	0.5 µg/m^3	Annual mean	31 December 2004

Pollutant	Applies	National Air Quality Objective	Concentration Measured as	Date to be Achieved by and Maintained Thereafter
For the Protection of Vegetation and Ecosystems				
NO_x	UK	30 µg/m^3	Annual mean	31 December 2000
SO_2	UK	20 µg/m^3	Annual mean	31 December 2000
	UK	20 µg/m^3	Winter average	31 December 2000
Ozone	UK	Target value of 18,000 µg/m^3 based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	Average over 5 years	1 January 2010

Table 12B.4: Environment Agency Environmental Assessment Levels for those Pollutants and/or Averaging Periods for which an Equivalent Air Quality Standard or Objective is not Prescribed

Pollutant	Applies	Environmental Assessment Level	Concentration measured as
For the Protection of Human Health			
NH_3	UK	180 µg/m^3	Annual mean
	UK	2,500 µg/m^3	1hour mean
H_2CO	UK	5 µg/m^3	Annual mean
	UK	100 µg/m^3	1hour mean
CO	UK	30,000 µg/m^3	1 hour mean
For the Protection of Vegetation and Ecosystems			
NO_x	UK	75 µg/m^3	Daily mean

APPENDIX 12C: AIR QUALITY SIGNIFICANCE CRITERIA

APPENDIX 12C: AIR QUALITY SIGNIFICANCE CRITERIA

Table 12C.1: Definition of Impact Magnitude for Changes in Annual Mean NO_2 and PM_{10} Concentration from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and emissions from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >4µg/m^3
Medium	Increase/decrease 2 - 4µg/m^3
Small	Increase/decrease 0.4 - 2µg/m^3
Imperceptible	Increase/decrease <0.4µg/m^3

Table 12C.2: Air Quality Impact Descriptors for Changes to Annual Mean NO_2 and PM_{10} from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>40µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (36 - 40µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (30 - 36µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<30µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.3: Definition of Impact Magnitude for Changes in Number of exceedences of 1-hour Mean NO_2 Concentration Greater than 200µg/m^3 for Road Traffic and On-Site Exhaust Emissions to Air from Construction Plant and Machinery.

Magnitude of Change	Number of time above 200µg/m^3 [a]
Large	Increase/decrease >2 hours
Medium	Increase/decrease 1 - 2 hours
Small	Increase/decrease 0 - 1 hour
70Imperceptible	Increase/decrease 0 hours

[a] Based on percentage of 18 exceedences, rounded to the most appropriate whole number of exceedences.

Table 12C.4: Air Quality Impact Descriptors for Changes in Number of Exceedences of 1-hour NO_2 Concentration Greater than 200µg/m^3 from Road Traffic and On-Site Exhaust Emissions to Air from Construction Plant and Machinery.

Absolute Concentration in Relation to Objective/Limit Value	Change in Number of Days [a b]		
	Small	Medium	Large
Above objective/limit value with scheme (>18 times)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (16 - 18 times)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (14 - 16 times)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<14 times)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

[b] Based on percentage of 18 allowed exceedences, rounded to the most appropriate whole number of exceedences.

Table 12C.5: Definition of Impact Magnitude for Changes in 1-hour Mean NO_2 99.79 Percentile Concentration at Human Receptor Locations from Marine Vessels and emissions from HPC Commissioning and Operation.

Magnitude of Change	1-hour Mean
Large	Increase/decrease >20 µg/m^3
Medium	Increase/decrease 10 – 20 µg/m^3
Small	Increase/decrease 2 – 10 µg/m^3
Imperceptible	Increase/decrease <2 µg/m^3

Table 12C.6: Air Quality Impact Descriptors for Changes to 1-hour Mean NO_2 99.79 Percentile Concentration at Human Receptor Locations from Marine Vessels and emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>200 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (180 - 200 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (150– 180 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<150 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.7: Definition of Impact Magnitude for Changes in Annual Mean NO_x Concentration at Ecological Receptor Locations from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and emissions from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >3µg/m^3
Medium	Increase/decrease 1.5 - 3µg/m^3
Small	Increase/decrease 0.3 – 1.5µg/m^3
Imperceptible	Increase/decrease <0.3µg/m^3

Table 12C.8: Air Quality Impact Descriptors for Changes to Annual Mean NO_x at Ecological Receptor Locations from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>30µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (27 - 30µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (22.5 - 27µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<22.5µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.9: Definition of Impact Magnitude for Changes in 24-hour Mean NO_x Concentration at Ecological Receptor Locations from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and emissions from HPC Commissioning and Operation.

Magnitude of Change	24-hour Mean
Large	Increase/decrease >7.5µg/m^3
Medium	Increase/decrease 3.75 – 7.5µg/m^3
Small	Increase/decrease 0.75 – 3.75µg/m^3
Imperceptible	Increase/decrease <0.75µg/m^3

Table 12C.10: Air Quality Impact Descriptors for Changes to 24-hour Mean NOx at Ecological Receptor Locations from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>75µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (67.5 - 75µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (56.25 – 67.5µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<56.25µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.11: Definition of Impact Magnitude for Changes in 24-hour Mean PM_{10} Concentration from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from HPC Commissioning and Operation.

Magnitude of Change	24-hour Mean
Large	Increase/decrease >5µg/m^3
Medium	Increase/decrease 2.5 - 5µg/m^3
Small	Increase/decrease 0.5 – 2.5µg/m^3
Imperceptible	Increase/decrease <0.5µg/m^3

Table 12C.12: Air Quality Impact Descriptors for Changes to Annual Mean $PM_{2.5}$ from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>50µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (45 - 50µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (37.5 - 45µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<37.5µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.13: Definition of Impact Magnitude for Changes in Annual Mean $PM_{2.5}$ Concentration from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >2.5µg/m^3
Medium	Increase/decrease 1.25 - 2.5µg/m^3
Small	Increase/decrease 0.25 - 1.25µg/m^3
Imperceptible	Increase/decrease <0.25µg/m^3

Table 12C.14: Air Quality Impact Descriptors for Changes to Annual Mean $PM_{2.5}$ from Road Traffic, Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>25µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (22.5 - 25µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (18.75 - 22.5µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<18.75µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.15: Definition of Impact Magnitude for Changes in Number of Days with PM_{10} Concentration Greater than 50µg/m^3 from Road Traffic and On-Site Exhaust Emissions to Air from Construction Plant and Machinery.

Magnitude of Change	Number of days above 50µg/m^3 [a]
Large	Increase/decrease >4 days
Medium	Increase/decrease 2 - 4 days
Small	Increase/decrease 1 - 2 days
Imperceptible	Increase/decrease <1 day

[a] Based on percentage of 35 days, rounded to the most appropriate whole number of days.

Table 12C.16: Air Quality Impact Descriptors for Changes to Number of Days with PM_{10} Concentration Greater than 50µg/m^3 from Road Traffic and On-Site Exhaust Emissions to Air from Construction Plant and Machinery.

Absolute Concentration in Relation to Objective/Limit Value	Change in Number of Days [a b]		
	Small	Medium	Large
Above objective/limit value with scheme (>35 days)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (32 - 35 days)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (26 - 32 days)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<26 days)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

[b] Based on percentage of 35 days, rounded to the most appropriate whole number of days.

Table 12C.17: Definition of Impact Magnitude for Changes in Annual Mean SO_2 Concentration at Ecological Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >2 µg/m^3
Medium	Increase/decrease 1 - 2 µg/m^3
Small	Increase/decrease 0.2 - 1 µg/m^3
Imperceptible	Increase/decrease <0.2 µg/m^3

Table 12C.18: Air Quality Impact Descriptors for Changes to Annual Mean SO_2 at Ecological Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>20µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (18 - 20µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (15 - 18µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<15µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'

Table 12C.19: Definition of Impact Magnitude for Changes in 1-hour Mean SO_2 99.73 Percentile Concentration at Human Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Magnitude of Change	1-hour Mean
Large	Increase/decrease >35 µg/m^3
Medium	Increase/decrease 17.5 – 35 µg/m^3
Small	Increase/decrease 3.5 – 17.5 µg/m^3
Imperceptible	Increase/decrease <3.5 µg/m^3

Table 12C.20: Air Quality Impact Descriptors for Changes to 1-hour Mean SO_2 99.73 Percentile Concentration at Human Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>350 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (315 - 350 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (262.5 - 315 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<262.5 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.21: Definition of Impact Magnitude for Changes in 24-hour Mean SO_2 99.18 Percentile Concentration at Human Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Magnitude of Change	24-hour Mean
Large	Increase/decrease >12.5 µg/m^3
Medium	Increase/decrease 6.25 – 12.5 µg/m^3
Small	Increase/decrease 1.25 – 6.25 µg/m^3
Imperceptible	Increase/decrease <1.25 µg/m^3

Table 12C.22: Air Quality Impact Descriptors for Changes to 24-hour Mean SO_2 99.18 Percentile Concentration at Human Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>125 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (112.5 - 125 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (93.75–112.5 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<93.75 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.23: Definition of Impact Magnitude for Changes in 15-minute Mean SO_2 99.9 Percentile Concentration at Human Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant and Machinery, and from Emissions from HPC Commissioning and Operation.

Magnitude of Change	15-minute Mean
Large	Increase/decrease >26.6 µg/m^3
Medium	Increase/decrease 13.3 – 26.6 µg/m^3
Small	Increase/decrease 2.66 – 13.3 µg/m^3
Imperceptible	Increase/decrease <2.66 µg/m^3

Table 12C.24: Air Quality Impact Descriptors for Changes to 15-minute Mean SO_2 99.9 Percentile Concentration at Human Receptor Locations from Marine Vessels, On-Site Exhaust Emissions to Air from Construction Plant, and Machinery and from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>266 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (239.4 - 266 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (199.5 – 239.4 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<199.5 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.25: Definition of Impact Magnitude for Changes in 8-hour rolling Mean CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	8-hour rolling Mean
Large	Increase/decrease >1000 µg/m^3
Medium	Increase/decrease 500 – 1000 µg/m^3
Small	Increase/decrease 100 – 500 µg/m^3
Imperceptible	Increase/decrease <100 µg/m^3

Table 12C.26: Air Quality Impact Descriptors for Changes to 8-hour rolling Mean CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>10000 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (9000 - 10000 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (7500 – 9000 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<7500 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.27: Definition of Impact Magnitude for Changes in 1-hour Mean CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	1-hour Mean
Large	Increase/decrease >3000 µg/m^3
Medium	Increase/decrease 1500 – 3000 µg/m^3
Small	Increase/decrease 300 – 1500 µg/m^3
Imperceptible	Increase/decrease <300 µg/m^3

Table 12C.28: Air Quality Impact Descriptors for Changes to 1-hour rolling Mean CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>30000 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (27000 - 30000 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (22500 – 27000 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<22500 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.29: Definition of Impact Magnitude for Changes in Annual Mean H_2CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >0.5 µg/m^3
Medium	Increase/decrease 0.25 – 0.5 µg/m^3
Small	Increase/decrease 0.05– 0.25 µg/m^3
Imperceptible	Increase/decrease 0.05 µg/m^3

Table 12C.30: Air Quality Impact Descriptors for Changes to Annual Mean H_2CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>5 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (4.5 – 5 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (3.75 – 4.5 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<3.75 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as 'negligible'.

Table 12C.31: Definition of Impact Magnitude for Changes in 1-hour mean H_2CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	1-hour Mean
Large	Increase/decrease >10 µg/m^3
Medium	Increase/decrease 5 – 10 µg/m^3
Small	Increase/decrease 1 – 5 µg/m^3
Imperceptible	Increase/decrease 1 µg/m^3

Table 12C.32: Air Quality Impact Descriptors for Changes to 1-hour mean H_2CO Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>100 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (90 – 100 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (75 – 90 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<75 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.33: Definition of Impact Magnitude for Changes in Annual Mean NH_3 Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >18 µg/m^3
Medium	Increase/decrease 9 – 18 µg/m^3
Small	Increase/decrease 1.8 – 9 µg/m^3
Imperceptible	Increase/decrease 1.8 µg/m^3

Table 12C.34: Air Quality Impact Descriptors for Changes to Annual Mean NH_3 Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>180 μg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (162 – 180 μg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (135 – 162 μg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<3.75 μg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.35: Definition of Impact Magnitude for Changes in 1-hour mean NH_3 Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	1-hour Mean
Large	Increase/decrease >250 μg/m^3
Medium	Increase/decrease 125 – 250 μg/m^3
Small	Increase/decrease 12.5 – 125 μg/m^3
Imperceptible	Increase/decrease 12.5 μg/m^3

Table 12C.36: Air Quality Impact Descriptors for Changes to 1-hour mean NH_3 Concentration at Human Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>2500 μg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (2250 – 2500 μg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (1875 – 2250 μg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<1875 μg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

Table 12C.37: Definition of Impact Magnitude for Changes in annual mean NH_3 Concentration at Ecological Receptor Locations from Emissions from HPC Commissioning and Operation.

Magnitude of Change	Annual Mean
Large	Increase/decrease >0.3 µg/m^3
Medium	Increase/decrease 0.15 – 0.3 µg/m^3
Small	Increase/decrease 0.03 – 0.15 µg/m^3
Imperceptible	Increase/decrease 0.03 µg/m^3

Table 12C.38: Air Quality Impact Descriptors for Changes in annual mean NH_3 Concentration at Ecological Receptor Locations from Emissions from HPC Commissioning and Operation.

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration [a]		
	Small	Medium	Large
Above objective/limit value with scheme (>3 µg/m^3)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (2.7 – 3 µg/m^3)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (2.25 – 2.7 µg/m^3)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value with scheme (<2.25 µg/m^3)	Negligible	Negligible	Slight adverse

[a] An Imperceptible change would be described as ‘negligible’.

APPENDIX 12D: INPUT PARAMETERS AND RESULTS OF H1 SCREENING ASSESSMENT AND ADMS 4 ASSESSMENT OF OPERATIONAL EMISSIONS

APPENDIX 12D: INPUT PARAMETERS AND RESULTS OF H1 SCREENING ASSESSMENT AND ADMS 4 ASSESSMENT OF OPERATIONAL EMISSIONS

Table 12D.1: Input Data for Commissioning H1 Screening Assessment

Process	Substance released to air	Physical height of release (m)	Effective height of release (m)	Release rate of substance, *RR* (g/s)	Dispersion factor, $DF_{long\text{-}term}$ (µg/m³/g/s)	Dispersion factor, $DF_{short\text{-}term}$ (µg/m³/g/s)	Long-term conversion factor	Short-term conversion factor
Exhaust gases from engines of backup diesel generators during periodic testing (EDGs)	SO_2 15-min	30 a	0	2.93 c	148	3900	0.02797 e	1.34
	$SO_{2\ 1\text{-}hr}$	30 [a]	0	2.93 [c]	-	3900	-	1.00
	$SO_{2\ 24\text{-}hr}$	30 [a]	0	2.93 [c]	-	3900	-	0.59
	NO_2	30 [a]	0	30.66 [c]	148	3900	0.02797 [e]	1.00
	NO_x	30 [a]	0	30.66 [c]	148	3900	0.02797 [e]	0.59
	CO	30 [a]	0	2.41 [d]	-	3900	-	0.70
	CO	30 [a]	0	2.41 [d]	-	3900	-	1.00
	PM_{10}	30 [a]	0	0.80 [d]	148	3900	0.02797 [e]	0.59
	$PM_{2.5}$	30 [a]	0	0.80 [d]	148	-	0.02797 [e]	-

Process	Substance released to air	Physical height of release (m)	Effective height of release (m)	Release rate of substance, *RR* (g/s)	Dispersion factor, $DF_{long\text{-}term}$ (µg/m³/g/s)	Dispersion factor, $DF_{short\text{-}term}$ (µg/m³/g/s)	Long-term conversion factor	Short-term conversion factor
Exhaust gases from engines of backup diesel generators during periodic testing (SBOs)	$SO_{2\ 15\text{-min}}$	30 [a]	0	0.40 [c]	148	3900	0.02797 [e]	1.34
	$SO_{2\ 1\text{-hr}}$	30 [a]	0	0.40 [c]	-	3900	-	1.00
	$SO_{2\ 24\text{-hr}}$	30 [a]	0	0.40 [c]	-	3900	-	0.59
	NO_2	30 [a]	0	6.80 [c]	148	3900	0.02797 [e]	1.00
	NO_x	30 [a]	0	6.80 [c]	148	3900	0.02797 [e]	0.59
	CO	30 [a]	0	0.57 [d]	-	3900	-	0.70
	CO	30 [a]	0	0.57 [d]	-	3900	-	1.00
	PM_{10}	30 [a]	0	0.19 [d]	148	3900	0.02797 [e]	0.59
	$PM_{2.5}$	30 [a]	0	0.19 [d]	148	-	0.02797 [e]	-
Thermal decomposition of insulation material - commissioning phase	H_2CO	70 [b]	10	0.0342 [a]	32.0	580.0	0.00114 [f]	1.00
	CO	70 [b]	10	0.0320 [a]	-	580.0	0.00114 [f]	0.70
	CO	70 [b]	10	0.0320 [a]	-	580.0	0.00114 [f]	1.00

[a] Data acquired from EDF 'Pre-Construction Environmental Report (PCER)' (2009).
[b] Data acquired from AMEC 'Determination of UK EPR Stack Height' (2009).
[c] Data acquired from EDF Technical Note 'ECUK100656 rev B - Assumptions to be taken into account for the EIA (IPC Submission) concerning the diesels' (2011).
[d] Data calculated from Environmental Benchmarks published within Environment Agency 'How to comply with your environmental permit. Additional guidance for: Combustion Activities (EPR 1.01)' (2009).
[e] Long-term conversion factor based upon emissions being discharged for 245 hours per EDG/SBO generator per year.
[f] Long-term conversion factor based upon emissions taking 10 hours to evacuate at normal flow rates.

Table 12D.2: Input Data for Routine Test H1 Screening Assessment

Process	Substance released to air	Physical height of release (m)	Effective height of release (m)	Release rate of substance, RR (g/s)	Dispersion factor, DF $DF_{long\text{-}term}$ (µg/m³/g/s)	Dispersion factor, $DF_{short\text{-}term}$ (µg/m³/g/s)	Long-term conversion factor	Short-term conversion factor
Exhaust gases from engines of backup diesel generators during periodic testing (EDGs)	$SO_{2\ 15\text{-}min}$	30 [a]	0	2.93 [d]	148	3900	0.00685 [f]	1.34
	$SO_{2\ 1\text{-}hr}$	30 [a]	0	2.93 [d]	-	3900	-	1.00
	$SO_{2\ 24\text{-}hr}$	30 [a]	0	2.93 [d]	-	3900	-	0.59
	NO_2	30 [a]	0	30.66 [d]	148	3900	0.00685 [f]	1.00
	NO_x	30 [a]	0	30.66 [d]	148	3900	0.00685 [f]	0.59
	CO	30 [a]	0	2.41 [e]	-	3900	-	0.70
	CO	30 [a]	0	2.41 [e]	-	3900	-	1.00
	PM_{10}	30 [a]	0	0.80 [e]	148	3900	0.00685 [f]	0.59
	$PM_{2.5}$	30 [a]	0	0.80 [e]	148	-	0.00685 [f]	-
Exhaust gases from engines of backup diesel generators during periodic testing (SBOs)	$SO_{2\ 15\text{-}min}$	30 [a]	0	0.40 [d]	148	3900	0.00685 [f]	1.34
	$SO_{2\ 1\text{-}hr}$	30 [a]	0	0.40 [d]	-	3900	-	1.00
	$SO_{2\ 24\text{-}hr}$	30 [a]	0	0.40 [d]	-	3900	-	0.59
	NO_2	30 [a]	0	6.80 [d]	148	3900	0.00685 [f]	1.00
	NO_x	30 [a]	0	6.80 [d]	148	3900	0.00685 [f]	0.59
	CO	30 [a]	0	0.57 [e]	-	3900	-	0.70
	CO	30 [a]	0	0.57 [e]	-	3900	-	1.00
	PM_{10}	30 [a]	0	0.19 [e]	148	3900	0.00685 [f]	0.59
	$PM_{2.5}$	30 [a]	0	0.19 [e]	148	-	0.00685 [f]	-

Process	Substance released to air	Physical height of release (m)	Effective height of release (m)	Release rate of substance, RR (g/s)	Dispersion factor, DF DF_{long} -term (µg/m^3/g/s)	Dispersion factor, DF_{short} -term (µg/m^3/g/s)	Long-term conversion factor	Short-term conversion factor
Thermal decomposition of insulation material - plant start-up or resuming of operation following routine maintenance (assumed two starts per year)	H_2CO	70 [b]	10	0.0243 [a]	32.0	580.0	0.00183 [g]	1.00
	CO	70 [b]	10	0.0229 [a]	-	580.0	0.00183 [g]	0.70
	CO	70 [b]	10	0.0229 [a]	-	580.0	0.00183 [g]	1.00
Discharges as the temperature rises in the steam generators during start-up (assumed two starts per year)	NH_3	38 [c]	0	3.12 [a]	148	3900	0.0189 [h]	1.00

[a] Data acquired from EDF ‘Pre-Construction Environmental Report (PCER)’ (2009).
[b] Data acquired from AMEC ‘Determination of UK EPR Stack Height’ (2009).
[c] Data based upon Flamanville 3 design - data provided in SR email 01/02/11.
[d] Data acquired from EDF Technical Note ‘ECUK100656 rev B - Assumptions to be taken into account for the EIA (IPC Submission) concerning the diesels’ (2011).
[e] Data calculated from Environmental Benchmarks published within Environment Agency ‘How to comply with your environmental permit. Additional guidance for: Combustion Activities (EPR 1.01)’ (2009).
[f] Long-term conversion factor based upon emissions being discharged for 60 hours per EDG/SBO generator per year.
[g] Long-term conversion factor based upon emissions taking 8 hours to evacuate at normal flow rates and assuming the installation is restarted two times per year.
[h] Long-term conversion factor based upon emissions being discharged for 83 hours per steam generator and assuming the installation is restarted two times per year.

Table 12D.3: Environmental Assessment Levels (EALs) Used in the H1 Screening Assessments

Process	Substance released to air	Human health EAL [a]		Ecological EAL [b]	
		Long-term ($\mu g/m^3$)	Short-term ($\mu g/m^3$)	Long-term ($\mu g/m^3$)	Short-term ($\mu g/m^3$)
Exhaust gases from engines of backup diesel generators (EDGs and SBOs) - commissioning and operational phases	$SO_{2\ 15\text{-min}}$	-	266 (15-minute mean)	20 (annual mean)	-
	$SO_{2\ 1\text{-hr}}$	-	350 (1-hour mean)	-	-
	$SO_{2\ 24\text{-hr}}$	-	125 (24-hour mean)	-	-
	NO_2	40 (annual mean)	200 (1-hour mean)	-	-
	NO_x	-	-	30 (annual mean)	75 (24-hour mean)
	CO	-	10000 (8-hour mean)	-	-
	CO	-	30000 (1-hour mean)		
	PM_{10}	40 (annual mean)	50 (24-hour mean)	-	-
	$PM_{2.5}$	25 (annual mean)	-	-	-
Thermal decomposition of insulation material - commissioning and operational phases	H_2CO	5 (annual mean)	100 (1-hour mean)	-	-
	CO	-	10000 (8-hour mean)	-	-
	CO	-	30000 (1-hour mean)	-	-

Process	Substance released to air	Human health EAL [a]		Ecological EAL [b]	
		Long-term ($\mu g/m^3$)	Short-term ($\mu g/m^3$)	Long-term ($\mu g/m^3$)	Short-term ($\mu g/m^3$)
Discharges as the temperature rises in the steam generators during start-up - operational phase	NH_3	180 (annual mean)	2500 (1-hour mean)	3 (annual mean)	-

[a] All EALs for human receptor location obtained from Table B1 and Table B5 of Environment Agency's H1 guidance - Annex (f) Air emissions (2010).
[b] All EALs for ecological receptor location obtained from Table B4 of Environment Agency's H1 guidance - Annex (f) Air emissions (2010).

Table 12D.4: Background Pollutant Concentrations used in H1 Assessment

Process	Substance released to air	Annual average background concentration for 2009 (µg/m^3)
Thermal decomposition of insulation material - commissioning phase	H_2CO [a]	0.0
	CO [b]	78.5
Exhaust gases from engines of backup diesel generators during periodic testing	SO_2 [c]	1.8
	NO_2 [d]	6.8
	NO_x [d]	11.5
	CO [b]	78.5
	PM_{10} [d]	18.2
	$PM_{2.5}$ [e]	7.9
Thermal decomposition of insulation material - plant start-up or resuming of operation following routine maintenance	H_2CO [a]	0.0
	CO [b]	78.5
Discharges as the temperature rises in the steam generators during start-up	NH_3 [f]	1.1

[a] Background concentration of formaldehyde assumed to be negligible.

[b] Background concentration of carbon monoxide taken from Defra's UK Air Quality Archive (average of the four 1km x 1km grid squares closest to Hinkley Point). 2001 background map CO annual mean concentrations factored to 2009 using published Defra annual adjustment factors.

[c] 2009 annual mean background concentration of SO2 assumed to be equal to 2008 annual mean SO2 concentration obtained from the baseline air quality monitoring campaign.

[d] 2009 annual mean background concentrations of NO2, NOx and PM10 obtained by applying the ratio for 2008 to 2009 annual mean concentrations from Defra's UK Air Quality Archive (average of the four 1km x 1km grid squares closest to Hinkley Point) to 2008 annual mean pollutant concentrations obtained from the baseline air quality monitoring campaign.

[e] 2009 annual mean background concentration of PM2.5 taken from Defra's UK Air Quality Archive (average of the four 1km x 1km grid squares closest to Hinkley Point).

[f] 2009 annual mean background concentration of NH3 assumed to be equal to 2008 annual mean concentration obtained from the Ammonia Monitoring Network results for North Wyke.

Table 12D.5: Short-term and Long-term Process Contributions to air (*PC_{air}*) Calculated by H1 Methodology for the Commissioning and Routine Test Scenarios

Substance released to air	Commissioning		Routine Test	
	Process Contribution, PC_{air} - long (µg/m^3)	Process Contribution, PC_{air} - short (µg/m^3)	Process Contribution, PC_{air} - long (µg/m^3)	Process Contribution, PC_{air} - short (µg/m^3)
$SO_{2\ 15\text{-}min}$	103.6	15312.2	25.4	15312.2
$SO_{2\ 1\text{-}hr}$	-	11427.0	-	11427.0
$SO_{2\ 24\text{-}hr}$	-	6741.9	-	6741.9
NO_2	1127.9	59787.0	276.2	59787.0
NO_x	1127.9	70548.7	276.2	70548.7
$CO_{\ 8\text{-}hr}$	-	6605.3	-	6597.9
$CO_{\ 1\text{-}hr}$	-	9436.1	-	9425.6
PM_{10}	29.6	1840.8	7.3	1840.8
$PM_{2.5}$	29.6	-	7.3	-
H_2CO	0.002	39.6	0.003	28.2
NH_3	-	-	70.0	97344.0

Table 12D.6: Comparison of Short-term and Long-term Process Contributions to Air (PC_{air}) of Substances Emitted to Air for the Commissioning and Routine Test Scenarios against the Relevant EAL

Substance released to air	Commissioning				Routine Test			
	Human Health		Ecological		Human Health		Ecological	
	EAL $PC_{air - long}$	EAL $PC_{air - short}$	EAL $PC_{air - long}$	EAL $PC_{air - short}$	EAL $PC_{air - long}$	EAL $PC_{air - short}$	EAL $PC_{air - long}$	EAL $PC_{air - short}$
	Insignificant?	Insignificant?	Insignificant?	Insignificant?	Insignificant?	Insignificant?	Insignificant?	Insignificant?
$SO_{2\ 15\text{-min}}$	-	No	No	-	-	No	No	-
$SO_{2\ 1\text{-hr}}$	-	No	-	-	-	No	-	-
$SO_{2\ 24\text{-hr}}$	-	No	-	-	-	No	-	-
NO_2	No	No	-	-	No	No	-	-
NO_x	-	-	No	No	-	-	No	No
$CO_{\ 8\text{-hr}}$	-	No	-	-	-	No	-	-
$CO_{\ 1\text{-hr}}$	-	No	-	-	-	No	-	-
PM_{10}	No	No	-	-	No	No	-	-
$PM_{2.5}$	No	-	-	-	No	-	-	-
H_2CO	Yes	No	-	-	Yes	No	-	-
NH_3	-	-	-	-	No	No	No	-

Table 12D.7: Identification of Need for Detailed Modelling of Emissions to air for the Commissioning and Routine Test Scenarios using H1 Methodology

Substance released to air	Commissioning				Routine Test			
	Human Health		Ecological		Human Health		Ecological	
	Long-term detailed modelling required?	Short-term detailed modelling required?	Long-term detailed modelling required?	Short-term detailed modelling required?	Long-term detailed modelling required?	Short-term detailed modelling required?	Long-term detailed modelling required?	Short-term detailed modelling required?
$SO_{2\ 15\text{-min}}$	-	Yes	Yes	-	-	Yes	Yes	-
$SO_{2\ 1\text{-hr}}$	-	Yes	-	-	-	Yes	-	-
$SO_{2\ 24\text{-hr}}$	-	Yes	-	-	-	Yes	-	-
NO_2	Yes	Yes	-	-	Yes	Yes	-	-
NO_x	-	-	Yes	Yes	-	-	Yes	Yes
$CO_{\ 8\text{-hr}}$	-	Yes	-	-	-	Yes	-	-
$CO_{\ 1\text{-hr}}$	-	Yes	-	-	-	Yes	-	-
PM_{10}	Yes	Yes	-	-	No	Yes	-	-
$PM_{2.5}$	Yes	-	-	-	No	-	-	-
H_2CO	-	Yes	-	-	-	Yes	-	-
NH_3	-	-	-	-	No	Yes	Yes	-

Table 12D.8: Stack Parameters and Emission Rates for EDGs and SBOs and Non-diesel Generator Emissions to Air

Parameter	Value [a]	Units
EDG Emissions		
Stack internal diameter	1.0	M
Stack height	30.0	m
Exit velocity	35	m/s
Ambient temperature of discharge gases	375	˚C
SO_2 emission rate	2.93	g/s
NO_x emission rate	30.66	g/s
PM_{10} emission rate	0.80	g/s
CO emission rate	2.41	g/s
SBO Emissions		
Stack internal diameter	0.82	m
Stack height	30.0	m
Exit velocity	15.0	m/s
Ambient temperature of discharge gases	515	˚C
SO_2 emission rate	0.40	g/s
NO_x emission rate	6.80	g/s
PM_{10} emission rate	0.19	g/s
CO emission rate	0.57	g/s
Main Stack Emissions		
Stack internal diameter	3.0	m
Stack height	70.0	m
Exit velocity	0.982	m/s
Ambient temperature of discharge gases	15	˚C
H_2CO emission rate (commissioning)	0.0342	g/s
CO emission rate (commissioning)	0.0320	g/s
H_2CO emission rate (operation)	0.0243	g/s
CO emission rate (operation)	0.0229	g/s
NH_3 Emissions		
Stack internal diameter	2.66	m
Stack height	38.0	m
Exit velocity	0.53	m/s
Ambient temperature of discharge gases	100	˚C
NH_3 emission rate	3.12	g/s

[a] All input data parameters acquired from EDF 'Pre-Construction Environmental Report (PCER)' (2009), EDF Technical Note 'ECUK100656 rev B - Assumptions to be taken into account for the EIA (IPC Submission) concerning the diesels' (2011) and Flamanville 3 data provided in SR email 01/02/11.

Table 12D.9: Building and Stack Data

Building or Stack	Centre location (easting) [a]	Centre location (northing) [a]	Height (m) [b]	Length or diameter (m) [b]	Breadth (m) [b]	Angle from north (°)	Shape
Buildings							
C1 Turbine Hall	320369	145931	46	122	63	0	rectangular
C1 Reactor Building	320369	145812	64	57	-	-	circular
C1 Fuel Building/Nuclear Aux Building	320380	145770	36	87	26	90	rectangular
C1 Safeguard Elec Buildings 2-3/Access Building	320364	145855	34	83	29	90	rectangular
C1 Safeguard Elec Building 4	320409	145812	37	56	24	0	rectangular
C1 Safeguard Elec Building 1	320328	145812	36	56	24	0	rectangular
C2 Turbine Hall	320139	145931	46	122	63	0	rectangular
C2 Reactor Building	320139	145812	64	57	-	-	circular
C2 Fuel Building/Nuclear Aux Building	320151	145770	36	87	26	90	rectangular
C2 Safeguard Elec Buildings 2-3/Access Building	320144	145855	34	83	29	90	rectangular
C2 Safeguard Elec Building 4	320179	145812	37	56	24	0	rectangular
C2 Safeguard Elec Building 1	320098	145812	36	56	24	0	rectangular
Emergency Diesel Building C1b	320458	145832	27	45	26	0	rectangular
Emergency Diesel Building C2a	320283	145832	27	45	26	0	rectangular
Emergency Diesel Building C1a	320225	145832	27	45	26	0	rectangular
Emergency Diesel Building C2b	320051	145832	27	45	26	0	rectangular
Operational Service Centre	320254	145931	35	66	82	90	rectangular
Interim Level Waste ISF	320542	146081	16	37	137	90	rectangular
Spent Fuel ISF	320608	146078	25	65	150	90	rectangular
C1 Cooling Water Pumphouse	320379	146045	18	83	57	90	rectangular
C2 Cooling Water Pumphouse	320149	146045	18	83	57	90	rectangular

Building or Stack	Centre location (easting) [a]	Centre location (northing) [a]	Height (m) [b]	Length or diameter (m) [b]	Breadth (m) [b]	Angle from north (^{o})	Shape
Demineralisation/Desalination Station	320472	145938	14	39	31	90	rectangular
Auxiliary Boilers	320467	145890	17	25	24	90	rectangular
Contaminated Tools Store 1	320139	145681	13	64	28		rectangular
Contaminated Tools Store 2	320003	145938	13	64	28		rectangular
Stacks							
EDG_2_C1b	320458	145832	30 [c]	1.00 [f]	-	-	circular
EDG_2_C2a	320283	145832	30 [c]	1.00 [f]	-	-	circular
EDG_2_C1a	320225	145832	30 [c]	1.00 [f]	-	-	circular
EDG_2_C2b	320051	145832	30 [c]	1.00 [f]	-	-	circular
EDG_1_C1b	320458	145822	30 [c]	1.00 [f]	-	-	circular
EDG_1_C2a	320283	145822	30 [c]	1.00 [f]	-	-	circular
EDG_1_C1a	320225	145822	30 [c]	1.00 [f]	-	-	circular
EDG_1_C2b	320051	145822	30 [c]	1.00 [f]	-	-	circular
SBO_C1b	320458	145842	30 [c]	0.82 [f]	-	-	circular
SBO_C2a	320283	145842	30 [c]	0.82 [f]	-	-	circular
SBO_C1a	320225	145842	30 [c]	0.82 [f]	-	-	circular
SBO_C2b	320051	145842	30 [c]	0.82 [f]	-	-	circular
C1 Main	320394	145793	70 [d]	3.00 [c]	-	-	circular
C2 Main	320164	145793	70 [d]	3.00 [c]	-	-	circular
NH3_C1a	320328	145812	38 [e]	2.66 [e]	-	-	circular
NH3_C1b	320344	145854	38 [e]	2.66 [e]	-	-	circular
NH3_C1c	320394	145854	38 [e]	2.66 [e]	-	-	circular
NH3_C1d	320411	145812	38 [e]	2.66 [e]	-	-	circular

Building or Stack	Centre location (easting) [a]	Centre location (northing) [a]	Height (m) [b]	Length or diameter (m) [b]	Breadth (m) [b]	Angle from north (^{o})	Shape
NH3_C2a	320098	145812	38 e	2.66 e	-	-	circular
NH3_C2b	320114	145854	38 e	2.66 e	-	-	circular
NH3_C2c	320164	145854	38 e	2.66 e	-	-	circular
NH3_C2d	320181	145812	38 e	2.66 e	-	-	circular

[a] Building and stack locations based upon Hinkley Point C Site Plot Plan PREL E 10/12/10 – configuration agreed with SR, email 17/02/11.
[b] Building dimensions provided in SR email 14/02/11.
[c] Data acquired from EDF 'Pre-Construction Environmental Report (PCER)' (2009).
[d] Data acquired from AMEC 'Determination of UK EPR Stack Height' (2009).
[e] Data based upon 1m above building height.
[f] Stack diameter reduced from 1m to produce 15 m/s velocity. Approved in SR email 10/08/11.

Table 12D.10: Locations of Human Receptor Locations

Receptor	Easting	Northing	Distance from stacks (m) [a]	Bearing from stacks (°) [a]
Human Receptors				
Trighern Farm	322655	145238	2439	103
Zipe Farm	321934	144561	2063	127
Wick Farm	321578	144620	1750	132
Doggetts	320599	144714	1126	164
Knighton Farm	319375	144512	1569	215
Shurton village	320185	144256	1541	184
Bullen Farm	319150	144550	1681	222
Point south of Knighton	319250	144250	1856	214
Burton village	319350	144050	1976	208
Warren's Farm	319850	143981	1863	193
Newnham Bridge	320661	144169	1669	167
Wick village	321550	144550	1778	134
Gunter's Grove	321158	144115	1895	152
Point west of Wick	321250	144650	1500	140
Caravan Park	321750	143950	2358	141
Wick Park Cottage	321650	143550	2629	149
Farringdon Hill Farm	321350	143450	2577	155
Kennels south Farringdon	321350	143250	2760	157
Idson Farm	322428	144387	2568	123
Upper Cock Farm	322950	143450	3553	131
Lower Cock Farm	323350	143350	3924	129
Woolstone Farm	323750	144350	3758	113
Chalcott Farm	323351	144813	3224	108
Whitewick Farm	323493	145272	3255	99
Stolford Farm	323163	145824	2883	89
Browns Cottage	323096	145123	2895	103
Little Dowdens Farm	322750	145650	2474	93
Cole Pool	319254	143674	2355	206
Stogursey	320260	143185	2609	180
Wick House Farm	321599	144541	1819	134
West End Cottage	322691	145607	2418	94
Footpath - Benhole Lane South	319715	144975	995	215
Footpath - Benhole Lane North	319561	145814	719	272
Footpath - Coastal	319858	146152	554	310
Pixies Mound	320890	145573	649	110

[a] Distances and bearings calculated from the mid-point between the two EPR reactors.

Table 12D.11: NO_2 Concentrations at Human Receptor Locations – Commissioning

Receptor	Annual Mean				99.79%-ile 1-hour Mean			
	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	40	0.59	7.39	18.5%	200	11.20	24.80	12.4%
Zipe Farm	40	0.39	7.19	18.0%	200	11.73	25.33	12.7%
Wick Farm	40	0.38	7.18	18.0%	200	12.82	26.42	13.2%
Doggetts	40	0.16	6.96	17.4%	200	18.37	31.97	16.0%
Knighton Farm	40	0.28	7.08	17.7%	200	15.57	29.17	14.6%
Shurton village	40	0.12	6.92	17.3%	200	11.98	25.58	12.8%
Bullen Farm	40	0.28	7.08	17.7%	200	14.21	27.81	13.9%
Point south of Knighton	40	0.21	7.01	17.5%	200	11.95	25.55	12.8%
Burton village	40	0.17	6.97	17.4%	200	10.26	23.86	11.9%
Warren’s Farm	40	0.12	6.92	17.3%	200	9.55	23.15	11.6%
Newnham Bridge	40	0.09	6.89	17.2%	200	10.20	23.80	11.9%
Wick village	40	0.33	7.13	17.8%	200	12.09	25.69	12.8%
Gunter’s Grove	40	0.11	6.91	17.3%	200	9.58	23.18	11.6%
Point west of Wick	40	0.32	7.12	17.8%	200	14.71	28.31	14.2%
Caravan Park	40	0.15	6.95	17.4%	200	7.90	21.50	10.7%
Wick Park Cottage	40	0.09	6.89	17.2%	200	6.43	20.03	10.0%
Farringdon Hill Farm	40	0.07	6.87	17.2%	200	6.42	20.02	10.0%
Kennels S Farringdon	40	0.06	6.86	17.2%	200	6.03	19.63	9.8%
Idson Farm	40	0.34	7.14	17.8%	200	9.93	23.53	11.8%
Upper Cock Farm	40	0.15	6.95	17.4%	200	6.08	19.68	9.8%
Lower Cock Farm	40	0.15	6.95	17.4%	200	5.58	19.18	9.6%
Woolstone Farm	40	0.31	7.11	17.8%	200	6.52	20.12	10.1%
Chalcott Farm	40	0.42	7.22	18.0%	200	8.37	21.97	11.0%
Whitewick Farm	40	0.35	7.15	17.9%	200	7.61	21.21	10.6%
Stolford Farm	40	0.29	7.09	17.7%	200	6.77	20.37	10.2%
Browns Cottage	40	0.46	7.26	18.1%	200	9.19	22.79	11.4%
Little Dowdens Far	40	0.44	7.24	18.1%	200	9.58	23.18	11.6%
Cole Pool	40	0.13	6.93	17.3%	200	7.94	21.54	10.8%
Stogursey	40	0.06	6.86	17.1%	200	6.02	19.62	9.8%
Wick House Farm	40	0.33	7.13	17.8%	200	12.18	25.78	12.9%
West End Cottage	40	0.47	7.27	18.2%	200	10.19	23.79	11.9%
Footpath - Benhole Lane (South)	-	-	-	-	200	28.30	41.90	21.0%
Footpath - Benhole Lane (North)	-	-	-	-	200	65.12	78.72	39.4%
Footpath - Coastal	-	-	-	-	200	102.71	116.31	58.2%
Pixies Mound	-	-	-	-	200	73.22	86.82	43.4%

Table 12D.12: PM_{10} Concentrations at Human Receptor Locations – Commissioning

Receptor	Annual Mean				90.41%-ile 24-hour Mean			
	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	40	0.02	18.22	45.6%	50	0.18	36.58	73.2%
Zipe Farm	40	0.01	18.21	45.5%	50	0.17	36.57	73.1%
Wick Farm	40	0.01	18.21	45.5%	50	0.17	36.57	73.1%
Doggetts	40	0.01	18.21	45.5%	50	0.07	36.47	72.9%
Knighton Farm	40	0.01	18.21	45.5%	50	0.09	36.49	73.0%
Shurton village	40	0.00	18.20	45.5%	50	0.04	36.44	72.9%
Bullen Farm	40	0.01	18.21	45.5%	50	0.11	36.51	73.0%
Point south of Knighton	40	0.01	18.21	45.5%	50	0.08	36.48	73.0%
Burton village	40	0.01	18.21	45.5%	50	0.06	36.46	72.9%
Warren’s Farm	40	0.00	18.20	45.5%	50	0.04	36.44	72.9%
Newnham Bridge	40	0.00	18.20	45.5%	50	0.03	36.43	72.9%
Wick village	40	0.01	18.21	45.5%	50	0.15	36.55	73.1%
Gunter’s Grove	40	0.00	18.20	45.5%	50	0.05	36.45	72.9%
Point west of Wick	40	0.01	18.21	45.5%	50	0.16	36.56	73.1%
Caravan Park	40	0.01	18.21	45.5%	50	0.07	36.47	72.9%
Wick Park Cottage	40	0.00	18.20	45.5%	50	0.04	36.44	72.9%
Farringdon Hill Farm	40	0.00	18.20	45.5%	50	0.03	36.43	72.9%
Kennels S Farringdon	40	0.00	18.20	45.5%	50	0.02	36.42	72.8%
Idson Farm	40	0.01	18.21	45.5%	50	0.13	36.53	73.1%
Upper Cock Farm	40	0.01	18.21	45.5%	50	0.07	36.47	72.9%
Lower Cock Farm	40	0.01	18.21	45.5%	50	0.06	36.46	72.9%
Woolstone Farm	40	0.01	18.21	45.5%	50	0.11	36.51	73.0%
Chalcott Farm	40	0.02	18.22	45.5%	50	0.14	36.54	73.1%
Whitewick Farm	40	0.01	18.21	45.5%	50	0.11	36.51	73.0%
Stolford Farm	40	0.01	18.21	45.5%	50	0.09	36.49	73.0%
Browns Cottage	40	0.02	18.22	45.5%	50	0.14	36.54	73.1%
Little Dowdens Far	40	0.02	18.22	45.5%	50	0.14	36.54	73.1%
Cole Pool	40	0.00	18.20	45.5%	50	0.05	36.45	72.9%
Stogursey	40	0.00	18.20	45.5%	50	0.02	36.42	72.8%
Wick House Farm	40	0.01	18.21	45.5%	50	0.15	36.55	73.1%
West End Cottage	40	0.02	18.22	45.5%	50	0.15	36.55	73.1%

Table 12D.13: $PM_{2.5}$ Concentrations at Human Receptor Locations – Commissioning

Receptor	Annual Mean			
	AQS	PC	PEC	%PEC of AQS
Trighern Farm	25	0.02	7.92	31.7%
Zipe Farm	25	0.01	7.91	31.7%
Wick Farm	25	0.01	7.91	31.7%
Doggetts	25	0.01	7.91	31.6%
Knighton Farm	25	0.01	7.91	31.6%
Shurton village	25	0.00	7.90	31.6%
Bullen Farm	25	0.01	7.91	31.6%
Point south of Knighton	25	0.01	7.91	31.6%
Burton village	25	0.01	7.91	31.6%
Warren’s Farm	25	0.00	7.90	31.6%
Newnham Bridge	25	0.00	7.90	31.6%
Wick village	25	0.01	7.91	31.6%
Gunter’s Grove	25	0.00	7.90	31.6%
Point west of Wick	25	0.01	7.91	31.6%
Caravan Park	25	0.01	7.91	31.6%
Wick Park Cottage	25	0.00	7.90	31.6%
Farringdon Hill Farm	25	0.00	7.90	31.6%
Kennels S Farringdon	25	0.00	7.90	31.6%
Idson Farm	25	0.01	7.91	31.7%
Upper Cock Farm	25	0.01	7.91	31.6%
Lower Cock Farm	25	0.01	7.91	31.6%
Woolstone Farm	25	0.01	7.91	31.6%
Chalcott Farm	25	0.02	7.92	31.7%
Whitewick Farm	25	0.01	7.91	31.7%
Stolford Farm	25	0.01	7.91	31.6%
Browns Cottage	25	0.02	7.92	31.7%
Little Dowdens Far	25	0.02	7.92	31.7%
Cole Pool	25	0.00	7.90	31.6%
Stogursey	25	0.00	7.90	31.6%
Wick House Farm	25	0.01	7.91	31.6%
West End Cottage	25	0.02	7.92	31.7%

Table 12D.14: CO Concentrations at Human Receptor Locations – Commissioning

Receptor	1-hour Mean				Rolling 8-hour Mean			
	EAL	PC	PEC	%PEC of EAL	AQS	PC	PEC	%PEC of AQS
Trighern Farm	30000	4	161	0.5%	10000	2	159	1.6%
Zipe Farm	30000	4	161	0.5%	10000	2	159	1.6%
Wick Farm	30000	4	161	0.5%	10000	3	160	1.6%
Doggetts	30000	6	163	0.5%	10000	5	162	1.6%
Knighton Farm	30000	5	162	0.5%	10000	3	160	1.6%
Shurton village	30000	4	161	0.5%	10000	3	160	1.6%
Bullen Farm	30000	5	162	0.5%	10000	4	161	1.6%
Point south of Knighton	30000	4	161	0.5%	10000	3	160	1.6%
Burton village	30000	3	160	0.5%	10000	2	159	1.6%
Warren's Farm	30000	3	160	0.5%	10000	2	159	1.6%
Newnham Bridge	30000	4	161	0.5%	10000	3	160	1.6%
Wick village	30000	4	161	0.5%	10000	3	160	1.6%
Gunter's Grove	30000	3	160	0.5%	10000	2	159	1.6%
Point west of Wick	30000	5	162	0.5%	10000	3	160	1.6%
Caravan Park	30000	3	160	0.5%	10000	2	159	1.6%
Wick Park Cottage	30000	2	159	0.5%	10000	1	158	1.6%
Farringdon Hill Farm	30000	2	159	0.5%	10000	2	159	1.6%
Kennels S Farringdon	30000	2	159	0.5%	10000	2	159	1.6%
Idson Farm	30000	4	161	0.5%	10000	2	159	1.6%
Upper Cock Farm	30000	2	159	0.5%	10000	1	158	1.6%
Lower Cock Farm	30000	2	159	0.5%	10000	1	158	1.6%
Woolstone Farm	30000	2	159	0.5%	10000	1	158	1.6%
Chalcott Farm	30000	3	160	0.5%	10000	2	159	1.6%
Whitewick Farm	30000	2	159	0.5%	10000	1	158	1.6%
Stolford Farm	30000	3	160	0.5%	10000	1	158	1.6%
Browns Cottage	30000	3	160	0.5%	10000	2	159	1.6%
Little Dowdens Far	30000	3	160	0.5%	10000	2	159	1.6%
Cole Pool	30000	2	159	0.5%	10000	2	159	1.6%
Stogursey	30000	2	159	0.5%	10000	1	158	1.6%
Wick House Farm	30000	4	161	0.5%	10000	3	160	1.6%
West End Cottage	30000	3	160	0.5%	10000	2	159	1.6%
Footpath - Benhole Lane (South)	30000	9	166	0.6%	-	-	-	-
Footpath - Benhole Lane (North)	30000	17	174	0.6%	-	-	-	-
Footpath - Coastal	30000	26	183	0.6%	-	-	-	-
Pixies Mound	30000	24	181	0.6%	-	-	-	-

Table 12D.15: SO_2 Concentrations at Human Receptor Locations – Commissioning

Receptor	99.9%-ile 15-minute Mean				99.73%-ile of 1-hour Mean				99.18%-ile of 24-hour Mean			
	AQO	PC	PEC	%PEC of AQO	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	266	4.73	8.33	3.1%	350	2.96	6.56	1.9%	125	1.30	4.90	3.9%
Zipe Farm	266	4.51	8.11	3.0%	350	3.13	6.73	1.9%	125	1.32	4.92	3.9%
Wick Farm	266	5.32	8.92	3.4%	350	3.27	6.87	2.0%	125	1.39	4.99	4.0%
Doggetts	266	6.73	10.33	3.9%	350	4.92	8.52	2.4%	125	2.51	6.11	4.9%
Knighton Farm	266	6.01	9.61	3.6%	350	4.15	7.75	2.2%	125	2.21	5.81	4.6%
Shurton village	266	4.16	7.76	2.9%	350	3.17	6.77	1.9%	125	1.83	5.43	4.3%
Bullen Farm	266	5.67	9.27	3.5%	350	3.82	7.42	2.1%	125	1.83	5.43	4.3%
Point south of Knighton	266	4.73	8.33	3.1%	350	3.17	6.77	1.9%	125	1.65	5.25	4.2%
Burton village	266	3.95	7.55	2.8%	350	2.69	6.29	1.8%	125	1.50	5.10	4.1%
Warren’s Farm	266	3.82	7.42	2.8%	350	2.59	6.19	1.8%	125	1.39	4.99	4.0%
Newnham Bridge	266	3.98	7.58	2.8%	350	2.70	6.30	1.8%	125	1.31	4.91	3.9%
Wick village	266	4.79	8.39	3.2%	350	3.18	6.78	1.9%	125	1.37	4.97	4.0%
Gunter’s Grove	266	3.69	7.29	2.7%	350	2.52	6.12	1.7%	125	1.10	4.70	3.8%
Point west of Wick	266	5.40	9.00	3.4%	350	3.94	7.54	2.2%	125	1.95	5.55	4.4%
Caravan Park	266	3.21	6.81	2.6%	350	2.10	5.70	1.6%	125	0.89	4.49	3.6%
Wick Park Cottage	266	2.60	6.20	2.3%	350	1.72	5.32	1.5%	125	0.68	4.28	3.4%
Farringdon Hill Farm	266	2.80	6.40	2.4%	350	1.67	5.27	1.5%	125	0.63	4.23	3.4%
Kennels S Farringdon	266	2.73	6.33	2.4%	350	1.55	5.15	1.5%	125	0.55	4.15	3.3%
Idson Farm	266	4.03	7.63	2.9%	350	2.59	6.19	1.8%	125	1.01	4.61	3.7%
Upper Cock Farm	266	2.62	6.22	2.3%	350	1.54	5.14	1.5%	125	0.52	4.12	3.3%
Lower Cock Farm	266	2.42	6.02	2.3%	350	1.47	5.07	1.4%	125	0.48	4.08	3.3%
Woolstone Farm	266	3.05	6.65	2.5%	350	1.75	5.35	1.5%	125	0.80	4.40	3.5%

Receptor	99.9%-ile 15-minute Mean				99.73%-ile of 1-hour Mean				99.18%-ile of 24-hour Mean			
	AQO	PC	PEC	%PEC of AQO	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Chalcott Farm	266	3.83	7.43	2.8%	350	2.22	5.82	1.7%	125	0.97	4.57	3.7%
Whitewick Farm	266	3.27	6.87	2.6%	350	2.04	5.64	1.6%	125	0.73	4.33	3.5%
Stolford Farm	266	3.00	6.60	2.5%	350	1.80	5.40	1.5%	125	0.63	4.23	3.4%
Browns Cottage	266	3.84	7.44	2.8%	350	2.41	6.01	1.7%	125	1.02	4.62	3.7%
Little Dowdens Far	266	3.75	7.35	2.8%	350	2.51	6.11	1.7%	125	0.81	4.41	3.5%
Cole Pool	266	3.21	6.81	2.6%	350	2.06	5.66	1.6%	125	1.10	4.70	3.8%
Stogursey	266	2.55	6.15	2.3%	350	1.59	5.19	1.5%	125	0.82	4.42	3.5%
Wick House Farm	266	4.86	8.46	3.2%	350	3.20	6.80	1.9%	125	1.32	4.92	3.9%
West End Cottage	266	4.27	7.87	3.0%	350	2.69	6.29	1.8%	125	0.92	4.52	3.6%
Footpath - Benhole Lane (South)	266	10.22	13.82	5.2%	350	7.55	11.15	3.2%	-	-	-	-
Footpath - Benhole Lane (North)	266	22.39	25.99	9.8%	350	17.57	21.17	6.0%	-	-	-	-
Footpath - Coastal	266	32.23	35.83	13.5%	350	27.82	31.42	9.0%	-	-	-	-
Pixies Mound	266	24.60	28.20	10.6%	350	19.75	23.35	6.7%	-	-	-	-

Table 12D.16: H_2CO Concentrations at Human Receptor Locations – Commissioning

Receptor	Annual Mean				1-hour Mean			
	EAL	PC	PEC	%PEC of EAL	EAL	PC	PEC	%PEC of EAL
Trighern Farm	5	0.00	0.00	0.0%	100	0.30	0.30	0.3%
Zipe Farm	5	0.00	0.00	0.0%	100	0.21	0.21	0.2%
Wick Farm	5	0.00	0.00	0.0%	100	0.22	0.22	0.2%
Doggetts	5	0.00	0.00	0.0%	100	0.71	0.71	0.7%
Knighton Farm	5	0.00	0.00	0.0%	100	0.37	0.37	0.4%
Shurton village	5	0.00	0.00	0.0%	100	0.41	0.41	0.4%
Bullen Farm	5	0.00	0.00	0.0%	100	0.40	0.40	0.4%
Point south of Knighton	5	0.00	0.00	0.0%	100	0.30	0.30	0.3%
Burton village	5	0.00	0.00	0.0%	100	0.29	0.29	0.3%
Warren's Farm	5	0.00	0.00	0.0%	100	0.32	0.32	0.3%
Newnham Bridge	5	0.00	0.00	0.0%	100	0.45	0.45	0.5%
Wick village	5	0.00	0.00	0.0%	100	0.24	0.24	0.2%
Gunter's Grove	5	0.00	0.00	0.0%	100	0.35	0.35	0.4%
Point west of Wick	5	0.00	0.00	0.0%	100	0.32	0.32	0.3%
Caravan Park	5	0.00	0.00	0.0%	100	0.19	0.19	0.2%
Wick Park Cottage	5	0.00	0.00	0.0%	100	0.16	0.16	0.2%
Farringdon Hill Farm	5	0.00	0.00	0.0%	100	0.28	0.28	0.3%
Kennels S Farringdon	5	0.00	0.00	0.0%	100	0.27	0.27	0.3%
Idson Farm	5	0.00	0.00	0.0%	100	0.19	0.19	0.2%
Upper Cock Farm	5	0.00	0.00	0.0%	100	0.09	0.09	0.1%
Lower Cock Farm	5	0.00	0.00	0.0%	100	0.08	0.08	0.1%
Woolstone Farm	5	0.00	0.00	0.0%	100	0.22	0.22	0.2%
Chalcott Farm	5	0.00	0.00	0.0%	100	0.23	0.23	0.2%
Whitewick Farm	5	0.00	0.00	0.0%	100	0.17	0.17	0.2%
Stolford Farm	5	0.00	0.00	0.0%	100	0.20	0.20	0.2%
Browns Cottage	5	0.00	0.00	0.0%	100	0.25	0.25	0.2%
Little Dowdens Far	5	0.00	0.00	0.0%	100	0.19	0.19	0.2%
Cole Pool	5	0.00	0.00	0.0%	100	0.26	0.26	0.3%
Stogursey	5	0.00	0.00	0.0%	100	0.32	0.32	0.3%
Wick House Farm	5	0.00	0.00	0.0%	100	0.22	0.22	0.2%
West End Cottage	5	0.00	0.00	0.0%	100	0.19	0.19	0.2%
Footpath - Benhole Lane (South)	-	-	-	-	100	0.59	0.59	0.6%
Footpath - Benhole Lane (North)	-	-	-	-	100	0.90	0.90	0.9%
Footpath - Coastal	-	-	-	-	100	1.04	1.04	1.0%
Pixies Mound	-	-	-	-	100	0.81	0.81	0.8%

Table 12D.17: NO_2 Concentrations at Human Receptor Locations – Routine Test

Receptor	Annual Mean				99.79%-ile 1-hour Mean			
	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	40	0.14	6.94	17.4%	200	11.20	24.80	12.4%
Zipe Farm	40	0.10	6.90	17.2%	200	11.73	25.33	12.7%
Wick Farm	40	0.09	6.89	17.2%	200	12.82	26.42	13.2%
Doggetts	40	0.04	6.84	17.1%	200	18.37	31.97	16.0%
Knighton Farm	40	0.07	6.87	17.2%	200	15.57	29.17	14.6%
Shurton village	40	0.03	6.83	17.1%	200	11.98	25.58	12.8%
Bullen Farm	40	0.07	6.87	17.2%	200	14.21	27.81	13.9%
Point south of Knighton	40	0.05	6.85	17.1%	200	11.95	25.55	12.8%
Burton village	40	0.04	6.84	17.1%	200	10.26	23.86	11.9%
Warren’s Farm	40	0.03	6.83	17.1%	200	9.55	23.15	11.6%
Newnham Bridge	40	0.02	6.82	17.1%	200	10.20	23.80	11.9%
Wick village	40	0.08	6.88	17.2%	200	12.09	25.69	12.8%
Gunter’s Grove	40	0.03	6.83	17.1%	200	9.58	23.18	11.6%
Point west of Wick	40	0.08	6.88	17.2%	200	14.71	28.31	14.2%
Caravan Park	40	0.04	6.84	17.1%	200	7.90	21.50	10.7%
Wick Park Cottage	40	0.02	6.82	17.1%	200	6.43	20.03	10.0%
Farringdon Hill Farm	40	0.02	6.82	17.0%	200	6.42	20.02	10.0%
Kennels S Farringdon	40	0.02	6.82	17.0%	200	6.03	19.63	9.8%
Idson Farm	40	0.08	6.88	17.2%	200	9.93	23.53	11.8%
Upper Cock Farm	40	0.04	6.84	17.1%	200	6.08	19.68	9.8%
Lower Cock Farm	40	0.04	6.84	17.1%	200	5.58	19.18	9.6%
Woolstone Farm	40	0.08	6.88	17.2%	200	6.52	20.12	10.1%
Chalcott Farm	40	0.10	6.90	17.3%	200	8.37	21.97	11.0%
Whitewick Farm	40	0.09	6.89	17.2%	200	7.61	21.21	10.6%
Stolford Farm	40	0.07	6.87	17.2%	200	6.77	20.37	10.2%
Browns Cottage	40	0.11	6.91	17.3%	200	9.19	22.79	11.4%
Little Dowdens Far	40	0.11	6.91	17.3%	200	9.58	23.18	11.6%
Cole Pool	40	0.03	6.83	17.1%	200	7.94	21.54	10.8%
Stogursey	40	0.01	6.81	17.0%	200	6.02	19.62	9.8%
Wick House Farm	40	0.08	6.88	17.2%	200	12.18	25.78	12.9%
West End Cottage	40	0.12	6.92	17.3%	200	10.19	23.79	11.9%
Footpath - Benhole Lane (South)	-	-	-	-	200	28.30	41.90	21.0%
Footpath - Benhole Lane (North)	-	-	-	-	200	65.12	78.72	39.4%
Footpath - Coastal	-	-	-	-	200	102.71	116.31	58.2%
Pixies Mound	-	-	-	-	200	73.22	86.82	43.4%

Table 12D.18: PM_{10} Concentrations at Human Receptor Locations – Routine Test

Receptor	Annual Mean				90.41%-ile 24-hour Mean			
	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	40	0.01	18.21	45.5%	50	0.18	36.58	73.2%
Zipe Farm	40	0.00	18.20	45.5%	50	0.17	36.57	73.1%
Wick Farm	40	0.00	18.20	45.5%	50	0.17	36.57	73.1%
Doggetts	40	0.00	18.20	45.5%	50	0.07	36.47	72.9%
Knighton Farm	40	0.00	18.20	45.5%	50	0.09	36.49	73.0%
Shurton village	40	0.00	18.20	45.5%	50	0.04	36.44	72.9%
Bullen Farm	40	0.00	18.20	45.5%	50	0.11	36.51	73.0%
Point south of Knighton	40	0.00	18.20	45.5%	50	0.08	36.48	73.0%
Burton village	40	0.00	18.20	45.5%	50	0.06	36.46	72.9%
Warren’s Farm	40	0.00	18.20	45.5%	50	0.04	36.44	72.9%
Newnham Bridge	40	0.00	18.20	45.5%	50	0.03	36.43	72.9%
Wick village	40	0.00	18.20	45.5%	50	0.15	36.55	73.1%
Gunter’s Grove	40	0.00	18.20	45.5%	50	0.05	36.45	72.9%
Point west of Wick	40	0.00	18.20	45.5%	50	0.16	36.56	73.1%
Caravan Park	40	0.00	18.20	45.5%	50	0.07	36.47	72.9%
Wick Park Cottage	40	0.00	18.20	45.5%	50	0.04	36.44	72.9%
Farringdon Hill Farm	40	0.00	18.20	45.5%	50	0.03	36.43	72.9%
Kennels S Farringdon	40	0.00	18.20	45.5%	50	0.02	36.42	72.8%
Idson Farm	40	0.00	18.20	45.5%	50	0.13	36.53	73.1%
Upper Cock Farm	40	0.00	18.20	45.5%	50	0.07	36.47	72.9%
Lower Cock Farm	40	0.00	18.20	45.5%	50	0.06	36.46	72.9%
Woolstone Farm	40	0.00	18.20	45.5%	50	0.11	36.51	73.0%
Chalcott Farm	40	0.00	18.20	45.5%	50	0.14	36.54	73.1%
Whitewick Farm	40	0.00	18.20	45.5%	50	0.11	36.51	73.0%
Stolford Farm	40	0.00	18.20	45.5%	50	0.09	36.49	73.0%
Browns Cottage	40	0.00	18.20	45.5%	50	0.14	36.54	73.1%
Little Dowdens Far	40	0.00	18.20	45.5%	50	0.14	36.54	73.1%
Cole Pool	40	0.00	18.20	45.5%	50	0.05	36.45	72.9%
Stogursey	40	0.00	18.20	45.5%	50	0.02	36.42	72.8%
Wick House Farm	40	0.00	18.20	45.5%	50	0.15	36.55	73.1%
West End Cottage	40	0.00	18.20	45.5%	50	0.15	36.55	73.1%

Table 12D.19: $PM_{2.5}$ Concentrations at Human Receptor Locations – Routine Test

Receptor	Annual Mean			
	AQS	PC	PEC	%PEC of AQS
Trighern Farm	25	0.01	7.91	31.6%
Zipe Farm	25	0.00	7.90	31.6%
Wick Farm	25	0.00	7.90	31.6%
Doggetts	25	0.00	7.90	31.6%
Knighton Farm	25	0.00	7.90	31.6%
Shurton village	25	0.00	7.90	31.6%
Bullen Farm	25	0.00	7.90	31.6%
Point south of Knighton	25	0.00	7.90	31.6%
Burton village	25	0.00	7.90	31.6%
Warren's Farm	25	0.00	7.90	31.6%
Newnham Bridge	25	0.00	7.90	31.6%
Wick village	25	0.00	7.90	31.6%
Gunter's Grove	25	0.00	7.90	31.6%
Point west of Wick	25	0.00	7.90	31.6%
Caravan Park	25	0.00	7.90	31.6%
Wick Park Cottage	25	0.00	7.90	31.6%
Farringdon Hill Farm	25	0.00	7.90	31.6%
Kennels S Farringdon	25	0.00	7.90	31.6%
Idson Farm	25	0.00	7.90	31.6%
Upper Cock Farm	25	0.00	7.90	31.6%
Lower Cock Farm	25	0.00	7.90	31.6%
Woolstone Farm	25	0.00	7.90	31.6%
Chalcott Farm	25	0.00	7.90	31.6%
Whitewick Farm	25	0.00	7.90	31.6%
Stolford Farm	25	0.00	7.90	31.6%
Browns Cottage	25	0.00	7.90	31.6%
Little Dowdens Far	25	0.00	7.90	31.6%
Cole Pool	25	0.00	7.90	31.6%
Stogursey	25	0.00	7.90	31.6%
Wick House Farm	25	0.00	7.90	31.6%
West End Cottage	25	0.00	7.90	31.6%

Table 12D.20: CO Concentrations at Human Receptor Locations – Routine Test

Receptor	1-hour Mean				Rolling 8-hour Mean			
	EAL	PC	PEC	%PEC of EAL	AQS	PC	PEC	%PEC of AQS
Trighern Farm	30000	4	161	0.5%	10000	2	159	1.6%
Zipe Farm	30000	4	161	0.5%	10000	2	159	1.6%
Wick Farm	30000	4	161	0.5%	10000	3	160	1.6%
Doggetts	30000	6	163	0.5%	10000	5	162	1.6%
Knighton Farm	30000	5	162	0.5%	10000	3	160	1.6%
Shurton village	30000	4	161	0.5%	10000	3	160	1.6%
Bullen Farm	30000	5	162	0.5%	10000	4	161	1.6%
Point south of Knighton	30000	4	161	0.5%	10000	3	160	1.6%
Burton village	30000	3	160	0.5%	10000	2	159	1.6%
Warren’s Farm	30000	3	160	0.5%	10000	2	159	1.6%
Newnham Bridge	30000	4	161	0.5%	10000	3	160	1.6%
Wick village	30000	4	161	0.5%	10000	3	160	1.6%
Gunter’s Grove	30000	3	160	0.5%	10000	2	159	1.6%
Point west of Wick	30000	5	162	0.5%	10000	3	160	1.6%
Caravan Park	30000	3	160	0.5%	10000	2	159	1.6%
Wick Park Cottage	30000	2	159	0.5%	10000	1	158	1.6%
Farringdon Hill Farm	30000	2	159	0.5%	10000	2	159	1.6%
Kennels S Farringdon	30000	2	159	0.5%	10000	2	159	1.6%
Idson Farm	30000	4	161	0.5%	10000	2	159	1.6%
Upper Cock Farm	30000	2	159	0.5%	10000	1	158	1.6%
Lower Cock Farm	30000	2	159	0.5%	10000	1	158	1.6%
Woolstone Farm	30000	2	159	0.5%	10000	1	158	1.6%
Chalcott Farm	30000	3	160	0.5%	10000	2	159	1.6%
Whitewick Farm	30000	2	159	0.5%	10000	1	158	1.6%
Stolford Farm	30000	3	160	0.5%	10000	1	158	1.6%
Browns Cottage	30000	3	160	0.5%	10000	2	159	1.6%
Little Dowdens Far	30000	3	160	0.5%	10000	2	159	1.6%
Cole Pool	30000	2	159	0.5%	10000	2	159	1.6%
Stogursey	30000	2	159	0.5%	10000	1	158	1.6%
Wick House Farm	30000	4	161	0.5%	10000	3	160	1.6%
West End Cottage	30000	3	160	0.5%	10000	2	159	1.6%
Footpath - Benhole Lane (South)	30000	9	166	0.6%	-	-	-	-
Footpath - Benhole Lane (North)	30000	17	174	0.6%	-	-	-	-
Footpath - Coastal	30000	26	183	0.6%	-	-	-	-
Pixies Mound	30000	24	181	0.6%	-	-	-	-

Table 12D.21: SO_2 Concentrations at Human Receptor Locations – Routine Test

Receptor	99.9%-ile 15-minute Mean				99.73%-ile of 1-hour Mean				99.18%-ile of 24-hour Mean			
	AQO	PC	PEC	%PEC of AQO	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	266	4.73	8.33	3.1%	350	2.96	6.56	1.9%	125	1.30	4.90	3.9%
Zipe Farm	266	4.51	8.11	3.0%	350	3.13	6.73	1.9%	125	1.32	4.92	3.9%
Wick Farm	266	5.32	8.92	3.4%	350	3.27	6.87	2.0%	125	1.39	4.99	4.0%
Doggetts	266	6.73	10.33	3.9%	350	4.92	8.52	2.4%	125	2.51	6.11	4.9%
Knighton Farm	266	6.01	9.61	3.6%	350	4.15	7.75	2.2%	125	2.21	5.81	4.6%
Shurton village	266	4.16	7.76	2.9%	350	3.17	6.77	1.9%	125	1.83	5.43	4.3%
Bullen Farm	266	5.67	9.27	3.5%	350	3.82	7.42	2.1%	125	1.83	5.43	4.3%
Point south of Knighton	266	4.73	8.33	3.1%	350	3.17	6.77	1.9%	125	1.65	5.25	4.2%
Burton village	266	3.95	7.55	2.8%	350	2.69	6.29	1.8%	125	1.50	5.10	4.1%
Warren’s Farm	266	3.82	7.42	2.8%	350	2.59	6.19	1.8%	125	1.39	4.99	4.0%
Newnham Bridge	266	3.98	7.58	2.8%	350	2.70	6.30	1.8%	125	1.31	4.91	3.9%
Wick village	266	4.79	8.39	3.2%	350	3.18	6.78	1.9%	125	1.37	4.97	4.0%
Gunter’s Grove	266	3.69	7.29	2.7%	350	2.52	6.12	1.7%	125	1.10	4.70	3.8%
Point west of Wick	266	5.40	9.00	3.4%	350	3.94	7.54	2.2%	125	1.95	5.55	4.4%
Caravan Park	266	3.21	6.81	2.6%	350	2.10	5.70	1.6%	125	0.89	4.49	3.6%
Wick Park Cottage	266	2.60	6.20	2.3%	350	1.72	5.32	1.5%	125	0.68	4.28	3.4%
Farringdon Hill Farm	266	2.80	6.40	2.4%	350	1.67	5.27	1.5%	125	0.63	4.23	3.4%
Kennels S Farringdon	266	2.73	6.33	2.4%	350	1.55	5.15	1.5%	125	0.55	4.15	3.3%
Idson Farm	266	4.03	7.63	2.9%	350	2.59	6.19	1.8%	125	1.01	4.61	3.7%
Upper Cock Farm	266	2.62	6.22	2.3%	350	1.54	5.14	1.5%	125	0.52	4.12	3.3%
Lower Cock Farm	266	2.42	6.02	2.3%	350	1.47	5.07	1.4%	125	0.48	4.08	3.3%
Woolstone Farm	266	3.05	6.65	2.5%	350	1.75	5.35	1.5%	125	0.80	4.40	3.5%

Receptor	99.9%-ile 15-minute Mean				99.73%-ile of 1-hour Mean				99.18%-ile of 24-hour Mean			
	AQO	PC	PEC	%PEC of AQO	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Chalcott Farm	266	3.83	7.43	2.8%	350	2.22	5.82	1.7%	125	0.97	4.57	3.7%
Whitewick Farm	266	3.27	6.87	2.6%	350	2.04	5.64	1.6%	125	0.73	4.33	3.5%
Stolford Farm	266	3.00	6.60	2.5%	350	1.80	5.40	1.5%	125	0.63	4.23	3.4%
Browns Cottage	266	3.84	7.44	2.8%	350	2.41	6.01	1.7%	125	1.02	4.62	3.7%
Little Dowdens Far	266	3.75	7.35	2.8%	350	2.51	6.11	1.7%	125	0.81	4.41	3.5%
Cole Pool	266	3.21	6.81	2.6%	350	2.06	5.66	1.6%	125	1.10	4.70	3.8%
Stogursey	266	2.55	6.15	2.3%	350	1.59	5.19	1.5%	125	0.82	4.42	3.5%
Wick House Farm	266	4.86	8.46	3.2%	350	3.20	6.80	1.9%	125	1.32	4.92	3.9%
West End Cottage	266	4.27	7.87	3.0%	350	2.69	6.29	1.8%	125	0.92	4.52	3.6%
Footpath - Benhole Lane (South)	266	10.22	13.82	5.2%	350	7.55	11.15	3.2%	-	-	-	-
Footpath - Benhole Lane (North)	266	22.39	25.99	9.8%	350	17.57	21.17	6.0%	-	-	-	-
Footpath - Coastal	266	32.23	35.83	13.5%	350	27.82	31.42	9.0%	-	-	-	-
Pixies Mound	266	24.60	28.20	10.6%	350	19.75	23.35	6.7%	-	-	-	-

Table 12D.22: H_2CO Concentrations at Human Receptor Locations – Routine Test

Receptor	Annual Mean				1-hour Mean			
	EAL	PC	PEC	%PEC of EAL	EAL	PC	PEC	%PEC of EAL
Trighern Farm	5	0.00	0.00	0.0%	100	0.21	0.21	0.2%
Zipe Farm	5	0.00	0.00	0.0%	100	0.15	0.15	0.4%
Wick Farm	5	0.00	0.00	0.0%	100	0.16	0.16	0.4%
Doggetts	5	0.00	0.00	0.0%	100	0.51	0.51	0.6%
Knighton Farm	5	0.00	0.00	0.0%	100	0.26	0.26	0.2%
Shurton village	5	0.00	0.00	0.0%	100	0.29	0.29	0.3%
Bullen Farm	5	0.00	0.00	0.0%	100	0.28	0.28	0.2%
Point south of Knighton	5	0.00	0.00	0.0%	100	0.21	0.21	0.2%
Burton village	5	0.00	0.00	0.0%	100	0.21	0.21	0.2%
Warren's Farm	5	0.00	0.00	0.0%	100	0.23	0.23	0.2%
Newnham Bridge	5	0.00	0.00	0.0%	100	0.32	0.32	0.4%
Wick village	5	0.00	0.00	0.0%	100	0.17	0.17	0.3%
Gunter's Grove	5	0.00	0.00	0.0%	100	0.25	0.25	0.3%
Point west of Wick	5	0.00	0.00	0.0%	100	0.23	0.23	0.3%
Caravan Park	5	0.00	0.00	0.0%	100	0.14	0.14	0.2%
Wick Park Cottage	5	0.00	0.00	0.0%	100	0.11	0.11	0.2%
Farringdon Hill Farm	5	0.00	0.00	0.0%	100	0.20	0.20	0.2%
Kennels S Farringdon	5	0.00	0.00	0.0%	100	0.19	0.19	0.2%
Idson Farm	5	0.00	0.00	0.0%	100	0.13	0.13	0.3%
Upper Cock Farm	5	0.00	0.00	0.0%	100	0.06	0.06	0.2%
Lower Cock Farm	5	0.00	0.00	0.0%	100	0.06	0.06	0.2%
Woolstone Farm	5	0.00	0.00	0.0%	100	0.16	0.16	0.1%
Chalcott Farm	5	0.00	0.00	0.0%	100	0.16	0.16	0.1%
Whitewick Farm	5	0.00	0.00	0.0%	100	0.12	0.12	0.2%
Stolford Farm	5	0.00	0.00	0.0%	100	0.14	0.14	0.2%
Browns Cottage	5	0.00	0.00	0.0%	100	0.18	0.18	0.1%
Little Dowdens Far	5	0.00	0.00	0.0%	100	0.13	0.13	0.3%
Cole Pool	5	0.00	0.00	0.0%	100	0.18	0.18	0.2%
Stogursey	5	0.00	0.00	0.0%	100	0.23	0.23	0.2%
Wick House Farm	5	0.00	0.00	0.0%	100	0.16	0.16	0.3%
West End Cottage	5	0.00	0.00	0.0%	100	0.14	0.14	0.3%
Footpath - Benhole Lane (South)	-	-	-	-	100	0.42	0.42	0.4%
Footpath - Benhole Lane (North)	-	-	-	-	100	0.64	0.64	0.6%
Footpath - Coastal	-	-	-	-	100	0.74	0.74	0.7%
Pixies Mound	-	-	-	-	100	0.58	0.58	0.6%

Table 12D.23: NH_3 Concentrations at Human Receptor Locations – Routine Test

Receptor	Annual Mean				1-hour Mean			
	EAL	PC	PEC	%PEC of EAL	EAL	PC	PEC	%PEC of EAL
Trighern Farm	180	0.05	1.15	0.6%	2500	73	75	3.0%
Zipe Farm	180	0.03	1.13	0.6%	2500	73	75	3.0%
Wick Farm	180	0.03	1.13	0.6%	2500	87	89	3.6%
Doggetts	180	0.03	1.13	0.6%	2500	168	170	6.8%
Knighton Farm	180	0.03	1.13	0.6%	2500	124	126	5.0%
Shurton village	180	0.02	1.12	0.6%	2500	122	124	5.0%
Bullen Farm	180	0.02	1.12	0.6%	2500	142	144	5.8%
Point south of Knighton	180	0.02	1.12	0.6%	2500	108	110	4.4%
Burton village	180	0.02	1.12	0.6%	2500	96	98	3.9%
Warren’s Farm	180	0.01	1.11	0.6%	2500	144	146	5.9%
Newnham Bridge	180	0.01	1.11	0.6%	2500	113	115	4.6%
Wick village	180	0.03	1.13	0.6%	2500	83	86	3.4%
Gunter’s Grove	180	0.02	1.12	0.6%	2500	83	86	3.4%
Point west of Wick	180	0.03	1.13	0.6%	2500	103	105	4.2%
Caravan Park	180	0.02	1.12	0.6%	2500	59	61	2.4%
Wick Park Cottage	180	0.01	1.11	0.6%	2500	63	66	2.6%
Farringdon Hill Farm	180	0.01	1.11	0.6%	2500	58	60	2.4%
Kennels S Farringdon	180	0.01	1.11	0.6%	2500	60	62	2.5%
Idson Farm	180	0.03	1.13	0.6%	2500	73	75	3.0%
Upper Cock Farm	180	0.01	1.11	0.6%	2500	48	50	2.0%
Lower Cock Farm	180	0.01	1.11	0.6%	2500	42	45	1.8%
Woolstone Farm	180	0.03	1.13	0.6%	2500	59	61	2.4%
Chalcott Farm	180	0.03	1.13	0.6%	2500	60	62	2.5%
Whitewick Farm	180	0.03	1.13	0.6%	2500	51	53	2.1%
Stolford Farm	180	0.03	1.13	0.6%	2500	81	83	3.3%
Browns Cottage	180	0.04	1.14	0.6%	2500	60	63	2.5%
Little Dowdens Far	180	0.04	1.14	0.6%	2500	73	76	3.0%
Cole Pool	180	0.01	1.11	0.6%	2500	85	87	3.5%
Stogursey	180	0.01	1.11	0.6%	2500	79	81	3.2%
Wick House Farm	180	0.03	1.13	0.6%	2500	83	85	3.4%
West End Cottage	180	0.04	1.14	0.6%	2500	68	71	2.8%
Footpath - Benhole Lane (South)	-	-	-	-	2500	168	170	6.8%
Footpath - Benhole Lane (North)	-	-	-	-	2500	355	357	14.3%
Footpath - Coastal	-	-	-	-	2500	499	501	20.0%
Pixies Mound	-	-	-	-	2500	294	296	11.9%

Table 12D.24: NO_x Concentrations at Ecological Receptor Locations – Commissioning

Receptor	Annual Mean				24-hour Mean			
	AQS	PC	PEC	%PEC of AQS	EAL	PC	PEC	%PEC of EAL
Bridgwater Bay SSSI / Severn Estuary SPA/SAC/Ramsar	30	7.30	18.80	62.7%	75	189	212	282.7%
Bridgwater Bay NNR	30	6.58	18.08	60.3%	75	167	190	253.3%
Hinkley CWS	30	16.57	28.07	93.6%	75	251	274	365.3%

Table 12D.25: SO_2 Concentrations at Ecological Receptor Locations – Commissioning

Receptor	Annual Mean			
	AQS	PC	PEC	%PEC of AQS
Bridgwater Bay SSSI / Severn Estuary SPA/SAC/Ramsar	20	0.70	2.50	12.5%
Bridgwater Bay NNR	20	0.51	2.31	11.6%
Hinkley CWS	20	1.71	3.51	17.6%

Table 12D.26: NO_x Concentrations at Ecological Receptor Locations – Routine Test

Receptor	Annual Mean				24-hour Mean			
	AQS	PC	PEC	%PEC of AQS	EAL	PC	PEC	%PEC of EAL
Bridgwater Bay SSSI / Severn Estuary SPA/SAC/Ramsar	30	1.79	13.29	44.3%	75	189	212	282.7%
Bridgwater Bay NNR	30	1.61	13.11	43.7%	75	167	190	253.3%
Hinkley CWS	30	4.06	15.56	51.9%	75	251	274	365.3%

Table 12D.27: SO_2 Concentrations at Ecological Receptor Locations – Routine Test

Receptor	Annual Mean			
	AQS	PC	PEC	%PEC of AQS
Bridgwater Bay SSSI / Severn Estuary SPA/SAC/Ramsar	20	0.17	1.97	9.9%
Bridgwater Bay NNR	20	0.12	1.92	9.6%
Hinkley CWS	20	0.42	2.22	11.1%

Table 12D.28: NH_3 Concentrations at Ecological Receptor Locations – Routine Test

Receptor	Annual Mean			
	EAL	PC	PEC	%PEC of EAL
Bridgwater Bay SSSI / Severn Estuary SPA/SAC/Ramsar	3	0.73	1.83	61.0%
Bridgwater Bay NNR	3	0.58	1.68	56.0%
0-Hinkley CWS	3	0.55	1.65	55.0%

Table 12D.29: Deposition Rates at Ecological Receptor Locations – Commissioning and Routine Test

Receptor	Commissioning Nitrogen Deposition (kg N ha^{-1} y^{-1})	Test Nitrogen Deposition (kg N ha^{-1} y^{-1})	Commissioning Acid Deposition (keq ha^{-1} y^{-1})	Test Acid Deposition (keq ha^{-1} y^{-1})
Bridgwater Bay SSSI / Severn Estuary SPA/SAC/Ramsar	1.05	3.99	0.16	0.30
Bridgwater Bay NNR	0.80	3.27	0.14	0.24
Hinkley CWS	2.13	3.14	0.36	0.29

APPENDIX 12E INPUT PARAMETERS AND RESULTS OF ADMS ROADS ASSESSMENTS OF VEHICULAR EMISSIONS

Table 12E 1: Traffic input data for ADMS Roads 2009 'model verification/baseline' scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10678	57	8
AA	12033	51	8
AB	10396	50	8
Abq	10396	19	8
AD	10323	50	8
Adq	10323	6	8
Adqq	10323	11	8
AE	15891	41	8
Aeq	15891	10	8
B	19360	54	20
Bq	19360	27	20
D	22956	42	8
Dq	22956	34	8
Dqq	22956	31	8
E	13159	42	8
Eq	13159	14	8
Eqq	13159	42	8
F	16818	37	8
Fq	16818	13	8
Fqq	16818	10	8
Ga	21970	63	26
Gaq	21970	35	26
Gb(E)	11027	64	10
Gb(W)	10944	62	10
Gc	21970	63	20
I1	24728	44	8
I1q	24728	10	8
I2	21644	43	8
I3	21089	44	8
I4	21217	47	8
I4q	21217	27	8
J	20240	29	15
Jq	20240	5	15
Jqq	20240	11	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	15338	45	8
K1q	15338	37	8
K2	14028	46	8
K2q	14028	26	8
K2qq	14028	48	8
K3	15442	45	8
K3q	15442	14	8
K4	17198	36	8
K4q	17198	23	8
K4qq	17198	10	8
K5	20410	44	18
K5q	20410	6	18
K5qq	20410	14	18
L	14061	65	8
Lq	14061	26	8
Lqq	14061	47	8
M	16536	60	8
M5Na	25407	114	12
M5Nb	25407	114	12
M5Sa	25468	114	12
M5Sb	25468	114	12
N1a	12931	60	8
N1b	12931	60	8
N1q	12931	53	8
N2	12829	50	8
N3	17129	39	8
N3q	17129	11	8
O1	22609	26	14
O1q	22609	5	14
O2	18820	43	14
O2q	18820	8	14
S	12959	56	8
SA	3252	34	8
SB	2719	33	8
Sc	3917	39	8
Scq	3917	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	2957	21	8
SE	4767	15	8
Seq	4767	16	8
SF	17521	40	8
SFq	17521	3	8
SFqq	17521	19	8
SG	8944	47	8
SGq	8944	39	8
SGqq	8944	8	8
SH	13756	28	8
SHq	13756	10	8
SI	9372	50	8
Siq	9372	3	8
SJ	6142	39	8
SK	5266	35	8
SKq	5266	6	8
SL	6838	40	8
SM	5001	39	8
SN	11550	28	8
SNq	11550	10	8
SO	13741	24	8
SP	13700	45	8
SQ	9646	44	8
Sqs	12959	27	8
SR	6993	47	8
SS	15955	59	8
SSq	15955	29	8
ST1	18510	46	21
ST1q	18510	27	21
ST1qq	18510	40	21
ST2	4104	76	8
ST3	4774	91	8
ST3q	4774	37	8
ST4	4776	74	8
ST4q	4776	29	8
ST5	5065	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1518	48	8
T1q	1518	48	8
T2	4612	40	8
T2q	4612	13	8
V1	8154	94	8
v2	7754	82	8
v2q	7754	31	8
v3	3904	73	8
v3q	3904	13	8
V4	4091	71	8
Y	11601	44	8
Yq	11601	26	8
Yqq	11601	16	8
ZE	7031	44	8
Zeq	7031	11	8
Zeqq	7031	5	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 2: Traffic input data for ADMS Roads 2013 ‘without development’ model scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10806	57	8
AA	12302	51	8
AB	10636	50	8
Abq	10636	24	8
AD	10436	50	8
Adq	10436	8	8
Adqq	10436	11	8
AE	16285	41	8
Aeq	16285	13	8
B	19951	54	20
Bq	19951	29	20
D	24194	42	8
Dq	24194	34	8
Dqq	24194	31	8
E	14299	42	8
Eq	14299	13	8
Eqq	14299	42	8
F	18017	37	8
Fq	18017	14	8
Fqq	18017	13	8
Ga	22555	63	26
Gaq	22555	29	26
Gb(E)	11441	64	10
Gb(W)	11114	62	10
Gc	22555	63	20
I1	25593	44	8
I1q	25593	8	8
I2	22482	43	8
I3	21709	44	8
I4	21945	47	8
I4q	21945	32	8
J	21539	29	15
Jq	21539	5	15
Jqq	21539	11	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	15559	45	8
K1q	15559	37	8
K2	14201	46	8
K2q	14201	27	8
K2qq	14201	47	8
K3	15778	45	8
K3q	15778	14	8
K4	17653	36	8
K4q	17653	21	8
K4qq	17653	13	8
K5	21246	44	18
K5q	21246	8	18
K5qq	21246	13	18
L	14994	65	8
Lq	14994	24	8
Lqq	14994	14	8
M	16764	60	8
M5Na	26099	114	12
M5Nb	26099	114	12
M5Sa	26151	114	12
M5Sb	26151	114	12
N1a	13428	60	8
N1b	13428	60	8
N1q	13428	10	8
N2	13221	50	8
N3	18846	39	8
N3q	18846	10	8
O1	23490	26	14
O1q	23490	5	14
O2	19876	43	14
O2q	19876	10	14
S	13150	56	8
SA	3397	34	8
SB	2872	33	8
Sc	4050	39	8
Scq	4050	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	3081	21	8
SE	4866	15	8
Seq	4866	16	8
SF	17718	40	8
SFq	17718	3	8
SFqq	17718	16	8
SG	9034	47	8
SGq	9034	35	8
SGqq	9034	11	8
SH	14029	28	8
SHq	14029	10	8
SI	9499	50	8
Siq	9499	5	8
SJ	6198	39	8
SK	5510	35	8
SKq	5510	6	8
SL	7017	40	8
SM	5006	39	8
SN	11937	28	8
SNq	11937	10	8
SO	13629	24	8
SP	13757	45	8
SQ	9538	44	8
Sqs	13150	29	8
SR	6841	47	8
SS	16272	59	8
SSq	16272	34	8
ST1	19089	46	21
ST1q	19089	21	21
ST1qq	19089	39	21
ST2	4254	76	8
ST3	4964	91	8
ST3q	4964	40	8
ST4	4846	74	8
ST4q	4846	27	8
ST5	5223	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1546	48	8
T1q	1546	48	8
T2	4658	40	8
T2q	4658	11	8
V1	8338	94	8
v2	8051	82	8
v2q	8051	31	8
v3	4115	73	8
v3q	4115	14	8
V4	4236	71	8
Y	11788	44	8
Yq	11788	27	8
Yqq	11788	18	8
ZE	7265	44	8
Zeq	7265	14	8
Zeqq	7265	6	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 3: Traffic input data for ADMS Roads 2013 'with development' model scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10804	57	8
AA	13129	51	8
AB	11323	50	8
Abq	11323	27	8
AD	10699	50	8
Adq	10699	8	8
Adqq	10699	10	8
AE	17044	41	8
Aeq	17044	13	8
B	21002	54	20
Bq	21002	29	20
D	24946	42	8
Dq	24946	34	8
Dqq	24946	29	8
E	14807	42	8
Eq	14807	13	8
Eqq	14807	43	8
F	18032	37	8
Fq	18032	14	8
Fqq	18032	14	8
Ga	23404	63	26
Gaq	23404	31	26
Gb(E)	11795	64	10
Gb(W)	11608	62	10
Gc	23404	63	20
I1	26994	44	8
I1q	26994	8	8
I2	23676	43	8
I3	22796	44	8
I4	23160	47	8
I4q	23160	32	8
J	21932	29	15
Jq	21932	5	15
Jqq	21932	11	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	16644	45	8
K1q	16644	37	8
K2	15314	46	8
K2q	15314	26	8
K2qq	15314	47	8
K3	16843	45	8
K3q	16843	14	8
K4	18639	36	8
K4q	18639	21	8
K4qq	18639	13	8
K5	22128	44	18
K5q	22128	8	18
K5qq	22128	13	18
L	15306	65	8
Lq	15306	24	8
Lqq	15306	14	8
M	16737	60	8
M5Na	26652	114	12
M5Nb	26652	114	12
M5Sa	26687	114	12
M5Sb	26687	114	12
N1a	13693	60	8
N1b	13693	60	8
N1q	13693	10	8
N2	13455	50	8
N3	18771	39	8
N3q	18771	11	8
O1	24000	26	14
O1q	24000	5	14
O2	20278	43	14
O2q	20278	10	14
S	15238	56	8
SA	3366	34	8
SB	2895	33	8
Sc	4199	39	8
Scq	4199	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	3072	21	8
SE	4992	15	8
Seq	4992	16	8
SF	17893	40	8
SFq	17893	3	8
SFqq	17893	18	8
SG	9092	47	8
SGq	9092	35	8
SGqq	9092	11	8
SH	14154	28	8
SHq	14154	10	8
SI	9467	50	8
Siq	9467	5	8
SJ	6168	39	8
SK	5535	35	8
SKq	5535	6	8
SL	6702	40	8
SM	4876	39	8
SN	12076	28	8
SNq	12076	10	8
SO	13813	24	8
SP	14063	45	8
SQ	9668	44	8
Sqs	15238	29	8
SR	6989	47	8
SS	16518	59	8
SSq	16518	34	8
ST1	21335	46	21
ST1q	21335	18	21
ST1qq	21335	39	21
ST2	4732	76	8
ST3	5506	91	8
ST3q	5506	37	8
ST4	5442	74	8
ST4q	5442	23	8
ST5	5844	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1400	48	8
T1q	1400	48	8
T2	4812	40	8
T2q	4812	11	8
V1	8683	94	8
v2	8185	82	8
v2q	8185	29	8
v3	4321	73	8
v3q	4321	13	8
V4	4269	71	8
Y	12605	44	8
Yq	12605	26	8
Yqq	12605	19	8
ZE	7769	44	8
Zeq	7769	14	8
Zeqq	7769	6	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 4: Traffic input data for ADMS Roads 2016 ‘without development’ model scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10772	57	8
AA	12649	51	8
AB	10853	50	8
Abq	10853	24	8
AD	11145	50	8
Adq	11145	6	8
Adqq	11145	10	8
AE	16796	41	8
Aeq	16796	13	8
B	21422	54	20
Bq	21422	29	20
D	26716	42	8
Dq	26716	32	8
Dqq	26716	29	8
E	15904	42	8
Eq	15904	13	8
Eqq	15904	43	8
F	18764	37	8
Fq	18764	14	8
Fqq	18764	13	8
Ga	24935	63	26
Gaq	24935	27	26
Gb(E)	12365	64	10
Gb(W)	12570	62	10
Gc	24935	63	20
I1	26962	44	8
I1q	26962	8	8
I2	23738	43	8
I3	23318	44	8
I4	22824	47	8
I4q	22824	34	8
J	22485	29	15
Jq	22485	5	15
Jqq	22485	13	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	16172	45	8
K1q	16172	37	8
K2	14297	46	8
K2q	14297	27	8
K2qq	14297	47	8
K3	16329	45	8
K3q	16329	14	8
K4	18156	36	8
K4q	18156	21	8
K4qq	18156	13	8
K5	22114	44	18
K5q	22114	8	18
K5qq	22114	13	18
L	14427	65	8
Lq	14427	24	8
Lqq	14427	16	8
M	16818	60	8
M5Na	27459	114	12
M5Nb	27459	114	12
M5Sa	27203	114	12
M5Sb	27203	114	12
N1a	11881	60	8
N1b	11881	60	8
N1q	11881	11	8
N2	11206	50	8
N3	15740	39	8
N3q	15740	10	8
O1	24650	26	14
O1q	24650	5	14
O2	20802	43	14
O2q	20802	10	14
S	13293	56	8
SA	3550	34	8
SB	3086	33	8
Sc	4286	39	8
Scq	4286	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	3149	21	8
SE	4900	15	8
Seq	4900	16	8
SF	16541	40	8
SFq	16541	3	8
SFqq	16541	14	8
SG	9129	47	8
SGq	9129	32	8
SGqq	9129	10	8
SH	14181	28	8
SHq	14181	10	8
SI	9700	50	8
Siq	9700	5	8
SJ	7025	39	8
SK	5614	35	8
SKq	5614	6	8
SL	7160	40	8
SM	4983	39	8
SN	12638	28	8
SNq	12638	10	8
SO	14196	24	8
SP	14461	45	8
SQ	10549	44	8
Sqs	13293	29	8
SR	7277	47	8
SS	17566	59	8
SSq	17566	32	8
ST1	20018	46	21
ST1q	20018	19	21
ST1qq	20018	39	21
ST2	4600	76	8
ST3	5202	91	8
ST3q	5202	39	8
ST4	5034	74	8
ST4q	5034	26	8
ST5	5364	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1523	48	8
T1q	1523	48	8
T2	4644	40	8
T2q	4644	11	8
V1	8256	94	8
v2	8057	82	8
v2q	8057	29	8
v3	4815	73	8
v3q	4815	14	8
V4	4701	71	8
Y	11988	44	8
Yq	11988	27	8
Yqq	11988	18	8
ZE	7666	44	8
Zeq	7666	13	8
Zeqq	7666	6	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 5: Traffic input data for ADMS Roads 2016 'with development' model scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10767	57	8
AA	14494	51	8
AB	12543	50	8
Abq	12543	24	8
AD	13016	50	8
Adq	13016	8	8
Adqq	13016	11	8
AE	18534	41	8
Aeq	18534	13	8
B	24134	54	20
Bq	24134	29	20
D	27145	42	8
Dq	27145	34	8
Dqq	27145	29	8
E	14807	42	8
Eq	14807	13	8
Eqq	14807	42	8
F	18361	37	8
Fq	18361	14	8
Fqq	18361	13	8
Ga	26177	63	26
Gaq	26177	29	26
Gb(E)	12806	64	10
Gb(W)	13372	62	10
Gc	26177	63	20
I1	28005	44	8
I1q	28005	8	8
I2	24539	43	8
I3	23531	44	8
I4	23956	47	8
I4q	23956	32	8
J	24208	29	15
Jq	24208	5	15
Jqq	24208	11	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	17547	45	8
K1q	17547	37	8
K2	15733	46	8
K2q	15733	27	8
K2qq	15733	47	8
K3	17618	45	8
K3q	17618	14	8
K4	19312	36	8
K4q	19312	21	8
K4qq	19312	13	8
K5	22956	44	18
K5q	22956	8	18
K5qq	22956	13	18
L	13165	65	8
Lq	13165	24	8
Lqq	13165	14	8
M	16804	60	8
M5Na	27248	114	12
M5Nb	27248	114	12
M5Sa	26788	114	12
M5Sb	26788	114	12
N1a	11908	60	8
N1b	11908	60	8
N1q	11908	10	8
N2	12314	50	8
N3	17788	39	8
N3q	17788	10	8
O1	25973	26	14
O1q	25973	5	14
O2	22124	43	14
O2q	22124	10	14
S	16875	56	8
SA	3390	34	8
SB	2977	33	8
Sc	4336	39	8
Scq	4336	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	3134	21	8
SE	4973	15	8
Seq	4973	16	8
SF	16704	40	8
SFq	16704	3	8
SFqq	16704	16	8
SG	9447	47	8
SGq	9447	35	8
SGqq	9447	11	8
SH	14221	28	8
SHq	14221	10	8
SI	9644	50	8
Siq	9644	5	8
SJ	6982	39	8
SK	5544	35	8
SKq	5544	6	8
SL	6081	40	8
SM	4504	39	8
SN	11815	28	8
SNq	11815	10	8
SO	14272	24	8
SP	14107	45	8
SQ	10077	44	8
Sqs	16875	29	8
SR	7398	47	8
SS	17734	59	8
SSq	17734	34	8
ST1	21399	46	21
ST1q	21399	21	21
ST1qq	21399	39	21
ST2	4514	76	8
ST3	4980	91	8
ST3q	4980	39	8
ST4	5850	74	8
ST4q	5850	27	8
ST5	6281	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1271	48	8
T1q	1271	48	8
T2	4914	40	8
T2q	4914	11	8
V1	9794	94	8
v2	9487	82	8
v2q	9487	31	8
v3	4650	73	8
v3q	4650	14	8
V4	4459	71	8
Y	13931	44	8
Yq	13931	27	8
Yqq	13931	18	8
ZE	7664	44	8
Zeq	7664	14	8
Zeqq	7664	6	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 6: Traffic input data for ADMS Roads 2021 'without development' model scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10765	57	8
AA	12776	51	8
AB	11045	50	8
Abq	11045	26	8
AD	11533	50	8
Adq	11533	8	8
Adqq	11533	11	8
AE	17008	41	8
Aeq	17008	13	8
B	21993	54	20
Bq	21993	29	20
D	27150	42	8
Dq	27150	34	8
Dqq	27150	31	8
E	16008	42	8
Eq	16008	13	8
Eqq	16008	45	8
F	18783	37	8
Fq	18783	13	8
Fqq	18783	14	8
Ga	24864	63	26
Gaq	24864	27	26
Gb(E)	12659	64	10
Gb(W)	12205	62	10
Gc	24864	63	20
I1	27338	44	8
I1q	27338	8	8
I2	24123	43	8
I3	23424	44	8
I4	23300	47	8
I4q	23300	32	8
J	23146	29	15
Jq	23146	5	15
Jqq	23146	11	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	16352	45	8
K1q	16352	39	8
K2	14560	46	8
K2q	14560	27	8
K2qq	14560	47	8
K3	16326	45	8
K3q	16326	14	8
K4	18481	36	8
K4q	18481	23	8
K4qq	18481	13	8
K5	22805	44	18
K5q	22805	8	18
K5qq	22805	13	18
L	16061	65	8
Lq	16061	24	8
Lqq	16061	16	8
M	17145	60	8
M5Na	29777	114	12
M5Nb	29777	114	12
M5Sa	29819	114	12
M5Sb	29819	114	12
N1a	12971	60	8
N1b	12971	60	8
N1q	12971	10	8
N2	12468	50	8
N3	18265	39	8
N3q	18265	11	8
O1	25320	26	14
O1q	25320	5	14
O2	21226	43	14
O2q	21226	10	14
S	13414	56	8
SA	3751	34	8
SB	3359	33	8
Sc	4497	39	8
Scq	4497	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	3098	21	8
SE	5028	15	8
Seq	5028	16	8
SF	17222	40	8
SFq	17222	3	8
SFqq	17222	16	8
SG	9371	47	8
SGq	9371	32	8
SGqq	9371	11	8
SH	14285	28	8
SHq	14285	10	8
SI	9766	50	8
Siq	9766	5	8
SJ	6923	39	8
SK	5697	35	8
SKq	5697	6	8
SL	6833	40	8
SM	5053	39	8
SN	12439	28	8
SNq	12439	10	8
SO	13754	24	8
SP	14104	45	8
SQ	9972	44	8
Sqs	13414	29	8
SR	7405	47	8
SS	18755	59	8
SSq	18755	31	8
ST1	21045	46	21
ST1q	21045	19	21
ST1qq	21045	39	21
ST2	4899	76	8
ST3	5877	91	8
ST3q	5877	37	8
ST4	5026	74	8
ST4q	5026	24	8
ST5	5453	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1518	48	8
T1q	1518	48	8
T2	4610	40	8
T2q	4610	11	8
V1	8483	94	8
v2	8118	82	8
v2q	8118	29	8
v3	5250	73	8
v3q	5250	14	8
V4	5362	71	8
Y	12120	44	8
Yq	12120	27	8
Yqq	12120	19	8
ZE	7889	44	8
Zeq	7889	13	8
Zeqq	7889	6	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 7: Traffic input data for ADMS Roads 2021 'with development' model scenario for the Bridgwater Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A	10782	57	8
AA	13494	51	8
AB	11583	50	8
Abq	11583	26	8
AD	12485	50	8
Adq	12485	8	8
Adqq	12485	11	8
AE	17748	41	8
Aeq	17748	13	8
B	21878	54	20
Bq	21878	29	20
D	27551	42	8
Dq	27551	34	8
Dqq	27551	31	8
E	15494	42	8
Eq	15494	13	8
Eqq	15494	45	8
F	18636	37	8
Fq	18636	13	8
Fqq	18636	14	8
Ga	25309	63	26
Gaq	25309	27	26
Gb(E)	12177	64	10
Gb(W)	13132	62	10
Gc	25309	63	20
I1	28598	44	8
I1q	28598	8	8
I2	25028	43	8
I3	23932	44	8
I4	24377	47	8
I4q	24377	32	8
J	25263	29	15
Jq	25263	5	15
Jqq	25263	11	15

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
K1	16933	45	8
K1q	16933	39	8
K2	15149	46	8
K2q	15149	27	8
K2qq	15149	47	8
K3	16914	45	8
K3q	16914	14	8
K4	18769	36	8
K4q	18769	23	8
K4qq	18769	13	8
K5	22767	44	18
K5q	22767	10	18
K5qq	22767	13	18
L	14224	65	8
Lq	14224	24	8
Lqq	14224	16	8
M	17157	60	8
M5Na	29310	114	12
M5Nb	29310	114	12
M5Sa	29229	114	12
M5Sb	29229	114	12
N1a	12216	60	8
N1b	12216	60	8
N1q	12216	10	8
N2	12499	50	8
N3	19967	39	8
N3q	19967	11	8
O1	27217	26	14
O1q	27217	5	14
O2	23036	43	14
O2q	23036	10	14
S	15021	56	8
SA	3466	34	8
SB	3099	33	8
Sc	4341	39	8
Scq	4341	31	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
SD	3097	21	8
SE	4948	15	8
Seq	4948	16	8
SF	16921	40	8
SFq	16921	3	8
SFqq	16921	16	8
SG	9417	47	8
SGq	9417	32	8
SGqq	9417	11	8
SH	14227	28	8
SHq	14227	10	8
SI	9641	50	8
Siq	9641	5	8
SJ	6921	39	8
SK	5513	35	8
SKq	5513	6	8
SL	6128	40	8
SM	4569	39	8
SN	12055	28	8
SNq	12055	10	8
SO	14413	24	8
SP	14366	45	8
SQ	10206	44	8
Sqs	15021	29	8
SR	7460	47	8
SS	18851	59	8
SSq	18851	31	8
ST1	21498	46	21
ST1q	21498	19	21
ST1qq	21498	39	21
ST2	4673	76	8
ST3	5550	91	8
ST3q	5550	37	8
ST4	5512	74	8
ST4q	5512	24	8
ST5	5981	73	8

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
T1	1362	48	8
T1q	1362	48	8
T2	4784	40	8
T2q	4784	11	8
V1	8874	94	8
v2	8481	82	8
v2q	8481	29	8
v3	4729	73	8
v3q	4729	14	8
V4	4759	71	8
Y	12792	44	8
Yq	12792	27	8
Yqq	12792	19	8
ZE	7534	44	8
Zeq	7534	13	8
Zeqq	7534	6	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 8: Queuing junction distances applied in Bridgwater ADMS Roads model setup

Source Name	Average Queue Length (m)
Abq	16
Adq	38
Adqq	16
Aeq	41
Bq	21
Dq	14
Dqq	9
Eq	58
Eqq	4
Fq	59
Fqq	46
Gaq	4
I1q	90
I4q	16
Jq	37
Jqq	49
K1q	27
K2q	16
K2qq	4
K3q	15
K4q	13
K4qq	33
K5q	33
K5qq	55
Lq	11
Lqq	50
N1q	21
N3q	32
O1q	49
O2q	34
Sqs	8
Scq	1
Seq	3
SFq	27

Source Name	Average Queue Length (m)
Sfqq	12
SGq	22
SGqq	25
SHq	38
Siq	36
SKq	29
Snq	36
SSq	10
ST1q	7
ST1qq	2
ST3q	10
ST4q	2
T1q	1
T2q	28
V2q	17
V3q	16
Yq	13
Yqq	31
Zeq	26
Zeqq	24

a ‘q’ suffix in source name denotes queuing link.

Table 12E 9: Traffic input data for ADMS Roads 2009 ‘model verification/baseline’ scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	6706	47	8
A2b	6706	47	8
A2c	6706	47	8
A2d	6706	47	8
P	6399	66	8
Pq	6399	23	8
Qg	7703	64	8
Qh	7703	64	8
Qi	7703	64	8
Qip	7703	40	8
R	14468	88	8
Rq	14468	63	8
U	2151	61	8
Uq	2151	55	8
x11	6706	97	8
x12	6706	97	8
x13	0	97	8
ZD	8533	30	8
ZDq	8533	14	8

a ‘q’ suffix in source name denotes queuing link.

Table 12E 10: Traffic input data for ADMS Roads 2013 'without development' model scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	6801	47	8
A2b	6801	47	8
A2c	6801	47	8
A2d	6801	47	8
P	6505	66	8
Pq	6505	26	8
Qg	7845	64	8
Qh	7845	64	8
Qi	7845	64	8
Qip	7845	39	8
R	14690	88	8
Rq	14690	63	8
U	2186	61	8
Uq	2186	56	8
x11	6801	97	8
x12	6801	97	8
x13	0	97	8
ZD	8619	30	8
ZDq	8619	14	8

a 'q' suffix in source name denotes queuing link.

Table 12E 11: Traffic input data for ADMS Roads 2013 'with development' model scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	8568	47	8
A2b	8568	47	8
A2c	8568	47	8
A2d	8568	47	8
P	7990	66	8
Pq	7990	24	8
Qg	8225	64	8
Qh	8225	64	8
Qi	8225	64	8
Qip	8225	39	8
R	16602	88	8
Rq	16602	61	8
U	3577	61	8
Uq	3577	58	8
x11	7371	97	8
x12	7371	97	8
x13	270	97	8
ZD	9068	30	8
ZDq	9068	13	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 12: Traffic input data for ADMS Roads 2016 'Without Development' model scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	6779	47	8
A2b	6779	47	8
A2c	6779	47	8
A2d	6779	47	8
P	6638	66	8
Pq	6638	24	8
Qg	7969	64	8
Qh	7969	64	8
Qi	7969	64	8
Qip	7969	40	8
R	14790	88	8
Rq	14790	64	8
U	2175	61	8
Uq	2175	56	8
x11	6779	97	8
x12	6779	97	8
x13	0	97	8
ZD	8558	30	8
ZDq	8558	14	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 13: Traffic input data for ADMS Roads 2016 ‘With Development’ model scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	3446	47	8
A2b	8316	47	8
A2c	8316	47	8
A2d	8316	47	8
P	13338	66	8
Pq	13338	26	8
Qg	8589	64	8
Qh	8589	64	8
Qi	8589	64	8
Qip	8589	39	8
R	18080	88	8
Rq	18080	63	8
U	1879	61	8
Uq	1879	55	8
X	6244	64	8
x11	8316	97	8
x12	8316	97	8
x13	270	97	8
ZD	5567	30	8
ZDq	5567	14	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 14: Traffic input data for ADMS Roads 2021 'without development' model scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	6832	47	8
A2b	6832	47	8
A2c	6832	47	8
A2d	6832	47	8
P	6840	66	8
Pq	6840	24	8
Qg	8140	64	8
Qh	8140	64	8
Qi	8140	64	8
Qip	8140	40	8
R	14928	88	8
Rq	14928	66	8
U	2182	61	8
Uq	2182	55	8
x11	6832	97	8
x12	6832	97	8
x13	0	97	8
ZD	8521	30	8
ZDq	8521	14	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 15: Traffic input data for ADMS Roads 2021 'with development' model scenario for the Cannington Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
A1	2880	47	8
A2b	7422	47	8
A2c	7422	47	8
A2d	7422	47	8
P	11805	66	8
Pq	11805	24	8
Qg	8572	64	8
Qh	8572	64	8
Qi	8572	64	8
Qip	8572	40	8
R	16377	88	8
Rq	16377	66	8
U	1795	61	8
Uq	1795	56	8
X	5765	64	8
x11	7422	97	8
x12	7422	97	8
x13	304	97	8
ZD	5032	30	8
ZDq	5032	14	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 16: Queuing junction distances applied in Cannington ADMS Roads model setup

Source Name	Average Queue Length (m)
Pq	7
Qip	1
Rq	1
Uq	1
ZDq	12

Table 12E 17: Traffic input data for ADMS Roads 2009 ‘model verification/baseline’ scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5139	48	8
x10	1063	80	8
x1q	5139	48	8
x2	5722	48	8
x3	9148	48	8
x4	9300	48	8
x4q	9300	48	8
x5	8303	80	8
x6	9892	80	8
x6q	9892	48	8
x7	10769	80	8
x8	2426	80	8
x9	9611	80	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 18: Traffic input data for ADMS Roads 2013 ‘without development’ model scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5523	48	8
x10	1412	80	8
x1q	5523	48	8
x2	6150	48	8
x3	9831	48	8
x4	9995	48	8
x4q	9995	48	8
x5	8922	80	8
x6	10630	80	8
x6q	10630	48	8
x7	12287	80	8
x8	2956	80	8
x9	11114	80	8

[a] ‘q’ suffix in source name denotes queuing link.

Table 12E 19: Traffic input data for ADMS Roads 2013 'with development' model scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5523	48	8
x10	1619	80	8
x1q	5523	48	8
x2	6977	48	8
x3	10658	48	8
x4	10822	48	8
x4q	10822	48	8
x5	9777	80	8
x6	11458	80	8
x6q	11458	48	8
x7	12747	80	8
x8	2956	80	8
x9	11301	80	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 20: Traffic input data for ADMS Roads 2016 'without development' model scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5523	48	8
x10	1412	80	8
x1q	5523	48	8
x2	6150	48	8
x3	9831	48	8
x4	9995	48	8
x4q	9995	48	8
x5	9777	80	8
x6	10630	80	8
x6q	10630	48	8
x7	12287	80	8
x8	2956	80	8
x9	11114	80	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 21: Traffic input data for ADMS Roads 2016 'with development' model scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5523	48	8
x10	1619	80	8
x1q	5523	48	8
x2	6977	48	8
x3	10658	48	8
x4	10822	48	8
x4q	10822	48	8
x5	9777	80	8
x6	11458	80	8
x6q	11458	48	8
x7	12747	80	8
x8	2956	80	8
x9	11301	80	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 22: Traffic input data for ADMS Roads 2021 'without development' model scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5523	48	8
x10	1412	80	8
x1q	5523	48	8
x2	6150	48	8
x3	9831	48	8
x4	9995	48	8
x4q	9995	48	8
x5	9777	80	8
x6	10630	80	8
x6q	10630	48	8
x7	12287	80	8
x8	2956	80	8
x9	11114	80	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 23: Traffic input data for ADMS Roads 2021 'with development' model scenario for the Williton Model

Source Name [a]	All Vehicles 24-hour AADT	Average Speed (km/hr)	Road Width (m)
x1	5523	48	8
x10	1619	80	8
x1q	5523	48	8
x2	6977	48	8
x3	10658	48	8
x4	10822	48	8
x4q	10822	48	8
x5	9777	80	8
x6	11458	80	8
x6q	11458	48	8
x7	12747	80	8
x8	2956	80	8
x9	11301	80	8

[a] 'q' suffix in source name denotes queuing link.

Table 12E 24: Queuing junction distances applied in Williton ADMS Roads model setup

Source Name	Average Queue Length (m)
x1q	4
x4q	4
x6q	4

Table 12E 25: Background annual mean pollutant concentrations applied to the Bridgwater, Cannington and Williton ADMS Roads model scenarios

Year	NO_x background concentration ($\mu g/m^3$)	NO_2 background concentration ($\mu g/m^3$)	PM_{10} background concentration ($\mu g/m^3$)	$PM_{2.5}$ background concentration ($\mu g/m^3$)
Bridgwater Model [a]				
2009	27.0	18.2	16.7	10.2
2013	23.5	16.2	16.1	9.7
2016	21.8	15.3	15.9	9.5
2020	20.2	14.3	15.7	9.3
Cannington Model [b]				
2009	11.5	6.8	18.2	7.9
2013	9.6	5.7	17.5	7.4
2016	8.5	5.1	17.1	7.2
2020	7.1	4.3	16.8	7.0
Williton Model [b]				
2009	11.5	6.8	18.2	7.9
2013	9.6	5.7	17.5	7.4
2016	8.5	5.1	17.1	7.2
2020	7.1	4.3	16.8	7.0

[a] Bridgwater background pollutant concentrations obtained from Defra UK Air Quality Resource (UK-AIR). Worst-case (i.e. highest) UK-AIR pollutant concentrations taken for the 16 1km x 1km grid squares within the Bridgwater model area.

[b] Cannington and Williton background pollutant concentrations determined from the baseline air quality monitoring campaign conducted at Hinkley Point between February and September 2009. AMEC ‘Final Air Quality Monitoring Report’ (2010).

Table 12E 26: Predicted 2013 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2013 'without development' NO_2 (µg/m^3)	2013 'with development' NO_2 (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	24.96	21.73	22.41	3.13%	-10.22%
10 Bristol Road, Puriton	331025	140917	1.8	29.42	24.53	25.57	4.24%	-13.09%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	22.60	20.07	20.21	0.70%	-10.58%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	27.11	24.35	24.54	0.78%	-9.48%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	32.05	26.17	26.29	0.46%	-17.97%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	22.34	19.77	19.93	0.81%	-10.79%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	31.68	26.58	29.73	11.85%	-6.16%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	26.16	23.44	23.62	0.77%	-9.71%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	25.78	21.82	21.93	0.50%	-14.93%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	22.10	19.63	19.75	0.61%	-10.63%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	22.01	19.55	19.66	0.56%	-10.68%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	21.82	19.37	19.48	0.57%	-10.72%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	23.63	20.35	21.17	4.03%	-10.41%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	28.13	23.70	23.61	-0.38%	-16.07%
28 Limousin Way, North Petherton	330243	135164	1.8	19.53	17.25	17.34	0.52%	-11.21%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	20.75	18.27	18.33	0.33%	-11.66%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	19.67	17.35	17.41	0.35%	-11.49%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	19.30	17.05	17.11	0.35%	-11.35%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2013 'without development' NO_2 (µg/m^3)	2013 'with development' NO_2 (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	19.87	17.54	17.63	0.51%	-11.27%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	19.97	17.59	17.65	0.34%	-11.62%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	26.39	23.57	23.72	0.64%	-10.12%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	19.79	17.47	17.55	0.46%	-11.32%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	27.82	24.95	25.12	0.68%	-9.71%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	32.02	29.05	29.26	0.72%	-8.62%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	22.96	20.42	20.57	0.73%	-10.41%
Bridgwater & Albion Rugby Football	330875	137588	1.8	20.62	18.21	18.31	0.55%	-11.20%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	19.82	17.49	17.56	0.40%	-11.40%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	21.06	18.33	18.39	0.33%	-12.68%
Compass House, Taunton Road (Back)	329911	134026	1.8	20.83	18.15	18.21	0.33%	-12.58%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	23.69	20.23	20.31	0.40%	-14.27%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	24.11	20.52	20.65	0.63%	-14.35%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	21.88	19.06	19.34	1.47%	-11.61%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	21.69	18.97	19.23	1.37%	-11.34%
Moto Hospitality Services, North Petherton	330345	134412	1.8	22.90	19.91	20.32	2.06%	-11.27%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	23.66	20.22	20.32	0.49%	-14.12%
Riverview, Downend Crescent, Puriton	331185	141247	1.8	27.42	23.08	23.97	3.86%	-12.58%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2013 'without development' NO_2 (µg/m^3)	2013 'with development' NO_2 (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Site of future housing development	329569	134364	1.8	18.85	16.72	16.75	0.18%	-11.14%
Somerset Skills & Learning Parkway	331410	137465	1.8	19.61	17.30	17.37	0.40%	-11.42%
The Brainwave Centre	330548	134943	1.8	22.66	19.83	20.23	2.02%	-10.72%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	22.05	19.29	19.60	1.61%	-11.11%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	28.05	23.55	24.20	2.76%	-13.73%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	20.75	18.10	18.21	0.61%	-12.24%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	21.85	18.92	18.95	0.16%	-13.27%
Unique Health and Fitness	330612	134940	1.8	21.21	18.56	18.77	1.13%	-11.50%

Table 12E 27: Worst-case predicted 2013 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2013 'without development' NO_2 (µg/m^3) (worst-case)	2013 'with development' NO_2 (µg/m^3) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	24.96	25.90	26.81	3.51%	7.41%
10 Bristol Road, Puriton	331025	140917	1.8	29.42	29.68	31.03	4.55%	5.47%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	22.60	23.58	23.77	0.81%	5.18%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	27.11	29.34	29.58	0.82%	9.11%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	32.05	31.39	31.56	0.54%	-1.53%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	22.34	23.15	23.37	0.95%	4.61%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	31.68	31.82	35.70	12.19%	12.69%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	26.16	28.13	28.37	0.85%	8.45%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	25.78	25.89	26.04	0.58%	1.01%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	22.10	22.96	23.13	0.74%	4.66%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	22.01	22.86	23.02	0.70%	4.59%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	21.82	22.61	22.76	0.66%	4.31%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	23.63	23.95	25.05	4.59%	6.01%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	28.13	28.58	28.46	-0.42%	1.17%
28 Limousin Way, North Petherton	330243	135164	1.8	19.53	19.64	19.77	0.66%	1.23%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	20.75	21.04	21.12	0.38%	1.78%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	19.67	19.78	19.86	0.40%	0.97%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2013 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2013 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
46 Sandalwood Ride, North Petherton	329947	134609	1.8	19.30	19.37	19.45	0.41%	0.78%
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	19.87	20.05	20.17	0.60%	1.51%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	19.97	20.10	20.18	0.40%	1.05%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	26.39	28.28	28.48	0.71%	7.92%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	19.79	19.94	20.05	0.55%	1.31%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	27.82	30.11	30.32	0.70%	8.99%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	32.02	35.32	35.58	0.74%	11.12%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	22.96	24.11	24.26	0.62%	5.66%
Bridgwater & Albion Rugby Football	330875	137588	1.8	20.62	20.98	21.12	0.67%	2.42%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	19.82	19.97	20.06	0.45%	1.21%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	21.06	21.19	21.26	0.33%	0.95%
Compass House, Taunton Road (Back)	329911	134026	1.8	20.83	20.93	21.02	0.43%	0.91%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	23.69	23.87	23.99	0.50%	1.27%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	24.11	24.27	24.45	0.74%	1.41%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	21.88	22.20	22.60	1.80%	3.29%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	21.69	22.07	22.43	1.63%	3.41%
Moto Hospitality Services, North Petherton	330345	134412	1.8	22.90	23.40	23.95	2.35%	4.59%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2013 'without development' NO_2 (µg/m^3) (worst-case)	2013 'with development' NO_2 (µg/m^3) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	23.66	23.85	23.99	0.59%	1.39%
Riverview, Downend Crescent, Puriton	331185	141247	1.8	27.42	27.72	28.89	4.22%	5.36%
Site of future housing development	329569	134364	1.8	18.85	18.89	18.93	0.21%	0.42%
Somerset Skills & Learning Parkway	331410	137465	1.8	19.61	19.71	19.80	0.46%	0.97%
The Brainwave Centre	330548	134943	1.8	22.66	23.27	23.82	2.36%	5.12%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	22.05	22.51	22.95	1.95%	4.08%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	28.05	28.38	29.23	3.00%	4.21%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	20.75	20.85	21.01	0.77%	1.25%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	21.85	22.01	22.06	0.23%	0.96%
Unique Health and Fitness	330612	134940	1.8	21.21	21.50	21.79	1.35%	2.73%

Table 12E 28: Predicted 2016 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3)	2016 'with development' NO_2 (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	24.96	19.37	19.78	2.12%	-20.75%
10 Bristol Road, Puriton	331025	140917	1.8	29.42	22.19	22.83	2.88%	-22.40%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	22.60	17.74	17.94	1.13%	-20.62%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	27.11	20.41	20.84	2.11%	-23.13%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	32.05	22.69	22.93	1.06%	-28.46%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	22.34	17.58	17.78	1.14%	-20.41%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	31.68	23.22	25.01	7.71%	-21.05%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	26.16	19.84	20.23	1.97%	-22.67%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	25.78	19.49	19.58	0.46%	-24.05%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	22.10	17.45	17.62	0.97%	-20.27%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	22.01	17.39	17.56	0.98%	-20.22%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	21.82	17.28	17.44	0.93%	-20.07%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	23.63	18.35	18.75	2.18%	-20.65%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	28.13	20.70	20.72	0.10%	-26.34%
28 Limousin Way, North Petherton	330243	135164	1.8	19.53	16.01	16.04	0.19%	-17.87%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	20.75	16.72	16.80	0.48%	-19.04%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	19.67	16.07	16.10	0.19%	-18.15%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	19.30	15.86	15.88	0.13%	-17.72%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$)	2016 'with development' NO_2 ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	19.87	16.18	16.23	0.31%	-18.32%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	19.97	16.25	16.29	0.25%	-18.43%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	26.39	19.98	20.34	1.80%	-22.93%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	19.79	16.13	16.18	0.31%	-18.24%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	27.82	20.85	21.29	2.11%	-23.47%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	32.02	23.48	24.14	2.81%	-24.61%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	22.96	17.95	18.17	1.23%	-20.86%
Bridgwater & Albion Rugby Football	330875	137588	1.8	20.62	16.60	16.70	0.60%	-19.01%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	19.82	16.15	16.20	0.31%	-18.26%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	21.06	16.80	16.83	0.18%	-20.09%
Compass House, Taunton Road (Back)	329911	134026	1.8	20.83	16.73	16.75	0.12%	-19.59%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	23.69	18.43	18.46	0.16%	-22.08%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	24.11	18.64	18.68	0.21%	-22.52%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	21.88	17.38	17.49	0.63%	-20.06%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	21.69	17.29	17.40	0.64%	-19.78%
Moto Hospitality Services, North Petherton	330345	134412	1.8	22.90	18.00	18.18	1.00%	-20.61%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	23.66	18.40	18.43	0.16%	-22.10%
Riverview, Downend Crescent, Puriton	331185	141247	1.8	27.42	20.69	21.30	2.95%	-22.32%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3)	2016 'with development' NO_2 (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
Site of future housing development	329569	134364	1.8	18.85	15.62	15.62	0.00%	-17.14%
Somerset Skills & Learning Parkway	331410	137465	1.8	19.61	16.03	16.06	0.19%	-18.10%
The Brainwave Centre	330548	134943	1.8	22.66	17.95	18.15	1.11%	-19.90%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	22.05	17.54	17.68	0.80%	-19.82%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	28.05	21.30	21.81	2.39%	-22.25%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	20.75	16.65	16.71	0.36%	-19.47%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	21.85	17.22	17.25	0.17%	-21.05%
Unique Health and Fitness	330612	134940	1.8	21.21	16.99	17.07	0.47%	-19.52%

Table 12E 29: Worst-case predicted 2016 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2016 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/ baseline' (worst-case)
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	24.96	25.99	26.80	3.12%	7.37%
10 Bristol Road, Puriton	331025	140917	1.8	29.42	31.52	32.72	3.81%	11.22%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	22.60	22.93	23.31	1.66%	3.14%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	27.11	27.76	28.49	2.63%	5.09%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	32.05	31.45	31.97	1.65%	-0.25%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	22.34	22.64	23.00	1.59%	2.95%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	31.68	32.16	35.55	10.54%	12.22%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	26.16	26.75	27.41	2.47%	4.78%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	25.78	25.94	26.13	0.73%	1.36%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	22.10	22.40	22.72	1.43%	2.81%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	22.01	22.30	22.61	1.39%	2.73%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	21.82	22.09	22.38	1.31%	2.57%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	23.63	24.15	25.05	3.73%	6.01%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	28.13	28.61	28.65	0.14%	1.85%
28 Limousin Way, North Petherton	330243	135164	1.8	19.53	19.69	19.77	0.41%	1.23%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	20.75	20.98	21.13	0.71%	1.83%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	19.67	19.79	19.85	0.30%	0.92%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	19.30	19.41	19.45	0.21%	0.78%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3) (worst-case)	2016 'with development' NO_2 (µg/m^3) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/ baseline' (worst-case)
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	19.87	19.99	20.11	0.60%	1.21%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	19.97	20.11	20.19	0.40%	1.10%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	26.39	26.98	27.60	2.30%	4.59%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	19.79	19.90	20.01	0.55%	1.11%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	27.82	28.52	29.24	2.52%	5.10%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	32.02	32.98	33.99	3.06%	6.15%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	22.96	23.33	23.73	1.71%	3.35%
Bridgwater & Albion Rugby Football	330875	137588	1.8	20.62	20.80	20.99	0.91%	1.79%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	19.82	19.94	20.03	0.45%	1.06%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	21.06	21.29	21.36	0.33%	1.42%
Compass House, Taunton Road (Back)	329911	134026	1.8	20.83	21.10	21.14	0.19%	1.49%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	23.69	24.29	24.34	0.21%	2.74%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	24.11	24.69	24.77	0.32%	2.74%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	21.88	22.35	22.59	1.07%	3.24%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	21.69	22.19	22.43	1.08%	3.41%
Moto Hospitality Services, North Petherton	330345	134412	1.8	22.90	23.52	23.91	1.66%	4.41%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	23.66	24.25	24.30	0.21%	2.70%
Riverview, Downend Crescent, Puriton	331185	141247	1.8	27.42	28.84	29.99	3.99%	9.37%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3) (worst-case)	2016 'with development' NO_2 (µg/m^3) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/ baseline' (worst-case)
Site of future housing development	329569	134364	1.8	18.85	18.92	18.93	0.05%	0.42%
Somerset Skills & Learning Parkway	331410	137465	1.8	19.61	19.72	19.79	0.35%	0.92%
The Brainwave Centre	330548	134943	1.8	22.66	23.40	23.81	1.75%	5.08%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	22.05	22.64	22.95	1.37%	4.08%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	28.05	29.92	30.92	3.34%	10.23%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	20.75	21.02	21.14	0.57%	1.88%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	21.85	22.10	22.17	0.32%	1.46%
Unique Health and Fitness	330612	134940	1.8	21.21	21.61	21.79	0.83%	2.73%

Table 12E 30: Predicted 2021 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2021 'without development' NO_2 (µg/m^3)	2021 'with development' NO_2 (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	24.96	16.85	16.98	0.77%	-31.97%
10 Bristol Road, Puriton	331025	140917	1.8	29.42	18.25	18.51	1.42%	-37.08%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	22.60	15.91	16.13	1.38%	-28.63%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	27.11	17.73	18.24	2.88%	-32.72%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	32.05	18.65	18.96	1.66%	-40.84%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	22.34	15.80	15.98	1.14%	-28.47%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	31.68	19.17	19.58	2.14%	-38.19%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	26.16	17.34	17.79	2.60%	-32.00%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	25.78	16.90	17.04	0.83%	-33.90%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	22.10	15.72	15.90	1.15%	-28.05%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	22.01	15.69	15.86	1.08%	-27.94%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	21.82	15.61	15.77	1.02%	-27.73%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	23.63	16.15	16.33	1.11%	-30.89%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	28.13	17.50	17.51	0.06%	-37.75%
28 Limousin Way, North Petherton	330243	135164	1.8	19.53	14.75	14.76	0.07%	-24.42%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	20.75	15.20	15.24	0.26%	-26.55%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	19.67	14.79	14.81	0.14%	-24.71%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	19.30	14.66	14.67	0.07%	-23.99%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2021 'without development' NO_2 (µg/m^3)	2021 'with development' NO_2 (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	19.87	14.86	14.90	0.27%	-25.01%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	19.97	14.90	14.92	0.13%	-25.29%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	26.39	17.41	17.84	2.47%	-32.40%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	19.79	14.83	14.87	0.27%	-24.86%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	27.82	18.01	18.54	2.94%	-33.36%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	32.02	19.82	20.64	4.14%	-35.54%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	22.96	16.06	16.30	1.49%	-29.01%
Bridgwater & Albion Rugby Football	330875	137588	1.8	20.62	15.15	15.22	0.46%	-26.19%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	19.82	14.85	14.88	0.20%	-24.92%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	21.06	15.20	15.21	0.07%	-27.78%
Compass House, Taunton Road (Back)	329911	134026	1.8	20.83	15.23	15.23	0.00%	-26.88%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	23.69	16.35	16.36	0.06%	-30.94%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	24.11	16.47	16.49	0.12%	-31.61%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	21.88	15.61	15.65	0.26%	-28.47%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	21.69	15.53	15.55	0.13%	-28.31%
Moto Hospitality Services, North Petherton	330345	134412	1.8	22.90	15.98	16.04	0.38%	-29.96%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	23.66	16.32	16.33	0.06%	-30.98%
Riverview, Downend Crescent, Puriton	331185	141247	1.8	27.42	17.42	17.57	0.86%	-35.92%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2021 'without development' NO_2 (µg/m^3)	2021 'with development' NO_2 (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
Site of future housing development	329569	134364	1.8	18.85	14.51	14.51	0.00%	-23.02%
Somerset Skills & Learning Parkway	331410	137465	1.8	19.61	14.76	14.78	0.14%	-24.63%
The Brainwave Centre	330548	134943	1.8	22.66	15.93	15.98	0.31%	-29.48%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	22.05	15.68	15.71	0.19%	-28.75%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	28.05	17.77	17.87	0.56%	-36.29%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	20.75	15.11	15.13	0.13%	-27.08%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	21.85	15.44	15.45	0.06%	-29.29%
Unique Health and Fitness	330612	134940	1.8	21.21	15.34	15.36	0.13%	-27.58%

Table 12E 31: Worst-case predicted 2021 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2021 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/ baseline' (worst-case)
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	24.96	26.32	26.80	1.82%	7.37%
10 Bristol Road, Puriton	331025	140917	1.8	29.42	31.87	33.04	3.67%	12.30%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	22.60	23.34	24.23	3.81%	7.21%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	27.11	28.60	30.53	6.75%	12.62%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	32.05	31.66	33.15	4.71%	3.43%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	22.34	23.00	23.78	3.39%	6.45%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	31.68	32.79	34.82	6.19%	9.91%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	26.16	27.50	29.22	6.25%	11.70%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	25.78	26.19	26.68	1.87%	3.49%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	22.10	22.77	23.53	3.34%	6.47%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	22.01	22.67	23.41	3.26%	6.36%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	21.82	22.44	23.12	3.03%	5.96%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	23.63	24.50	25.50	4.08%	7.91%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	28.13	28.86	28.90	0.14%	2.74%
28 Limousin Way, North Petherton	330243	135164	1.8	19.53	19.79	19.84	0.25%	1.59%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	20.75	21.16	21.32	0.76%	2.75%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	19.67	19.90	19.97	0.35%	1.53%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	19.30	19.52	19.55	0.15%	1.30%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2021 'without development' NO_2 (µg/m^3) (worst-case)	2021 'with development' NO_2 (µg/m^3) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/ baseline' (worst-case)
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	19.87	20.13	20.30	0.84%	2.16%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	19.97	20.22	20.31	0.45%	1.70%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	26.39	27.72	29.38	5.99%	11.33%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	19.79	20.03	20.18	0.75%	1.97%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	27.82	29.39	31.35	6.67%	12.69%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	32.02	34.19	36.99	8.19%	15.52%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	22.96	23.78	24.76	4.12%	7.84%
Bridgwater & Albion Rugby Football	330875	137588	1.8	20.62	21.00	21.34	1.62%	3.49%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	19.82	20.07	20.19	0.60%	1.87%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	21.06	21.44	21.50	0.28%	2.09%
Compass House, Taunton Road (Back)	329911	134026	1.8	20.83	21.37	21.40	0.14%	2.74%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	23.69	24.82	24.86	0.16%	4.94%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	24.11	25.25	25.32	0.28%	5.02%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	21.88	22.65	22.84	0.84%	4.39%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	21.69	22.41	22.54	0.58%	3.92%
Moto Hospitality Services, North Petherton	330345	134412	1.8	22.90	23.86	24.13	1.13%	5.37%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	23.66	24.78	24.83	0.20%	4.95%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2021 'without development' NO_2 (µg/m^3) (worst-case)	2021 'with development' NO_2 (µg/m^3) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/ baseline' (worst-case)
Riverview, Downend Crescent, Puriton	331185	141247	1.8	27.42	29.42	30.22	2.72%	10.21%
Site of future housing development	329569	134364	1.8	18.85	18.98	19.00	0.11%	0.80%
Somerset Skills & Learning Parkway	331410	137465	1.8	19.61	19.84	19.92	0.40%	1.58%
The Brainwave Centre	330548	134943	1.8	22.66	23.62	23.82	0.85%	5.12%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	22.05	22.85	23.01	0.70%	4.35%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	28.05	30.33	30.92	1.95%	10.23%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	20.75	21.19	21.30	0.52%	2.65%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	21.85	22.26	22.32	0.27%	2.15%
Unique Health and Fitness	330612	134940	1.8	21.21	21.82	21.92	0.46%	3.35%

Table 12E 32: Predicted 2013 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2013 'without development' PM_{10} ($\mu g/m^3$)	2013 'with development' PM_{10} ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	18.06	17.38	17.48	0.53%	-3.25%
10 Bristol Road, Puriton	331025	140917	1.8	18.61	17.80	17.92	0.64%	-3.72%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	17.57	16.98	16.99	0.06%	-3.31%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	18.65	18.05	18.06	0.06%	-3.15%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	18.76	17.81	17.83	0.06%	-4.96%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	17.49	16.89	16.90	0.07%	-3.35%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	18.69	17.78	18.00	1.25%	-3.69%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	18.41	17.81	17.82	0.06%	-3.19%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	18.15	17.37	17.40	0.14%	-4.14%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	17.46	16.87	16.88	0.05%	-3.32%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	17.44	16.85	16.86	0.05%	-3.32%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	17.39	16.80	16.81	0.05%	-3.33%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	17.58	16.94	17.01	0.41%	-3.29%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	18.55	17.77	17.76	-0.03%	-4.28%
28 Limousin Way, North Petherton	330243	135164	1.8	16.89	16.30	16.31	0.07%	-3.40%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	17.11	16.50	16.51	0.05%	-3.50%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	16.91	16.32	16.33	0.04%	-3.45%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	16.84	16.26	16.26	0.04%	-3.42%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2013 'without development' PM_{10} (µg/m^3)	2013 'with development' PM_{10} (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	16.96	16.37	16.38	0.05%	-3.42%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	16.97	16.37	16.38	0.05%	-3.47%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	18.44	17.83	17.83	0.05%	-3.26%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	16.94	16.35	16.36	0.05%	-3.42%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	18.79	18.18	18.19	0.05%	-3.21%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	19.89	19.27	19.28	0.05%	-3.06%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	17.65	17.06	17.07	0.06%	-3.29%
Bridgwater & Albion Rugby Football	330875	137588	1.8	17.11	16.52	16.53	0.05%	-3.41%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	16.94	16.35	16.36	0.04%	-3.44%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	17.14	16.52	16.53	0.04%	-3.58%
Compass House, Taunton Road (Back)	329911	134026	1.8	17.13	16.51	16.52	0.06%	-3.55%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	17.75	17.06	17.08	0.10%	-3.79%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	17.80	17.10	17.12	0.13%	-3.78%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	17.32	16.69	16.73	0.22%	-3.44%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	17.28	16.65	16.69	0.20%	-3.43%
Moto Hospitality Services, North Petherton	330345	134412	1.8	17.52	16.87	16.92	0.31%	-3.39%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	17.72	17.03	17.05	0.11%	-3.77%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2013 'without development' PM_{10} (µg/m^3)	2013 'with development' PM_{10} (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Riverview, Downend Crescent, Puriton	331185	141247	1.8	18.15	17.41	17.50	0.57%	-3.58%
Site of future housing development	329569	134364	1.8	16.77	16.20	16.20	0.02%	-3.40%
Somerset Skills & Learning Parkway	331410	137465	1.8	16.89	16.31	16.31	0.04%	-3.44%
The Brainwave Centre	330548	134943	1.8	17.52	16.88	16.94	0.30%	-3.36%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	17.37	16.74	16.78	0.24%	-3.40%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	18.33	17.57	17.64	0.42%	-3.75%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	17.06	16.45	16.46	0.07%	-3.51%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	17.29	16.65	16.66	0.03%	-3.66%
Unique Health and Fitness	330612	134940	1.8	17.18	16.56	16.59	0.16%	-3.44%

Table 12E 33: Predicted 2016 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2016 'without development' PM_{10} ($\mu g/m^3$)	2016 'with development' PM_{10} ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/ baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	18.06	17.07	17.13	0.40%	-5.14%
10 Bristol Road, Puriton	331025	140917	1.8	18.61	17.58	17.69	0.61%	-4.95%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	17.57	16.56	16.63	0.40%	-5.35%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	18.65	17.37	17.53	0.94%	-5.99%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	18.76	17.38	17.38	0.04%	-7.32%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	17.49	16.50	16.56	0.34%	-5.32%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	18.69	17.36	17.45	0.54%	-6.62%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	18.41	17.19	17.33	0.82%	-5.86%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	18.15	17.04	17.05	0.04%	-6.05%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	17.46	16.48	16.54	0.35%	-5.28%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	17.44	16.46	16.52	0.34%	-5.27%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	17.39	16.43	16.48	0.31%	-5.25%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	17.58	16.66	16.68	0.08%	-5.16%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	18.55	17.37	17.38	0.02%	-6.35%
28 Limousin Way, North Petherton	330243	135164	1.8	16.89	16.06	16.06	0.03%	-4.88%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	17.11	16.22	16.24	0.08%	-5.09%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	16.91	16.07	16.07	0.03%	-4.95%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	16.84	16.02	16.02	0.02%	-4.87%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2016 'without development' PM_{10} (µg/m^3)	2016 'with development' PM_{10} (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/ baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	16.96	16.10	16.11	0.07%	-4.97%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	16.97	16.12	16.12	0.04%	-4.99%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	18.44	17.22	17.35	0.77%	-5.91%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	16.94	16.09	16.10	0.06%	-4.96%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	18.79	17.48	17.65	0.94%	-6.11%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	19.89	18.30	18.56	1.43%	-6.68%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	17.65	16.63	16.70	0.45%	-5.40%
Bridgwater & Albion Rugby Football	330875	137588	1.8	17.11	16.22	16.25	0.14%	-5.08%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	16.94	16.09	16.10	0.05%	-4.97%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	17.14	16.25	16.26	0.04%	-5.13%
Compass House, Taunton Road (Back)	329911	134026	1.8	17.13	16.27	16.27	0.02%	-5.04%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	17.75	16.80	16.81	0.05%	-5.30%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	17.80	16.84	16.85	0.06%	-5.33%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	17.32	16.42	16.44	0.12%	-5.08%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	17.28	16.39	16.40	0.08%	-5.07%
Moto Hospitality Services, North Petherton	330345	134412	1.8	17.52	16.59	16.62	0.19%	-5.14%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	17.72	16.77	16.78	0.05%	-5.30%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2016 'without development' PM_{10} (µg/m^3)	2016 'with development' PM_{10} (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/ baseline'
Riverview, Downend Crescent, Puriton	331185	141247	1.8	18.15	17.13	17.27	0.76%	-4.90%
Site of future housing development	329569	134364	1.8	16.77	15.96	15.96	0.01%	-4.82%
Somerset Skills & Learning Parkway	331410	137465	1.8	16.89	16.05	16.06	0.03%	-4.94%
The Brainwave Centre	330548	134943	1.8	17.52	16.61	16.63	0.13%	-5.08%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	17.37	16.48	16.49	0.10%	-5.07%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	18.33	17.33	17.40	0.44%	-5.07%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	17.06	16.19	16.20	0.06%	-5.01%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	17.29	16.37	16.38	0.03%	-5.27%
Unique Health and Fitness	330612	134940	1.8	17.18	16.30	16.31	0.06%	-5.05%

Table 12E 34: Predicted 2021 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2021 'without development' PM_{10} ($\mu g/m^3$)	2021 'with development' PM_{10} ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	18.06	16.76	16.81	0.28%	-6.95%
10 Bristol Road, Puriton	331025	140917	1.8	18.61	17.20	17.26	0.33%	-7.25%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	17.57	16.35	16.41	0.39%	-6.59%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	18.65	17.17	17.33	0.93%	-7.04%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	18.76	16.94	16.97	0.18%	-9.50%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	17.49	16.28	16.33	0.33%	-6.61%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	18.69	16.92	16.94	0.13%	-9.35%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	18.41	16.99	17.13	0.82%	-6.95%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	18.15	16.69	16.73	0.24%	-7.85%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	17.46	16.26	16.32	0.34%	-6.53%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	17.44	16.25	16.30	0.33%	-6.52%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	17.39	16.21	16.26	0.30%	-6.50%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	17.58	16.38	16.40	0.12%	-6.74%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	18.55	17.01	17.02	0.02%	-8.28%
28 Limousin Way, North Petherton	330243	135164	1.8	16.89	15.83	15.83	0.02%	-6.24%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	17.11	15.98	15.99	0.07%	-6.55%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	16.91	15.84	15.84	0.02%	-6.31%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	16.84	15.79	15.80	0.01%	-6.20%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2021 'without development' PM_{10} (µg/m^3)	2021 'with development' PM_{10} (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	16.96	15.88	15.89	0.06%	-6.31%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	16.97	15.88	15.89	0.03%	-6.39%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	18.44	17.00	17.13	0.78%	-7.06%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	16.94	15.86	15.87	0.05%	-6.31%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	18.79	17.28	17.44	0.95%	-7.20%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	19.89	18.12	18.38	1.45%	-7.60%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	17.65	16.41	16.49	0.44%	-6.62%
Bridgwater & Albion Rugby Football	330875	137588	1.8	17.11	15.99	16.02	0.13%	-6.42%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	16.94	15.86	15.87	0.04%	-6.33%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	17.14	16.01	16.01	0.01%	-6.59%
Compass House, Taunton Road (Back)	329911	134026	1.8	17.13	16.03	16.04	0.01%	-6.39%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	17.75	16.55	16.55	0.02%	-6.72%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	17.80	16.58	16.59	0.03%	-6.78%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	17.32	16.17	16.19	0.07%	-6.55%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	17.28	16.14	16.14	0.05%	-6.57%
Moto Hospitality Services, North Petherton	330345	134412	1.8	17.52	16.32	16.34	0.12%	-6.70%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	17.72	16.52	16.52	0.02%	-6.73%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2021 'without development' PM_{10} (µg/m^3)	2021 'with development' PM_{10} (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
Riverview, Downend Crescent, Puriton	331185	141247	1.8	18.15	16.83	16.85	0.13%	-7.20%
Site of future housing development	329569	134364	1.8	16.77	15.74	15.74	0.00%	-6.13%
Somerset Skills & Learning Parkway	331410	137465	1.8	16.89	15.83	15.83	0.02%	-6.28%
The Brainwave Centre	330548	134943	1.8	17.52	16.34	16.35	0.09%	-6.70%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	17.37	16.21	16.22	0.07%	-6.62%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	18.33	16.99	16.99	0.04%	-7.30%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	17.06	15.96	15.96	0.01%	-6.46%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	17.29	16.12	16.12	0.01%	-6.79%
Unique Health and Fitness	330612	134940	1.8	17.18	16.05	16.06	0.04%	-6.51%

Table 12E 35: Predicted 2013 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ (µg/m^3)	2013 'without development' $PM_{2.5}$ (µg/m^3)	2013 'with development' $PM_{2.5}$ (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/ baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	11.13	10.50	10.56	0.58%	-5.13%
10 Bristol Road, Puriton	331025	140917	1.8	11.51	10.77	10.84	0.68%	-5.81%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	10.80	10.24	10.25	0.07%	-5.07%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	11.53	10.93	10.94	0.07%	-5.15%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	11.74	10.86	10.86	0.03%	-7.54%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	10.74	10.19	10.20	0.08%	-5.10%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	11.70	10.85	11.02	1.58%	-5.83%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	11.37	10.78	10.79	0.07%	-5.14%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	11.21	10.51	10.53	0.15%	-6.13%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	10.72	10.17	10.18	0.06%	-5.05%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	10.71	10.16	10.17	0.06%	-5.05%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	10.68	10.13	10.14	0.06%	-5.05%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	10.82	10.22	10.27	0.46%	-5.08%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	11.47	10.74	10.74	-0.04%	-6.36%
28 Limousin Way, North Petherton	330243	135164	1.8	10.33	9.81	9.81	0.07%	-4.99%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	10.49	9.94	9.95	0.06%	-5.17%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	10.35	9.82	9.83	0.04%	-5.05%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	10.30	9.78	9.78	0.05%	-4.99%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ ($\mu g/m^3$)	2013 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2013 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/ baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	10.38	9.85	9.86	0.05%	-5.03%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	10.39	9.86	9.86	0.05%	-5.09%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	11.39	10.79	10.80	0.06%	-5.22%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	10.37	9.84	9.84	0.05%	-5.03%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	11.64	11.02	11.03	0.06%	-5.25%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	12.39	11.72	11.73	0.06%	-5.31%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	10.85	10.30	10.30	0.07%	-5.07%
Bridgwater & Albion Rugby Football	330875	137588	1.8	10.49	9.95	9.96	0.06%	-5.06%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	10.37	9.84	9.85	0.05%	-5.05%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	10.50	9.95	9.95	0.04%	-5.26%
Compass House, Taunton Road (Back)	329911	134026	1.8	10.50	9.94	9.95	0.06%	-5.22%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	10.92	10.29	10.30	0.11%	-5.63%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	10.95	10.32	10.33	0.14%	-5.64%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	10.63	10.06	10.08	0.24%	-5.15%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	10.60	10.04	10.06	0.21%	-5.14%
Moto Hospitality Services, North Petherton	330345	134412	1.8	10.77	10.18	10.21	0.34%	-5.16%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	10.90	10.27	10.29	0.12%	-5.61%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ (µg/m^3)	2013 'without development' $PM_{2.5}$ (µg/m^3)	2013 'with development' $PM_{2.5}$ (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/ baseline'
Riverview, Downend Crescent, Puriton	331185	141247	1.8	11.21	10.52	10.58	0.61%	-5.57%
Site of future housing development	329569	134364	1.8	10.25	9.74	9.74	0.02%	-4.95%
Somerset Skills & Learning Parkway	331410	137465	1.8	10.34	9.81	9.81	0.04%	-5.03%
The Brainwave Centre	330548	134943	1.8	10.77	10.18	10.22	0.33%	-5.12%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	10.67	10.09	10.12	0.26%	-5.12%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	11.33	10.62	10.67	0.45%	-5.78%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	10.45	9.90	9.91	0.08%	-5.17%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	10.61	10.03	10.03	0.03%	-5.38%
Unique Health and Fitness	330612	134940	1.8	10.53	9.98	9.99	0.17%	-5.12%

Table 12E 36: Predicted 2016 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ ($\mu g/m^3$)	2016 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2016 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/ baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	11.13	10.20	10.24	0.41%	-8.01%
10 Bristol Road, Puriton	331025	140917	1.8	11.51	10.51	10.57	0.61%	-8.16%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	10.80	9.89	9.93	0.41%	-7.98%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	11.53	10.38	10.48	0.95%	-9.10%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	11.74	10.44	10.45	0.05%	-11.04%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	10.74	9.86	9.89	0.34%	-7.91%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	11.70	10.45	10.52	0.68%	-10.15%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	11.37	10.28	10.36	0.83%	-8.87%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	11.21	10.20	10.20	0.04%	-9.02%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	10.72	9.84	9.88	0.35%	-7.85%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	10.71	9.83	9.87	0.34%	-7.83%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	10.68	9.81	9.84	0.32%	-7.78%
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	10.82	9.96	9.97	0.09%	-7.85%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	11.47	10.38	10.38	0.02%	-9.45%
28 Limousin Way, North Petherton	330243	135164	1.8	10.33	9.59	9.59	0.03%	-7.16%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	10.49	9.69	9.70	0.09%	-7.51%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	10.35	9.60	9.60	0.03%	-7.24%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	10.30	9.56	9.56	0.02%	-7.12%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ (µg/m^3)	2016 'without development' $PM_{2.5}$ (µg/m^3)	2016 'with development' $PM_{2.5}$ (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/ baseline'
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	10.38	9.61	9.62	0.07%	-7.28%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	10.39	9.62	9.63	0.04%	-7.32%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	11.39	10.29	10.37	0.78%	-8.94%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	10.37	9.61	9.61	0.06%	-7.27%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	11.64	10.46	10.56	0.96%	-9.29%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	12.39	10.96	11.12	1.46%	-10.27%
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	10.85	9.93	9.98	0.46%	-8.07%
Bridgwater & Albion Rugby Football	330875	137588	1.8	10.49	9.69	9.70	0.15%	-7.48%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	10.37	9.61	9.62	0.05%	-7.28%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	10.50	9.71	9.71	0.04%	-7.55%
Compass House, Taunton Road (Back)	329911	134026	1.8	10.50	9.71	9.72	0.02%	-7.45%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	10.92	10.04	10.04	0.05%	-8.01%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	10.95	10.06	10.07	0.06%	-8.08%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	10.63	9.81	9.82	0.12%	-7.60%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	10.60	9.79	9.80	0.08%	-7.58%
Moto Hospitality Services, North Petherton	330345	134412	1.8	10.77	9.91	9.93	0.19%	-7.77%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	10.90	10.02	10.02	0.05%	-8.01%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ (µg/m^3)	2016 'without development' $PM_{2.5}$ (µg/m^3)	2016 'with development' $PM_{2.5}$ (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/ baseline'
Riverview, Downend Crescent, Puriton	331185	141247	1.8	11.21	10.24	10.32	0.77%	-7.92%
Site of future housing development	329569	134364	1.8	10.25	9.53	9.53	0.01%	-7.03%
Somerset Skills & Learning Parkway	331410	137465	1.8	10.34	9.59	9.59	0.03%	-7.22%
The Brainwave Centre	330548	134943	1.8	10.77	9.93	9.94	0.13%	-7.70%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	10.67	9.84	9.85	0.10%	-7.62%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	11.33	10.36	10.40	0.44%	-8.16%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	10.45	9.67	9.68	0.07%	-7.40%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	10.61	9.78	9.78	0.03%	-7.77%
Unique Health and Fitness	330612	134940	1.8	10.53	9.74	9.74	0.06%	-7.50%

Table 12E 37: Predicted 2021 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Bridgwater Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ ($\mu g/m^3$)	2021 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2021 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
1 Daws Farm Cottages, Taunton Road	330382	134585	1.8	11.13	9.91	9.94	0.26%	-10.72%
10 Bristol Road, Puriton	331025	140917	1.8	11.51	10.16	10.19	0.30%	-11.52%
100C Bath Road, Bridgwater, Sydenham	330964	137768	1.8	10.80	9.68	9.71	0.37%	-10.03%
104 Bath Road, Bridgwater, Sydenham	330973	137814	1.8	11.53	10.15	10.24	0.88%	-11.23%
128 Union Street, Bridgwater, Eastover	330553	137731	1.8	11.74	10.04	10.05	0.17%	-14.39%
131 Lower Bath Road, Bridgwater, Eastover	330812	137696	1.8	10.74	9.64	9.67	0.31%	-10.00%
131 The Drove, Bridgwater, Eastover	330529	137793	1.8	11.70	10.03	10.04	0.13%	-14.18%
135 Bath Road, Bridgwater, Sydenham	330942	137802	1.8	11.37	10.04	10.12	0.77%	-10.99%
141 St John Street, Bridgwater, Eastover	330659	136929	1.8	11.21	9.87	9.90	0.23%	-11.73%
144 Bath Road, Bridgwater, Sydenham	331100	137901	1.8	10.72	9.63	9.66	0.32%	-9.87%
150 Frederick Road, Bridgwater, Sydenham	331135	137931	1.8	10.71	9.62	9.65	0.31%	-9.85%
170 Bath Road, Bridgwater, Sydenham	331194	137980	1.8	10.68	9.60	9.63	0.28%	-9.79%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ ($\mu g/m^3$)	2021 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2021 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
196 Bristol Road, Bridgwater, Eastover	330613	137953	1.8	10.82	9.70	9.71	0.11%	-10.25%
2 Walpole Cottage Bristol Road, Pawlett	330725	141595	1.8	11.47	10.05	10.05	0.01%	-12.32%
28 Limousin Way, North Petherton	330243	135164	1.8	10.33	9.39	9.39	0.02%	-9.12%
3 Cornborough Place, Bridgwater, Eastover	330614	137259	1.8	10.49	9.47	9.48	0.07%	-9.65%
4 Elizabeth Way, Bridgwater, Sydenham	331113	137170	1.8	10.35	9.39	9.39	0.02%	-9.23%
46 Sandalwood Ride, North Petherton	329947	134609	1.8	10.30	9.36	9.37	0.01%	-9.05%
62A Fairfax Road, Bridgwater, Sydenham	331111	137627	1.8	10.38	9.41	9.42	0.05%	-9.26%
64 Clarks Road, Bridgwater, Sydenham	330838	137095	1.8	10.39	9.41	9.42	0.03%	-9.36%
69 Bath Road, Bridgwater, Eastover	330666	137563	1.8	11.39	10.05	10.12	0.73%	-11.13%
74 Fairfax Road, Bridgwater, Sydenham	331108	137549	1.8	10.37	9.40	9.41	0.04%	-9.24%
78 Bath Road, Bridgwater, Eastover	330670	137543	1.8	11.64	10.21	10.30	0.90%	-11.50%
86 Bath Road, Bridgwater, Eastover	330680	137557	1.8	12.39	10.68	10.83	1.38%	-12.56%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ (µg/m^3)	2021 'without development' $PM_{2.5}$ (µg/m^3)	2021 'with development' $PM_{2.5}$ (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
Bath Road News167, Bath Road, Bridgwater	330996	137879	1.8	10.85	9.72	9.76	0.41%	-10.12%
Bridgwater & Albion Rugby Football	330875	137588	1.8	10.49	9.48	9.49	0.12%	-9.51%
Bridgwater College, Bridgwater, Sydenham	330978	137387	1.8	10.37	9.40	9.41	0.04%	-9.27%
Chestnut House, Downend Road, Pawlett	330851	141439	1.8	10.50	9.49	9.49	0.01%	-9.68%
Compass House, Taunton Road (Back)	329911	134026	1.8	10.50	9.50	9.50	0.01%	-9.48%
Compass House, Taunton Road, North Petherton	329931	133987	1.8	10.92	9.79	9.80	0.02%	-10.27%
Compass Inn, Taunton Road, North Petherton	330110	134177	1.8	10.95	9.81	9.82	0.03%	-10.37%
Daws Farm, Taunton Road, North Petherton	330198	134378	1.8	10.63	9.58	9.59	0.07%	-9.81%
Dwelling at Corner of Marsh Lane	330590	134879	1.8	10.60	9.56	9.56	0.05%	-9.80%
Moto Hospitality Services, North Petherton	330345	134412	1.8	10.77	9.67	9.68	0.12%	-10.12%
Quantock View House, Taunton Road, North Petherton	330034	134075	1.8	10.90	9.78	9.78	0.02%	-10.26%
Riverview, Downend Crescent, Puriton	331185	141247	1.8	11.21	9.94	9.96	0.11%	-11.17%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' $PM_{2.5}$ ($\mu g/m^3$)	2021 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2021 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
Site of future housing development	329569	134364	1.8	10.25	9.33	9.33	0.00%	-8.91%
Somerset Skills & Learning Parkway	331410	137465	1.8	10.34	9.38	9.39	0.02%	-9.18%
The Brainwave Centre	330548	134943	1.8	10.77	9.67	9.68	0.08%	-10.10%
The Brainwave Centre (Accommodation block)	330568	134915	1.8	10.67	9.60	9.61	0.06%	-9.91%
The Old Post House, Bristol Road, Puriton	331145	140731	1.8	11.33	10.04	10.04	0.02%	-11.37%
The Woodlands, Downend Road, Puriton	330977	141363	1.8	10.45	9.46	9.46	0.01%	-9.51%
Tree Tops, Bristol Road, Pawlett	330822	141445	1.8	10.61	9.55	9.55	0.01%	-9.99%
Unique Health and Fitness	330612	134940	1.8	10.53	9.51	9.52	0.03%	-9.65%

Table 12E 38: Predicted 2013 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2013 'without development' NO_2 ($\mu g/m^3$)	2013 'with development' NO_2 ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/ baseline'
1 Park Lane, Cannington	325612	140008	1.8	9.00	7.45	9.47	27.11%	5.22%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.28	6.86	7.55	10.06%	-8.82%
15 Withiel Drive, Cannington	325146	139547	1.8	7.40	6.19	6.85	10.66%	-7.43%
17 Fore Street, Cannington	325868	139667	1.8	16.88	13.93	14.82	6.39%	-12.20%
17 Mill Close, Cannington	325505	139372	1.8	7.54	6.30	6.91	9.68%	-8.36%
22 Withiel Drive, Cannington	325030	139501	1.8	7.37	6.16	6.63	7.63%	-10.04%
24 Riverside, Otterhampton	326064	142340	1.8	7.01	5.87	6.26	6.64%	-10.70%
3 Lonsdale Road, Cannington	325913	139294	1.8	18.06	14.91	15.61	4.69%	-13.57%
32 Brownings Road, Cannington	325854	139005	1.8	9.68	7.92	9.57	20.83%	-1.14%
41 High Street, Cannington	325416	139555	1.8	10.13	8.65	16.50	90.75%	62.88%
44 Rodway, Cannington	325658	140150	1.8	12.61	10.32	15.79	53.00%	25.22%
45 High Street, Cannington	325406	139548	1.8	9.77	8.33	15.25	83.07%	56.09%
45 Main Road, Cannington	326061	138989	1.8	15.96	13.08	15.05	15.06%	-5.70%
5 Belvedere Close, Cannington	325622	139894	1.8	9.10	7.53	9.61	27.62%	5.60%
6 Dame Withycombe Villas	325241	142114	1.8	11.63	9.57	13.18	37.72%	13.33%
7 Fore Street, Cannington	325763	139675	1.8	12.25	10.11	11.61	14.84%	-5.22%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.10	5.95	6.49	9.08%	-8.59%
Bolham Farm, Otterhampton	325490	141730	1.8	11.64	9.58	13.27	38.52%	14.00%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2013 'without development' NO_2 ($\mu g/m^3$)	2013 'with development' NO_2 ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/ baseline'
Bridgwater College, Cannington	325611	139705	1.8	8.26	6.89	8.41	22.06%	1.82%
Brymore Lodge	325104	139302	1.8	8.85	7.44	11.23	50.94%	26.89%
Brymore Lodge (external buildings)	325118	139259	1.8	9.01	7.57	11.47	51.52%	27.30%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.28	6.08	6.23	2.47%	-14.42%
Cannington Primary School, Main Road	325927	139571	1.8	11.48	9.48	10.08	6.33%	-12.20%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	11.34	9.30	13.71	47.42%	20.90%
Claylands Corner, Stogursey	322750	142811	1.8	10.50	8.63	12.24	41.83%	16.57%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.97	7.46	8.39	12.47%	-6.47%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	10.56	8.71	11.55	32.61%	9.38%
Doggetts	320639	144643	1.8	7.20	6.02	6.43	6.81%	-10.69%
Grange Lodge, Cannington	326112	138786	1.8	22.22	18.27	23.78	30.16%	7.02%
Gunters Grove, Stogursey	321220	144136	1.8	7.62	6.36	7.18	12.89%	-5.77%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.08	5.93	6.13	3.37%	-13.42%
Hill Farm House	324700	142405	1.8	10.94	8.99	12.79	42.27%	16.91%
Just Wall Cottage, Otterhampton	325383	142112	1.8	10.12	8.35	10.87	30.18%	7.41%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2013 'without development' NO_2 ($\mu g/m^3$)	2013 'with development' NO_2 ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/ baseline'
Kiln Close, Stogursey	322606	142702	1.8	7.16	5.99	6.34	5.84%	-11.45%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.16	5.99	6.27	4.67%	-12.43%
Lower House Farm, Shurton	320486	144455	1.8	6.96	5.84	6.00	2.74%	-13.79%
Newham Farm, Shurton	320681	144142	1.8	6.97	5.85	6.02	2.91%	-13.63%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	9.86	8.13	11.00	35.30%	11.56%
Putnell Barn, Cannington	325507	140634	1.8	14.55	11.95	17.61	47.36%	21.03%
Putnell Farm, Cannington	325650	141366	1.8	8.68	7.20	8.66	20.28%	-0.23%
Putnell Farm (Rear of Property)	325724	141411	1.8	7.79	6.50	7.32	12.62%	-6.03%
Rothay High Street, Cannington	325071	139199	1.8	9.34	7.75	10.73	38.45%	14.88%
Ryedale House, Rodway	325727	139748	1.8	10.29	8.48	11.14	31.37%	8.26%
The Lodge, Withycombe	324089	142500	1.8	14.66	11.97	19.45	62.49%	32.67%
Wick Cottage, Stogursey	321807	144219	1.8	8.00	6.65	7.84	17.89%	-2.00%
Wick Pound Cottage, Wick	321595	144240	1.8	9.49	7.83	10.48	33.84%	10.43%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.23	6.05	6.36	5.12%	-12.03%

Table 12E 39: Worst-case predicted 2013 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO2 (µg/m3)	2013 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2013 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
1 Park Lane, Cannington	325612	140008	1.8	9.00	9.03	11.91	31.89%	32.33%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.28	8.30	9.29	11.93%	12.20%
15 Withiel Drive, Cannington	325146	139547	1.8	7.40	7.43	8.39	12.92%	13.38%
17 Fore Street, Cannington	325868	139667	1.8	16.88	16.97	18.14	6.89%	7.46%
17 Mill Close, Cannington	325505	139372	1.8	7.54	7.57	8.45	11.62%	12.07%
22 Withiel Drive, Cannington	325030	139501	1.8	7.37	7.39	8.07	9.20%	9.50%
24 Riverside, Otterhampton	326064	142340	1.8	7.01	7.01	7.58	8.13%	8.13%
3 Lonsdale Road, Cannington	325913	139294	1.8	18.06	18.16	19.04	4.85%	5.43%
32 Brownings Road, Cannington	325854	139005	1.8	9.68	9.72	12.06	24.07%	24.59%
41 High Street, Cannington	325416	139555	1.8	10.13	10.64	21.55	102.54%	112.73%
44 Rodway, Cannington	325658	140150	1.8	12.61	12.67	20.24	59.75%	60.51%
45 High Street, Cannington	325406	139548	1.8	9.77	10.22	19.90	94.72%	103.68%
45 Main Road, Cannington	326061	138989	1.8	15.96	16.06	18.73	16.63%	17.36%
5 Belvedere Close, Cannington	325622	139894	1.8	9.10	9.14	12.10	32.39%	32.97%
6 Dame Withycombe Villas	325241	142114	1.8	11.63	11.68	16.83	44.09%	44.71%
7 Fore Street, Cannington	325763	139675	1.8	12.25	12.32	14.41	16.96%	17.63%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.10	7.11	7.91	11.25%	11.41%
Bolham Farm, Otterhampton	325490	141730	1.8	11.64	11.69	16.95	45.00%	45.62%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO2 (µg/m3)	2013 'without development' NO_2 (µg/m^3) (worst-case)	2013 'with development' NO_2 (µg/m^3) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
Bridgwater College, Cannington	325611	139705	1.8	8.26	8.33	10.50	26.05%	27.12%
Brymore Lodge	325104	139302	1.8	8.85	9.08	14.47	59.36%	63.50%
Brymore Lodge (external buildings)	325118	139259	1.8	9.01	9.24	14.79	60.06%	64.15%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.28	7.29	7.50	2.88%	3.02%
Cannington Primary School, Main Road	325927	139571	1.8	11.48	11.53	12.35	7.11%	7.58%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	11.34	11.39	17.54	53.99%	54.67%
Claylands Corner, Stogursey	322750	142811	1.8	10.50	10.53	15.62	48.34%	48.76%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.97	9.02	10.35	14.75%	15.38%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	10.56	10.60	14.68	38.49%	39.02%
Doggetts	320639	144643	1.8	7.20	7.20	7.79	8.19%	8.19%
Grange Lodge, Cannington	326112	138786	1.8	22.22	22.61	29.79	31.76%	34.07%
Gunters Grove, Stogursey	321220	144136	1.8	7.62	7.63	8.81	15.47%	15.62%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.08	7.09	7.37	3.95%	4.10%
Hill Farm House	324700	142405	1.8	10.94	10.99	16.34	48.68%	49.36%
Just Wall Cottage, Otterhampton	325383	142112	1.8	10.12	10.15	13.78	35.76%	36.17%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO2 (µg/m3)	2013 'without development' NO_2 (µg/m^3) (worst-case)	2013 'with development' NO_2 (µg/m^3) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
Kiln Close, Stogursey	322606	142702	1.8	7.16	7.16	7.67	7.12%	7.12%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.16	7.17	7.57	5.58%	5.73%
Lower House Farm, Shurton	320486	144455	1.8	6.96	6.96	7.20	3.45%	3.45%
Newham Farm, Shurton	320681	144142	1.8	6.97	6.97	7.23	3.73%	3.73%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	9.86	9.89	13.97	41.25%	41.68%
Putnell Barn, Cannington	325507	140634	1.8	14.55	14.63	22.52	53.93%	54.78%
Putnell Farm, Cannington	325650	141366	1.8	8.68	8.70	10.82	24.37%	24.65%
Putnell Farm (Rear of Property)	325724	141411	1.8	7.79	7.80	9.01	15.51%	15.66%
Rothay High Street, Cannington	325071	139199	1.8	9.34	9.50	13.73	44.53%	47.00%
Ryedale House, Rodway	325727	139748	1.8	10.29	10.34	14.09	36.27%	36.93%
The Lodge, Withycombe	324089	142500	1.8	14.66	14.74	24.89	68.86%	69.78%
Wick Cottage, Stogursey	321807	144219	1.8	8.00	8.01	9.72	21.35%	21.50%
Wick Pound Cottage, Wick	321595	144240	1.8	9.49	9.51	13.27	39.54%	39.83%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.23	7.25	7.69	6.07%	6.36%

Table 12E 40: Predicted 2016 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$)	2016 'with development' NO_2 ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	9.00	6.48	6.15	-5.09%	-31.67%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.28	5.99	6.54	9.18%	-21.01%
15 Withiel Drive, Cannington	325146	139547	1.8	7.40	5.45	6.21	13.94%	-16.08%
17 Fore Street, Cannington	325868	139667	1.8	16.88	11.80	9.75	-17.37%	-42.24%
17 Mill Close, Cannington	325505	139372	1.8	7.54	5.54	5.86	5.78%	-22.28%
22 Withiel Drive, Cannington	325030	139501	1.8	7.37	5.43	7.13	31.31%	-3.26%
24 Riverside, Otterhampton	326064	142340	1.8	7.01	5.22	5.44	4.21%	-22.40%
3 Lonsdale Road, Cannington	325913	139294	1.8	18.06	12.61	10.49	-16.81%	-41.92%
32 Brownings Road, Cannington	325854	139005	1.8	9.68	6.81	8.46	24.23%	-12.60%
41 High Street, Cannington	325416	139555	1.8	10.13	7.19	7.32	1.81%	-27.74%
44 Rodway, Cannington	325658	140150	1.8	12.61	8.80	7.34	-16.59%	-41.79%
45 High Street, Cannington	325406	139548	1.8	9.77	6.96	7.12	2.30%	-27.12%
45 Main Road, Cannington	326061	138989	1.8	15.96	11.05	11.44	3.53%	-28.32%
5 Belvedere Close, Cannington	325622	139894	1.8	9.10	6.54	6.19	-5.35%	-31.98%
6 Dame Withycombe Villas	325241	142114	1.8	11.63	8.28	10.34	24.88%	-11.09%
7 Fore Street, Cannington	325763	139675	1.8	12.25	8.64	7.65	-11.46%	-37.55%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.10	5.28	5.60	6.06%	-21.13%
Bolham Farm, Otterhampton	325490	141730	1.8	11.64	8.29	10.39	25.33%	-10.74%
Bridgwater College, Cannington	325611	139705	1.8	8.26	6.01	6.01	0.00%	-27.24%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3)	2016 'with development' NO_2 (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
Brymore Lodge	325104	139302	1.8	8.85	6.35	7.09	11.65%	-19.89%
Brymore Lodge (external buildings)	325118	139259	1.8	9.01	6.44	7.21	11.96%	-19.98%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.28	5.37	5.57	3.72%	-23.49%
Cannington Primary School, Main Road	325927	139571	1.8	11.48	8.15	7.37	-9.57%	-35.80%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	11.34	7.98	10.21	27.94%	-9.96%
Claylands Corner, Stogursey	322750	142811	1.8	10.50	7.44	9.26	24.46%	-11.81%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.97	6.48	6.31	-2.62%	-29.65%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	10.56	7.56	9.17	21.30%	-13.16%
Doggetts	320639	144643	1.8	7.20	5.34	5.54	3.75%	-23.06%
Grange Lodge, Cannington	326112	138786	1.8	22.22	15.27	19.54	27.96%	-12.06%
Gunters Grove, Stogursey	321220	144136	1.8	7.62	5.61	6.02	7.31%	-21.00%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.08	5.26	5.83	10.84%	-17.66%
Hill Farm House	324700	142405	1.8	10.94	7.75	9.73	25.55%	-11.06%
HPC Accommodation 1	320696	144851	1.8	7.84	5.74	6.27	9.23%	-20.03%
HPC Accommodation 2	320726	144810	1.8	8.28	6.02	6.76	12.29%	-18.36%
HPC Accommodation 3	320603	144852	1.8	7.24	5.36	5.59	4.29%	-22.79%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$)	2016 'with development' NO_2 ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
HPC Accommodation 4	320599	144797	1.8	7.20	5.34	5.54	3.75%	-23.06%
Just Wall Cottage, Otterhampton	325383	142112	1.8	10.12	7.27	8.70	19.67%	-14.03%
Kiln Close, Stogursey	322606	142702	1.8	7.16	5.31	5.49	3.39%	-23.32%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.16	5.31	6.56	23.54%	-8.38%
Lower House Farm, Shurton	320486	144455	1.8	6.96	5.19	5.27	1.54%	-24.28%
Newham Farm, Shurton	320681	144142	1.8	6.97	5.20	5.29	1.73%	-24.10%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	9.86	7.03	6.90	-1.85%	-30.02%
Putnell Barn, Cannington	325507	140634	1.8	14.55	10.25	13.66	33.27%	-6.12%
Putnell Farm, Cannington	325650	141366	1.8	8.68	6.31	7.14	13.15%	-17.74%
Putnell Farm (Rear of Property)	325724	141411	1.8	7.79	5.73	6.20	8.20%	-20.41%
Rothay High Street, Cannington	325071	139199	1.8	9.34	6.61	7.97	20.57%	-14.67%
Ryedale House, Rodway	325727	139748	1.8	10.29	7.31	6.63	-9.30%	-35.57%
The Lodge, Withycombe	324089	142500	1.8	14.66	10.15	13.99	37.83%	-4.57%
Wick Cottage, Stogursey	321807	144219	1.8	8.00	5.84	6.44	10.27%	-19.50%
Wick Pound Cottage, Wick	321595	144240	1.8	9.49	6.79	8.12	19.59%	-14.44%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.23	5.35	7.69	43.74%	6.36%

Table 12E 41: Worst-case predicted 2016 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2016 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/baseline' (worst-case)
1 Park Lane, Cannington	325612	140008	1.8	9.00	9.02	8.62	-4.43%	-4.22%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.28	8.31	9.43	13.48%	13.89%
15 Withiel Drive, Cannington	325146	139547	1.8	7.40	7.41	8.92	20.38%	20.54%
17 Fore Street, Cannington	325868	139667	1.8	16.88	16.91	14.02	-17.09%	-16.94%
17 Mill Close, Cannington	325505	139372	1.8	7.54	7.55	8.20	8.61%	8.75%
22 Withiel Drive, Cannington	325030	139501	1.8	7.37	7.38	10.74	45.53%	45.73%
24 Riverside, Otterhampton	326064	142340	1.8	7.01	7.01	7.54	7.56%	7.56%
3 Lonsdale Road, Cannington	325913	139294	1.8	18.06	18.10	15.18	-16.13%	-15.95%
32 Brownings Road, Cannington	325854	139005	1.8	9.68	9.74	12.95	32.96%	33.78%
41 High Street, Cannington	325416	139555	1.8	10.13	10.16	10.55	3.84%	4.15%
44 Rodway, Cannington	325658	140150	1.8	12.61	12.65	10.50	-17.00%	-16.73%
45 High Street, Cannington	325406	139548	1.8	9.77	9.80	10.23	4.39%	4.71%
45 Main Road, Cannington	326061	138989	1.8	15.96	16.06	17.40	8.34%	9.02%
5 Belvedere Close, Cannington	325622	139894	1.8	9.10	9.12	8.67	-4.93%	-4.73%
6 Dame Withycombe Villas	325241	142114	1.8	11.63	11.67	16.12	38.13%	38.61%
7 Fore Street, Cannington	325763	139675	1.8	12.25	12.27	10.87	-11.41%	-11.27%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.10	7.11	7.85	10.41%	10.56%
Bolham Farm, Otterhampton	325490	141730	1.8	11.64	11.68	16.24	39.04%	39.52%
Bridgwater College, Cannington	325611	139705	1.8	8.26	8.27	8.40	1.57%	1.69%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3) (worst-case)	2016 'with development' NO_2 (µg/m^3) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/baseline' (worst-case)
Brymore Lodge	325104	139302	1.8	8.85	8.87	10.38	17.02%	17.29%
Brymore Lodge (external buildings)	325118	139259	1.8	9.01	9.04	10.59	17.15%	17.54%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.28	7.29	7.69	5.49%	5.63%
Cannington Primary School, Main Road	325927	139571	1.8	11.48	11.50	10.44	-9.22%	-9.06%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	11.34	11.37	16.31	43.45%	43.83%
Claylands Corner, Stogursey	322750	142811	1.8	10.50	10.52	14.59	38.69%	38.95%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.97	8.99	8.84	-1.67%	-1.45%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	10.56	10.59	14.11	33.24%	33.62%
Doggetts	320639	144643	1.8	7.20	7.20	7.67	6.53%	6.53%
Grange Lodge, Cannington	326112	138786	1.8	22.22	22.68	30.48	34.39%	37.17%
Gunters Grove, Stogursey	321220	144136	1.8	7.62	7.63	8.57	12.32%	12.47%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.08	7.08	8.24	16.38%	16.38%
Hill Farm House	324700	142405	1.8	10.94	10.98	15.33	39.62%	40.13%
HPC Accommodation 1	320696	144851	1.8	7.84	7.85	9.04	15.16%	15.31%
HPC Accommodation 2	320726	144810	1.8	8.28	8.29	9.97	20.27%	20.41%
HPC Accommodation 3	320603	144852	1.8	7.24	7.24	7.76	7.18%	7.18%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2016 'without development' NO_2 (µg/m^3) (worst-case)	2016 'with development' NO_2 (µg/m^3) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/baseline' (worst-case)
HPC Accommodation 4	320599	144797	1.8	7.20	7.20	7.66	6.39%	6.39%
Just Wall Cottage, Otterhampton	325383	142112	1.8	10.12	10.14	13.28	30.97%	31.23%
Kiln Close, Stogursey	322606	142702	1.8	7.16	7.16	7.57	5.73%	5.73%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.16	7.16	9.65	34.78%	34.78%
Lower House Farm, Shurton	320486	144455	1.8	6.96	6.96	7.16	2.87%	2.87%
Newham Farm, Shurton	320681	144142	1.8	6.97	6.97	7.18	3.01%	3.01%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	9.86	9.88	9.97	0.91%	1.12%
Putnell Barn, Cannington	325507	140634	1.8	14.55	14.61	21.70	48.53%	49.14%
Putnell Farm, Cannington	325650	141366	1.8	8.68	8.69	10.53	21.17%	21.31%
Putnell Farm (Rear of Property)	325724	141411	1.8	7.79	7.80	8.85	13.46%	13.61%
Rothay High Street, Cannington	325071	139199	1.8	9.34	9.38	12.03	28.25%	28.80%
Ryedale House, Rodway	325727	139748	1.8	10.29	10.31	9.35	-9.31%	-9.14%
The Lodge, Withycombe	324089	142500	1.8	14.66	14.72	22.88	55.43%	56.07%
Wick Cottage, Stogursey	321807	144219	1.8	8.00	8.00	9.37	17.13%	17.13%
Wick Pound Cottage, Wick	321595	144240	1.8	9.49	9.51	12.50	31.44%	31.72%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.23	7.24	11.84	63.54%	63.76%

Table 12E 42: Predicted 2021 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$)	2021 'with development' NO_2 ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
1 Park Lane, Cannington	325612	140008	1.8	9.00	5.29	4.91	-7.18%	-45.44%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.28	4.93	5.10	3.45%	-38.41%
15 Withiel Drive, Cannington	325146	139547	1.8	7.40	4.57	4.89	7.00%	-33.92%
17 Fore Street, Cannington	325868	139667	1.8	16.88	9.02	7.21	-20.07%	-57.29%
17 Mill Close, Cannington	325505	139372	1.8	7.54	4.63	4.73	2.16%	-37.27%
22 Withiel Drive, Cannington	325030	139501	1.8	7.37	4.55	5.33	17.14%	-27.68%
24 Riverside, Otterhampton	326064	142340	1.8	7.01	4.41	4.50	2.04%	-35.81%
3 Lonsdale Road, Cannington	325913	139294	1.8	18.06	9.58	7.66	-20.04%	-57.59%
32 Brownings Road, Cannington	325854	139005	1.8	9.68	5.46	6.08	11.36%	-37.19%
41 High Street, Cannington	325416	139555	1.8	10.13	5.83	5.68	-2.57%	-43.93%
44 Rodway, Cannington	325658	140150	1.8	12.61	6.91	5.60	-18.96%	-55.59%
45 High Street, Cannington	325406	139548	1.8	9.77	5.66	5.55	-1.94%	-43.19%
45 Main Road, Cannington	326061	138989	1.8	15.96	8.44	7.97	-5.57%	-50.06%
5 Belvedere Close, Cannington	325622	139894	1.8	9.10	5.33	4.93	-7.50%	-45.82%
6 Dame Withycombe Villas	325241	142114	1.8	11.63	6.59	7.06	7.13%	-39.29%
7 Fore Street, Cannington	325763	139675	1.8	12.25	6.80	5.87	-13.68%	-52.08%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.10	4.46	4.57	2.47%	-35.63%
Bolham Farm, Otterhampton	325490	141730	1.8	11.64	6.60	7.09	7.42%	-39.09%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 (µg/m^3)	2021 'without development' NO_2 (µg/m^3)	2021 'with development' NO_2 (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
Bridgwater College, Cannington	325611	139705	1.8	8.26	4.96	4.84	-2.42%	-41.40%
Brymore Lodge	325104	139302	1.8	8.85	5.20	5.44	4.62%	-38.53%
Brymore Lodge (external buildings)	325118	139259	1.8	9.01	5.26	5.51	4.75%	-38.85%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.28	4.51	4.59	1.77%	-36.95%
Cannington Primary School, Main Road	325927	139571	1.8	11.48	6.45	5.71	-11.47%	-50.26%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	11.34	6.34	6.84	7.89%	-39.68%
Claylands Corner, Stogursey	322750	142811	1.8	10.50	5.96	6.37	6.88%	-39.33%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.97	5.29	5.04	-4.73%	-43.81%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	10.56	6.08	6.45	6.09%	-38.92%
Doggetts	320639	144643	1.8	7.20	4.49	4.54	1.11%	-36.94%
Grange Lodge, Cannington	326112	138786	1.8	22.22	11.35	12.50	10.13%	-43.74%
Gunters Grove, Stogursey	321220	144136	1.8	7.62	4.68	4.77	1.92%	-37.40%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.08	4.44	4.69	5.63%	-33.76%
Hill Farm House	324700	142405	1.8	10.94	6.19	6.64	7.27%	-39.31%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$)	2021 'with development' NO_2 ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/ baseline'
Just Wall Cottage, Otterhampton	325383	142112	1.8	10.12	5.87	6.20	5.62%	-38.74%
Kiln Close, Stogursey	322606	142702	1.8	7.16	4.48	4.52	0.89%	-36.87%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.16	4.47	5.04	12.75%	-29.61%
Lower House Farm, Shurton	320486	144455	1.8	6.96	4.39	4.41	0.46%	-36.64%
Newham Farm, Shurton	320681	144142	1.8	6.97	4.40	4.42	0.45%	-36.59%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	9.86	5.68	5.29	-6.87%	-46.35%
Putnell Barn, Cannington	325507	140634	1.8	14.55	8.00	8.83	10.38%	-39.31%
Putnell Farm, Cannington	325650	141366	1.8	8.68	5.19	5.39	3.85%	-37.90%
Putnell Farm (Rear of Property)	325724	141411	1.8	7.79	4.78	4.89	2.30%	-37.23%
Rothay High Street, Cannington	325071	139199	1.8	9.34	5.35	5.88	9.91%	-37.04%
Ryedale House, Rodway	325727	139748	1.8	10.29	5.87	5.21	-11.24%	-49.37%
The Lodge, Withycombe	324089	142500	1.8	14.66	7.86	8.74	11.20%	-40.38%
Wick Cottage, Stogursey	321807	144219	1.8	8.00	4.85	4.98	2.68%	-37.75%
Wick Pound Cottage, Wick	321595	144240	1.8	9.49	5.51	5.81	5.44%	-38.78%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.23	4.49	5.58	24.28%	-22.82%

Table 12E 43: Worst-case predicted 2021 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2021 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/baseline' (worst-case)
1 Park Lane, Cannington	325612	140008	1.8	9.00	9.15	8.36	-8.63%	-7.11%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.28	8.39	9.03	7.63%	9.06%
15 Withiel Drive, Cannington	325146	139547	1.8	7.40	7.46	8.53	14.34%	15.27%
17 Fore Street, Cannington	325868	139667	1.8	16.88	17.40	13.48	-22.53%	-20.14%
17 Mill Close, Cannington	325505	139372	1.8	7.54	7.61	7.99	4.99%	5.97%
22 Withiel Drive, Cannington	325030	139501	1.8	7.37	7.42	9.92	33.69%	34.60%
24 Riverside, Otterhampton	326064	142340	1.8	7.01	7.02	7.51	6.98%	7.13%
3 Lonsdale Road, Cannington	325913	139294	1.8	18.06	18.63	14.55	-21.90%	-19.44%
32 Brownings Road, Cannington	325854	139005	1.8	9.68	9.89	11.97	21.03%	23.66%
41 High Street, Cannington	325416	139555	1.8	10.13	10.65	10.27	-3.57%	1.38%
44 Rodway, Cannington	325658	140150	1.8	12.61	12.99	10.02	-22.86%	-20.54%
45 High Street, Cannington	325406	139548	1.8	9.77	10.23	9.96	-2.64%	1.94%
45 Main Road, Cannington	326061	138989	1.8	15.96	16.49	16.15	-2.06%	1.19%
5 Belvedere Close, Cannington	325622	139894	1.8	9.10	9.26	8.41	-9.18%	-7.58%
6 Dame Withycombe Villas	325241	142114	1.8	11.63	11.90	14.28	20.00%	22.79%
7 Fore Street, Cannington	325763	139675	1.8	12.25	12.56	10.51	-16.32%	-14.20%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.10	7.12	7.80	9.55%	9.86%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2021 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/baseline' (worst-case)
Bolham Farm, Otterhampton	325490	141730	1.8	11.64	11.92	14.44	21.14%	24.05%
Bridgwater College, Cannington	325611	139705	1.8	8.26	8.39	8.20	-2.26%	-0.73%
Brymore Lodge	325104	139302	1.8	8.85	9.12	9.92	8.77%	12.09%
Brymore Lodge (external buildings)	325118	139259	1.8	9.01	9.29	10.11	8.83%	12.21%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.28	7.31	7.59	3.83%	4.26%
Cannington Primary School, Main Road	325927	139571	1.8	11.48	11.74	10.12	-13.80%	-11.85%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	11.34	11.64	14.29	22.77%	26.01%
Claylands Corner, Stogursey	322750	142811	1.8	10.50	10.74	12.92	20.30%	23.05%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.97	9.12	8.62	-5.48%	-3.90%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	10.56	10.77	12.65	17.46%	19.79%
Doggetts	320639	144643	1.8	7.20	7.23	7.48	3.46%	3.89%
Grange Lodge, Cannington	326112	138786	1.8	22.22	23.30	27.49	17.98%	23.72%
Gunters Grove, Stogursey	321220	144136	1.8	7.62	7.68	8.18	6.51%	7.35%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.08	7.10	7.94	11.83%	12.15%
Hill Farm House	324700	142405	1.8	10.94	11.21	13.55	20.87%	23.86%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2021 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/baseline' (worst-case)
Just Wall Cottage, Otterhampton	325383	142112	1.8	10.12	10.30	11.99	16.41%	18.48%
Kiln Close, Stogursey	322606	142702	1.8	7.16	7.19	7.41	3.06%	3.49%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.16	7.19	9.03	25.59%	26.12%
Lower House Farm, Shurton	320486	144455	1.8	6.96	6.97	7.08	1.58%	1.72%
Newham Farm, Shurton	320681	144142	1.8	6.97	6.99	7.10	1.57%	1.87%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	9.86	10.06	9.43	-6.26%	-4.36%
Putnell Barn, Cannington	325507	140634	1.8	14.55	14.98	18.85	25.83%	29.55%
Putnell Farm, Cannington	325650	141366	1.8	8.68	8.79	9.80	11.49%	12.90%
Putnell Farm (Rear of Property)	325724	141411	1.8	7.79	7.85	8.48	8.03%	8.86%
Rothay High Street, Cannington	325071	139199	1.8	9.34	9.60	11.30	17.71%	20.99%
Ryedale House, Rodway	325727	139748	1.8	10.29	10.52	9.05	-13.97%	-12.05%
The Lodge, Withycombe	324089	142500	1.8	14.66	15.17	19.60	29.20%	33.70%
Wick Cottage, Stogursey	321807	144219	1.8	8.00	8.08	8.81	9.03%	10.13%
Wick Pound Cottage, Wick	321595	144240	1.8	9.49	9.67	11.27	16.55%	18.76%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.23	7.27	10.74	47.73%	48.55%

Table 12E 44: Predicted 2013 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2013 'without development' PM_{10} ($\mu g/m^3$)	2013 'with development' PM_{10} ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	18.63	17.80	17.95	0.81%	-3.64%
15 Oak Tree Way, Cannington	325818	139119	1.8	18.47	17.68	17.73	0.28%	-4.03%
15 Withiel Drive, Cannington	325146	139547	1.8	18.34	17.57	17.62	0.26%	-3.92%
17 Fore Street, Cannington	325868	139667	1.8	20.06	18.94	19.05	0.57%	-5.06%
17 Mill Close, Cannington	325505	139372	1.8	18.36	17.59	17.63	0.24%	-3.96%
22 Withiel Drive, Cannington	325030	139501	1.8	18.33	17.57	17.60	0.19%	-3.99%
24 Riverside, Otterhampton	326064	142340	1.8	18.28	17.53	17.55	0.12%	-4.01%
3 Lonsdale Road, Cannington	325913	139294	1.8	20.28	19.11	19.21	0.53%	-5.28%
32 Brownings Road, Cannington	325854	139005	1.8	18.66	17.83	17.95	0.66%	-3.84%
41 High Street, Cannington	325416	139555	1.8	18.82	17.98	18.53	3.07%	-1.53%
44 Rodway, Cannington	325658	140150	1.8	19.27	18.32	18.73	2.21%	-2.82%
45 High Street, Cannington	325406	139548	1.8	18.75	17.92	18.41	2.70%	-1.84%
45 Main Road, Cannington	326061	138989	1.8	19.78	18.71	18.88	0.91%	-4.56%
5 Belvedere Close, Cannington	325622	139894	1.8	18.64	17.82	17.97	0.84%	-3.63%
6 Dame Withycombe Villas	325241	142114	1.8	19.05	18.13	18.32	1.08%	-3.81%
7 Fore Street, Cannington	325763	139675	1.8	19.20	18.26	18.38	0.69%	-4.25%
71 Estuary Park, Otterhampton	326008	142096	1.8	18.30	17.54	17.57	0.17%	-3.98%
Bolham Farm, Otterhampton	325490	141730	1.8	19.05	18.13	18.33	1.09%	-3.80%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2013 'without development' PM_{10} ($\mu g/m^3$)	2013 'with development' PM_{10} ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Bridgwater College, Cannington	325611	139705	1.8	18.49	17.70	17.80	0.60%	-3.72%
Brymore Lodge	325104	139302	1.8	18.58	17.77	18.03	1.47%	-2.92%
Brymore Lodge (external buildings)	325118	139259	1.8	18.60	17.79	18.06	1.51%	-2.90%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	18.32	17.56	17.57	0.06%	-4.10%
Cannington Primary School, Main Road	325927	139571	1.8	19.06	18.15	18.21	0.33%	-4.49%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	19.05	18.14	18.46	1.78%	-3.05%
Claylands Corner, Stogursey	322750	142811	1.8	18.89	18.02	18.28	1.46%	-3.24%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	18.62	17.79	17.87	0.40%	-4.04%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	18.87	17.99	18.14	0.86%	-3.86%
Doggetts	320639	144643	1.8	18.32	17.56	17.58	0.16%	-4.00%
Grange Lodge, Cannington	326112	138786	1.8	20.78	19.50	19.95	2.29%	-4.01%
Gunters Grove, Stogursey	321220	144136	1.8	18.39	17.61	17.67	0.33%	-3.90%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	18.29	17.54	17.55	0.08%	-4.06%
Hill Farm House	324700	142405	1.8	18.96	18.07	18.33	1.45%	-3.32%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} (µg/m^3)	2013 'without development' PM_{10} (µg/m^3)	2013 'with development' PM_{10} (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Just Wall Cottage, Otterhampton	325383	142112	1.8	18.79	17.93	18.06	0.75%	-3.89%
Kiln Close, Stogursey	322606	142702	1.8	18.31	17.55	17.57	0.14%	-4.01%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	18.30	17.55	17.56	0.11%	-4.04%
Lower House Farm, Shurton	320486	144455	1.8	18.28	17.52	17.53	0.07%	-4.06%
Newham Farm, Shurton	320681	144142	1.8	18.28	17.52	17.54	0.07%	-4.05%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	18.78	17.93	18.13	1.14%	-3.45%
Putnell Barn, Cannington	325507	140634	1.8	19.56	18.52	18.84	1.71%	-3.66%
Putnell Farm, Cannington	325650	141366	1.8	18.55	17.74	17.82	0.44%	-3.97%
Putnell Farm (Rear of Property)	325724	141411	1.8	18.41	17.63	17.67	0.25%	-4.01%
Rothay High Street, Cannington	325071	139199	1.8	18.63	17.81	18.02	1.16%	-3.29%
Ryedale House, Rodway	325727	139748	1.8	18.85	17.98	18.18	1.08%	-3.57%
The Lodge, Withycombe	324089	142500	1.8	19.65	18.63	19.20	3.04%	-2.32%
Wick Cottage, Stogursey	321807	144219	1.8	18.45	17.67	17.75	0.48%	-3.81%
Wick Pound Cottage, Wick	321595	144240	1.8	18.72	17.88	18.07	1.07%	-3.46%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	18.31	17.55	17.57	0.12%	-4.04%

Table 12E 45: Predicted 2016 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2016 'without development' PM_{10} ($\mu g/m^3$)	2016 'with development' PM_{10} ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	18.63	17.41	17.33	-0.44%	-6.94%
15 Oak Tree Way, Cannington	325818	139119	1.8	18.47	17.30	17.37	0.40%	-5.96%
15 Withiel Drive, Cannington	325146	139547	1.8	18.34	17.21	17.31	0.58%	-5.59%
17 Fore Street, Cannington	325868	139667	1.8	20.06	18.35	17.96	-2.08%	-10.46%
17 Mill Close, Cannington	325505	139372	1.8	18.36	17.23	17.27	0.23%	-5.95%
22 Withiel Drive, Cannington	325030	139501	1.8	18.33	17.21	17.44	1.33%	-4.87%
24 Riverside, Otterhampton	326064	142340	1.8	18.28	17.18	17.19	0.10%	-5.96%
3 Lonsdale Road, Cannington	325913	139294	1.8	20.28	18.49	18.09	-2.17%	-10.81%
32 Brownings Road, Cannington	325854	139005	1.8	18.66	17.43	17.66	1.28%	-5.39%
41 High Street, Cannington	325416	139555	1.8	18.82	17.54	17.54	-0.01%	-6.79%
44 Rodway, Cannington	325658	140150	1.8	19.27	17.85	17.56	-1.64%	-8.90%
45 High Street, Cannington	325406	139548	1.8	18.75	17.50	17.50	0.03%	-6.67%
45 Main Road, Cannington	326061	138989	1.8	19.78	18.16	18.15	-0.05%	-8.24%
5 Belvedere Close, Cannington	325622	139894	1.8	18.64	17.42	17.34	-0.47%	-6.99%
6 Dame Withycombe Villas	325241	142114	1.8	19.05	17.67	17.86	1.08%	-6.23%
7 Fore Street, Cannington	325763	139675	1.8	19.20	17.78	17.59	-1.08%	-8.38%
71 Estuary Park, Otterhampton	326008	142096	1.8	18.30	17.19	17.21	0.14%	-5.95%
Bolham Farm, Otterhampton	325490	141730	1.8	19.05	17.67	17.87	1.10%	-6.22%
Bridgwater College, Cannington	325611	139705	1.8	18.49	17.32	17.30	-0.08%	-6.43%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2016 'without development' PM_{10} ($\mu g/m^3$)	2016 'with development' PM_{10} ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
Brymore Lodge	325104	139302	1.8	18.58	17.38	17.47	0.54%	-5.96%
Brymore Lodge (external buildings)	325118	139259	1.8	18.60	17.39	17.49	0.56%	-5.97%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	18.32	17.20	17.23	0.16%	-5.95%
Cannington Primary School, Main Road	325927	139571	1.8	19.06	17.69	17.54	-0.84%	-7.98%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	19.05	17.70	17.91	1.19%	-5.98%
Claylands Corner, Stogursey	322750	142811	1.8	18.89	17.59	17.76	0.98%	-5.98%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	18.62	17.40	17.35	-0.25%	-6.78%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	18.87	17.56	17.70	0.85%	-6.17%
Doggetts	320639	144643	1.8	18.32	17.20	17.22	0.11%	-6.00%
Grange Lodge, Cannington	326112	138786	1.8	20.78	18.84	19.35	2.71%	-6.92%
Gunters Grove, Stogursey	321220	144136	1.8	18.39	17.25	17.29	0.22%	-5.99%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	18.29	17.18	17.26	0.44%	-5.66%
Hill Farm House	324700	142405	1.8	18.96	17.63	17.82	1.05%	-6.03%
HPC Accommodation 1	320696	144851	1.8	18.43	17.28	17.32	0.28%	-5.99%
HPC Accommodation 2	320726	144810	1.8	18.50	17.33	17.40	0.40%	-5.99%
HPC Accommodation 3	320603	144852	1.8	18.32	17.20	17.22	0.12%	-6.00%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/ baseline' PM_{10} ($\mu g/m^3$)	2016 'without development' PM_{10} ($\mu g/m^3$)	2016 'with development' PM_{10} ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
HPC Accommodation 4	320599	144797	1.8	18.32	17.20	17.22	0.11%	-6.00%
Just Wall Cottage, Otterhampton	325383	142112	1.8	18.79	17.51	17.64	0.75%	-6.15%
Kiln Close, Stogursey	322606	142702	1.8	18.31	17.19	17.21	0.10%	-6.00%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	18.30	17.19	17.36	0.96%	-5.18%
Lower House Farm, Shurton	320486	144455	1.8	18.28	17.17	17.18	0.05%	-6.00%
Newham Farm, Shurton	320681	144142	1.8	18.28	17.17	17.18	0.05%	-6.00%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	18.78	17.51	17.44	-0.38%	-7.10%
Putnell Barn, Cannington	325507	140634	1.8	19.56	18.00	18.33	1.84%	-6.26%
Putnell Farm, Cannington	325650	141366	1.8	18.55	17.35	17.43	0.44%	-6.08%
Putnell Farm (Rear of Property)	325724	141411	1.8	18.41	17.26	17.30	0.25%	-6.03%
Rothay High Street, Cannington	325071	139199	1.8	18.63	17.41	17.60	1.05%	-5.55%
Ryedale House, Rodway	325727	139748	1.8	18.85	17.56	17.42	-0.79%	-7.59%
The Lodge, Withycombe	324089	142500	1.8	19.65	18.11	18.48	2.04%	-5.97%
Wick Cottage, Stogursey	321807	144219	1.8	18.45	17.29	17.35	0.32%	-5.99%
Wick Pound Cottage, Wick	321595	144240	1.8	18.72	17.47	17.60	0.71%	-5.98%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	18.31	17.20	17.51	1.84%	-4.37%

Table 12E 46: Predicted 2021 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' PM_{10} ($\mu g/m^3$)	2021 'without development' PM_{10} ($\mu g/m^3$)	2021 'with development' PM_{10} ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	18.63	17.02	16.93	-0.52%	-9.11%
15 Oak Tree Way, Cannington	325818	139119	1.8	18.47	16.93	16.96	0.20%	-8.19%
15 Withiel Drive, Cannington	325146	139547	1.8	18.34	16.85	16.92	0.39%	-7.74%
17 Fore Street, Cannington	325868	139667	1.8	20.06	17.78	17.40	-2.13%	-13.28%
17 Mill Close, Cannington	325505	139372	1.8	18.36	16.87	16.89	0.12%	-8.04%
22 Withiel Drive, Cannington	325030	139501	1.8	18.33	16.85	17.01	0.95%	-7.22%
24 Riverside, Otterhampton	326064	142340	1.8	18.28	16.82	16.83	0.07%	-7.94%
3 Lonsdale Road, Cannington	325913	139294	1.8	20.28	17.89	17.49	-2.25%	-13.76%
32 Brownings Road, Cannington	325854	139005	1.8	18.66	17.04	17.16	0.74%	-8.03%
41 High Street, Cannington	325416	139555	1.8	18.82	17.13	17.10	-0.20%	-9.12%
44 Rodway, Cannington	325658	140150	1.8	19.27	17.39	17.09	-1.74%	-11.35%
45 High Street, Cannington	325406	139548	1.8	18.75	17.10	17.07	-0.15%	-8.97%
45 Main Road, Cannington	326061	138989	1.8	19.78	17.62	17.52	-0.57%	-11.41%
5 Belvedere Close, Cannington	325622	139894	1.8	18.64	17.03	16.93	-0.54%	-9.17%
6 Dame Withycombe Villas	325241	142114	1.8	19.05	17.22	17.29	0.40%	-9.22%
7 Fore Street, Cannington	325763	139675	1.8	19.20	17.32	17.12	-1.14%	-10.83%
71 Estuary Park, Otterhampton	326008	142096	1.8	18.30	16.83	16.84	0.09%	-7.95%
Bolham Farm, Otterhampton	325490	141730	1.8	19.05	17.22	17.30	0.42%	-9.21%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' PM_{10} ($\mu g/m^3$)	2021 'without development' PM_{10} ($\mu g/m^3$)	2021 'with development' PM_{10} ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
Bridgwater College, Cannington	325611	139705	1.8	18.49	16.94	16.91	-0.16%	-8.55%
Brymore Lodge	325104	139302	1.8	18.58	16.99	17.04	0.28%	-8.26%
Brymore Lodge (external buildings)	325118	139259	1.8	18.60	17.01	17.06	0.29%	-8.30%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	18.32	16.84	16.86	0.10%	-7.97%
Cannington Primary School, Main Road	325927	139571	1.8	19.06	17.24	17.09	-0.89%	-10.37%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	19.05	17.26	17.34	0.44%	-8.98%
Claylands Corner, Stogursey	322750	142811	1.8	18.89	17.17	17.24	0.36%	-8.78%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	18.62	17.00	16.95	-0.31%	-8.96%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	18.87	17.13	17.18	0.32%	-8.94%
Doggetts	320639	144643	1.8	18.32	16.84	16.85	0.04%	-8.02%
Grange Lodge, Cannington	326112	138786	1.8	20.78	18.19	18.39	1.11%	-11.52%
Gunters Grove, Stogursey	321220	144136	1.8	18.39	16.88	16.90	0.08%	-8.12%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	18.29	16.83	16.88	0.30%	-7.74%
Hill Farm House	324700	142405	1.8	18.96	17.20	17.27	0.39%	-8.92%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' PM_{10} ($\mu g/m^3$)	2021 'without development' PM_{10} ($\mu g/m^3$)	2021 'with development' PM_{10} ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
Just Wall Cottage, Otterhampton	325383	142112	1.8	18.79	17.09	17.14	0.28%	-8.82%
Kiln Close, Stogursey	322606	142702	1.8	18.31	16.84	16.84	0.04%	-8.01%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	18.30	16.83	16.95	0.68%	-7.41%
Lower House Farm, Shurton	320486	144455	1.8	18.28	16.82	16.82	0.02%	-7.97%
Newham Farm, Shurton	320681	144142	1.8	18.28	16.82	16.82	0.02%	-7.97%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	18.78	17.10	17.01	-0.56%	-9.43%
Putnell Barn, Cannington	325507	140634	1.8	19.56	17.49	17.62	0.74%	-9.90%
Putnell Farm, Cannington	325650	141366	1.8	18.55	16.96	16.99	0.17%	-8.42%
Putnell Farm (Rear of Property)	325724	141411	1.8	18.41	16.89	16.90	0.10%	-8.18%
Rothay High Street, Cannington	325071	139199	1.8	18.63	17.02	17.13	0.63%	-8.04%
Ryedale House, Rodway	325727	139748	1.8	18.85	17.14	16.99	-0.87%	-9.86%
The Lodge, Withycombe	324089	142500	1.8	19.65	17.61	17.74	0.77%	-9.72%
Wick Cottage, Stogursey	321807	144219	1.8	18.45	16.92	16.94	0.12%	-8.21%
Wick Pound Cottage, Wick	321595	144240	1.8	18.72	17.07	17.12	0.27%	-8.55%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	18.31	16.84	17.06	1.33%	-6.83%

Table 12E 47: Predicted 2013 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ ($\mu g/m^3$)	2013 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2013 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	8.19	7.64	7.75	1.38%	-5.32%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.07	7.55	7.59	0.48%	-5.93%
15 Withiel Drive, Cannington	325146	139547	1.8	7.97	7.48	7.51	0.44%	-5.70%
17 Fore Street, Cannington	325868	139667	1.8	9.31	8.48	8.56	0.93%	-8.09%
17 Mill Close, Cannington	325505	139372	1.8	7.98	7.49	7.52	0.41%	-5.78%
22 Withiel Drive, Cannington	325030	139501	1.8	7.96	7.47	7.50	0.32%	-5.81%
24 Riverside, Otterhampton	326064	142340	1.8	7.92	7.45	7.46	0.21%	-5.82%
3 Lonsdale Road, Cannington	325913	139294	1.8	9.48	8.60	8.68	0.85%	-8.47%
32 Brownings Road, Cannington	325854	139005	1.8	8.22	7.66	7.75	1.10%	-5.69%
41 High Street, Cannington	325416	139555	1.8	8.33	7.77	8.17	5.14%	-1.97%
44 Rodway, Cannington	325658	140150	1.8	8.68	8.02	8.31	3.69%	-4.22%
45 High Street, Cannington	325406	139548	1.8	8.28	7.73	8.08	4.53%	-2.45%
45 Main Road, Cannington	326061	138989	1.8	9.09	8.31	8.44	1.51%	-7.22%
5 Belvedere Close, Cannington	325622	139894	1.8	8.20	7.65	7.76	1.42%	-5.31%
6 Dame Withycombe Villas	325241	142114	1.8	8.53	7.89	8.03	1.81%	-5.80%
7 Fore Street, Cannington	325763	139675	1.8	8.64	7.98	8.07	1.15%	-6.55%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.93	7.45	7.48	0.29%	-5.78%
Bolham Farm, Otterhampton	325490	141730	1.8	8.53	7.89	8.04	1.83%	-5.78%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ (µg/m^3)	2013 'without development' $PM_{2.5}$ (µg/m^3)	2013 'with development' $PM_{2.5}$ (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Bridgwater College, Cannington	325611	139705	1.8	8.08	7.57	7.65	1.02%	-5.42%
Brymore Lodge	325104	139302	1.8	8.15	7.62	7.81	2.48%	-4.15%
Brymore Lodge (external buildings)	325118	139259	1.8	8.17	7.64	7.83	2.55%	-4.12%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.95	7.47	7.47	0.11%	-5.98%
Cannington Primary School, Main Road	325927	139571	1.8	8.53	7.90	7.94	0.56%	-6.89%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	8.51	7.89	8.12	2.99%	-4.52%
Claylands Corner, Stogursey	322750	142811	1.8	8.39	7.80	7.99	2.46%	-4.76%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.18	7.64	7.69	0.67%	-6.00%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	8.39	7.79	7.90	1.45%	-5.80%
Doggetts	320639	144643	1.8	7.95	7.47	7.49	0.28%	-5.81%
Grange Lodge, Cannington	326112	138786	1.8	9.88	8.90	9.22	3.68%	-6.66%
Gunters Grove, Stogursey	321220	144136	1.8	8.00	7.51	7.55	0.57%	-5.67%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.93	7.45	7.46	0.13%	-5.91%
Hill Farm House	324700	142405	1.8	8.45	7.84	8.03	2.44%	-4.94%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ ($\mu g/m^3$)	2013 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2013 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Just Wall Cottage, Otterhampton	325383	142112	1.8	8.33	7.74	7.84	1.27%	-5.83%
Kiln Close, Stogursey	322606	142702	1.8	7.94	7.46	7.48	0.24%	-5.84%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.94	7.46	7.47	0.19%	-5.88%
Lower House Farm, Shurton	320486	144455	1.8	7.92	7.44	7.45	0.12%	-5.89%
Newham Farm, Shurton	320681	144142	1.8	7.92	7.44	7.45	0.12%	-5.89%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	8.30	7.73	7.88	1.93%	-5.08%
Putnell Barn, Cannington	325507	140634	1.8	8.93	8.19	8.42	2.81%	-5.73%
Putnell Farm, Cannington	325650	141366	1.8	8.14	7.60	7.66	0.74%	-5.86%
Putnell Farm (Rear of Property)	325724	141411	1.8	8.02	7.52	7.55	0.43%	-5.87%
Rothay High Street, Cannington	325071	139199	1.8	8.19	7.65	7.80	1.96%	-4.77%
Ryedale House, Rodway	325727	139748	1.8	8.36	7.78	7.92	1.83%	-5.30%
The Lodge, Withycombe	324089	142500	1.8	8.97	8.24	8.65	5.02%	-3.58%
Wick Cottage, Stogursey	321807	144219	1.8	8.05	7.54	7.61	0.82%	-5.55%
Wick Pound Cottage, Wick	321595	144240	1.8	8.25	7.70	7.84	1.81%	-5.07%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.95	7.46	7.48	0.21%	-5.87%

Table 12E 48: Predicted 2016 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ ($\mu g/m^3$)	2016 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2016 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	8.19	7.38	7.33	-0.71%	-10.45%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.07	7.31	7.36	0.63%	-8.82%
15 Withiel Drive, Cannington	325146	139547	1.8	7.97	7.25	7.32	0.93%	-8.13%
17 Fore Street, Cannington	325868	139667	1.8	9.31	8.03	7.77	-3.28%	-16.56%
17 Mill Close, Cannington	325505	139372	1.8	7.98	7.26	7.29	0.36%	-8.72%
22 Withiel Drive, Cannington	325030	139501	1.8	7.96	7.25	7.40	2.13%	-7.02%
24 Riverside, Otterhampton	326064	142340	1.8	7.92	7.22	7.24	0.16%	-8.66%
3 Lonsdale Road, Cannington	325913	139294	1.8	9.48	8.13	7.85	-3.40%	-17.16%
32 Brownings Road, Cannington	325854	139005	1.8	8.22	7.40	7.55	2.04%	-8.11%
41 High Street, Cannington	325416	139555	1.8	8.33	7.47	7.47	-0.02%	-10.35%
44 Rodway, Cannington	325658	140150	1.8	8.68	7.68	7.48	-2.58%	-13.81%
45 High Street, Cannington	325406	139548	1.8	8.28	7.44	7.45	0.04%	-10.12%
45 Main Road, Cannington	326061	138989	1.8	9.09	7.90	7.89	-0.11%	-13.19%
5 Belvedere Close, Cannington	325622	139894	1.8	8.20	7.39	7.34	-0.75%	-10.53%
6 Dame Withycombe Villas	325241	142114	1.8	8.53	7.57	7.70	1.71%	-9.71%
7 Fore Street, Cannington	325763	139675	1.8	8.64	7.64	7.51	-1.73%	-13.04%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.93	7.23	7.25	0.23%	-8.65%
Bolham Farm, Otterhampton	325490	141730	1.8	8.53	7.57	7.70	1.74%	-9.69%
Bridgwater College, Cannington	325611	139705	1.8	8.08	7.32	7.31	-0.13%	-9.56%

Receptor name	X(m)	Y(m)	Z(m)	2009 ‘model verification/baseline’ $PM_{2.5}$ (µg/m^3)	2016 ‘without development’ $PM_{2.5}$ (µg/m^3)	2016 ‘with development’ $PM_{2.5}$ (µg/m^3)	% change 2016 ‘with development’ compared to 2016 ‘without development’	% change 2016 ‘with development’ compared to 2009 ‘model verification/baseline’
Brymore Lodge	325104	139302	1.8	8.15	7.36	7.42	0.86%	-8.89%
Brymore Lodge (external buildings)	325118	139259	1.8	8.17	7.37	7.44	0.89%	-8.93%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.95	7.24	7.26	0.25%	-8.68%
Cannington Primary School, Main Road	325927	139571	1.8	8.53	7.58	7.47	-1.36%	-12.36%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	8.51	7.58	7.72	1.87%	-9.27%
Claylands Corner, Stogursey	322750	142811	1.8	8.39	7.51	7.62	1.54%	-9.16%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.18	7.38	7.35	-0.40%	-10.21%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	8.39	7.49	7.59	1.35%	-9.48%
Doggetts	320639	144643	1.8	7.95	7.24	7.25	0.18%	-8.74%
Grange Lodge, Cannington	326112	138786	1.8	9.88	8.37	8.72	4.15%	-11.76%
Gunters Grove, Stogursey	321220	144136	1.8	8.00	7.27	7.30	0.36%	-8.80%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.93	7.23	7.28	0.70%	-8.20%
Hill Farm House	324700	142405	1.8	8.45	7.54	7.66	1.66%	-9.30%
HPC Accommodation 1	320696	144851	1.8	8.03	7.29	7.32	0.45%	-8.83%
HPC Accommodation 2	320726	144810	1.8	8.09	7.33	7.37	0.63%	-8.88%
HPC Accommodation 3	320603	144852	1.8	7.95	7.24	7.26	0.19%	-8.75%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ ($\mu g/m^3$)	2016 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2016 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
HPC Accommodation 4	320599	144797	1.8	7.95	7.24	7.25	0.18%	-8.74%
Just Wall Cottage, Otterhampton	325383	142112	1.8	8.33	7.46	7.55	1.19%	-9.39%
Kiln Close, Stogursey	322606	142702	1.8	7.94	7.24	7.25	0.16%	-8.74%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.94	7.23	7.35	1.54%	-7.47%
Lower House Farm, Shurton	320486	144455	1.8	7.92	7.22	7.23	0.08%	-8.71%
Newham Farm, Shurton	320681	144142	1.8	7.92	7.22	7.23	0.08%	-8.72%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	8.30	7.45	7.41	-0.62%	-10.79%
Putnell Barn, Cannington	325507	140634	1.8	8.93	7.80	8.03	2.88%	-10.11%
Putnell Farm, Cannington	325650	141366	1.8	8.14	7.35	7.40	0.70%	-9.08%
Putnell Farm (Rear of Property)	325724	141411	1.8	8.02	7.28	7.31	0.39%	-8.88%
Rothay High Street, Cannington	325071	139199	1.8	8.19	7.39	7.51	1.67%	-8.32%
Ryedale House, Rodway	325727	139748	1.8	8.36	7.49	7.39	-1.27%	-11.60%
The Lodge, Withycombe	324089	142500	1.8	8.97	7.86	8.11	3.17%	-9.66%
Wick Cottage, Stogursey	321807	144219	1.8	8.05	7.30	7.34	0.51%	-8.85%
Wick Pound Cottage, Wick	321595	144240	1.8	8.25	7.42	7.51	1.13%	-9.03%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.95	7.24	7.45	2.94%	-6.21%

Table 12E 49: Predicted 2021 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Cannington Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ ($\mu g/m^3$)	2021 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2021 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
1 Park Lane, Cannington	325612	140008	1.8	8.19	7.13	7.08	-0.77%	-13.56%
15 Oak Tree Way, Cannington	325818	139119	1.8	8.07	7.07	7.10	0.29%	-12.07%
15 Withiel Drive, Cannington	325146	139547	1.8	7.97	7.03	7.07	0.58%	-11.25%
17 Fore Street, Cannington	325868	139667	1.8	9.31	7.61	7.37	-3.11%	-20.82%
17 Mill Close, Cannington	325505	139372	1.8	7.98	7.04	7.05	0.18%	-11.70%
22 Withiel Drive, Cannington	325030	139501	1.8	7.96	7.03	7.13	1.40%	-10.49%
24 Riverside, Otterhampton	326064	142340	1.8	7.92	7.01	7.01	0.09%	-11.45%
3 Lonsdale Road, Cannington	325913	139294	1.8	9.48	7.68	7.43	-3.28%	-21.64%
32 Brownings Road, Cannington	325854	139005	1.8	8.22	7.14	7.22	1.08%	-12.11%
41 High Street, Cannington	325416	139555	1.8	8.33	7.20	7.18	-0.29%	-13.80%
44 Rodway, Cannington	325658	140150	1.8	8.68	7.36	7.17	-2.55%	-17.37%
45 High Street, Cannington	325406	139548	1.8	8.28	7.18	7.16	-0.22%	-13.51%
45 Main Road, Cannington	326061	138989	1.8	9.09	7.51	7.45	-0.86%	-18.09%
5 Belvedere Close, Cannington	325622	139894	1.8	8.20	7.14	7.08	-0.80%	-13.66%
6 Dame Withycombe Villas	325241	142114	1.8	8.53	7.27	7.31	0.57%	-14.33%
7 Fore Street, Cannington	325763	139675	1.8	8.64	7.32	7.20	-1.68%	-16.66%
71 Estuary Park, Otterhampton	326008	142096	1.8	7.93	7.01	7.02	0.13%	-11.49%
Bolham Farm, Otterhampton	325490	141730	1.8	8.53	7.27	7.31	0.60%	-14.32%

Receptor name	X(m)	Y(m)	Z(m)	2009 ‘model verification/baseline’ $PM_{2.5}$ ($\mu g/m^3$)	2021 ‘without development’ $PM_{2.5}$ ($\mu g/m^3$)	2021 ‘with development’ $PM_{2.5}$ ($\mu g/m^3$)	% change 2021 ‘with development’ compared to 2021 ‘without development’	% change 2021 ‘with development’ compared to 2009 ‘model verification/baseline’
Bridgwater College, Cannington	325611	139705	1.8	8.08	7.08	7.07	-0.24%	-12.60%
Brymore Lodge	325104	139302	1.8	8.15	7.12	7.15	0.42%	-12.30%
Brymore Lodge (external buildings)	325118	139259	1.8	8.17	7.12	7.15	0.42%	-12.39%
Brymore Secondary Technical School, Cannington	324645	139402	1.8	7.95	7.02	7.03	0.15%	-11.53%
Cannington Primary School, Main Road	325927	139571	1.8	8.53	7.27	7.17	-1.32%	-15.88%
Clayland Corner Bungalow, Stockland Bristol	322737	142957	1.8	8.51	7.28	7.33	0.63%	-13.88%
Claylands Corner, Stogursey	322750	142811	1.8	8.39	7.23	7.26	0.52%	-13.43%
Court Cottage, Fore Street, Cannington	325768	139588	1.8	8.18	7.12	7.09	-0.47%	-13.35%
Dame Withycombe Cottage, Withycombe Hill	325011	142453	1.8	8.39	7.21	7.24	0.45%	-13.69%
Doggetts	320639	144643	1.8	7.95	7.02	7.03	0.06%	-11.61%
Grange Lodge, Cannington	326112	138786	1.8	9.88	7.87	7.99	1.56%	-19.11%
Gunters Grove, Stogursey	321220	144136	1.8	8.00	7.05	7.06	0.12%	-11.85%
Hensfield Farm, Chad's Hill, Cannington	325037	140186	1.8	7.93	7.01	7.04	0.45%	-11.17%
Hill Farm House	324700	142405	1.8	8.45	7.25	7.29	0.56%	-13.73%

Receptor name	X(m)	Y(m)	Z(m)	2009 ‘model verification/baseline’ $PM_{2.5}$ (µg/m^3)	2021 ‘without development’ $PM_{2.5}$ (µg/m^3)	2021 ‘with development’ $PM_{2.5}$ (µg/m^3)	% change 2021 ‘with development’ compared to 2021 ‘without development’	% change 2021 ‘with development’ compared to 2009 ‘model verification/baseline’
Just Wall Cottage, Otterhampton	325383	142112	1.8	8.33	7.18	7.21	0.40%	-13.43%
Kiln Close, Stogursey	322606	142702	1.8	7.94	7.02	7.02	0.05%	-11.59%
Knapp Farm, Chad's Hill, Cannington	325206	139998	1.8	7.94	7.02	7.09	1.01%	-10.73%
Lower House Farm, Shurton	320486	144455	1.8	7.92	7.01	7.01	0.03%	-11.47%
Newham Farm, Shurton	320681	144142	1.8	7.92	7.01	7.01	0.03%	-11.48%
Pavilion 58 m Rodway, Cannington	325626	140438	1.8	8.30	7.18	7.12	-0.83%	-14.19%
Putnell Barn, Cannington	325507	140634	1.8	8.93	7.44	7.51	1.04%	-15.85%
Putnell Farm, Cannington	325650	141366	1.8	8.14	7.10	7.12	0.24%	-12.54%
Putnell Farm (Rear of Property)	325724	141411	1.8	8.02	7.05	7.06	0.15%	-11.98%
Rothay High Street, Cannington	325071	139199	1.8	8.19	7.13	7.20	0.93%	-12.07%
Ryedale House, Rodway	325727	139748	1.8	8.36	7.21	7.12	-1.28%	-14.88%
The Lodge, Withycombe	324089	142500	1.8	8.97	7.50	7.58	1.07%	-15.56%
Wick Cottage, Stogursey	321807	144219	1.8	8.05	7.07	7.08	0.17%	-12.06%
Wick Pound Cottage, Wick	321595	144240	1.8	8.25	7.16	7.19	0.38%	-12.89%
Withiel Farm, Withiel Drive, Cannington	324987	139620	1.8	7.95	7.02	7.16	1.96%	-9.92%

Table 12E 50: Predicted 2013 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_2 ($\mu g/m^3$)	2013 'without development' NO_2 ($\mu g/m^3$)	2013 'with development' NO_2 ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	7.13	5.98	5.99	0.17%	-15.99%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.99	7.51	7.55	0.53%	-16.02%
Kafue, 33 Five Bells	306662	142083	1.8	7.12	5.98	5.98	0.00%	-16.01%
Post Office, Williton	307714	141012	1.8	24.66	20.70	21.28	2.80%	-13.71%
Smithyard Cottage	306307	141850	1.8	11.35	9.41	9.53	1.28%	-16.04%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	9.94	8.28	8.31	0.36%	-16.40%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	14.04	11.67	11.74	0.60%	-16.38%
Washford Hill, Watchett	306484	142253	1.8	7.09	5.95	5.95	0.00%	-16.08%
Williton County Stores	307737	140954	1.8	39.46	34.27	35.37	3.21%	-10.36%

Table 12E 51: Worst-case predicted 2013 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_2 ($\mu g/m^3$)	2013 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2013 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
39 Five Bells	306532	142144	1.8	7.13	7.17	7.18	0.14%	0.70%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.99	9.23	9.27	0.43%	3.11%
Kafue, 33 Five Bells	306662	142083	1.8	7.12	7.16	7.17	0.14%	0.70%
Post Office, Williton	307714	141012	1.8	24.66	26.03	26.67	2.46%	8.15%
Smithyard Cottage	306307	141850	1.8	11.35	11.98	12.13	1.25%	6.87%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	9.94	10.29	10.33	0.39%	3.92%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	14.04	14.80	14.88	0.54%	5.98%
Washford Hill, Watchett	306484	142253	1.8	7.09	7.12	7.13	0.14%	0.56%
Williton County Stores	307737	140954	1.8	39.46	41.66	42.74	2.59%	8.31%

Table 12E 52: Predicted 2016 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$)	2016 'with development' NO_2 ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	7.13	5.28	5.28	0.00%	-25.95%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.99	6.42	6.45	0.47%	-28.25%
Kafue, 33 Five Bells	306662	142083	1.8	7.12	5.28	5.28	0.00%	-25.84%
Post Office, Williton	307714	141012	1.8	24.66	16.50	17.00	3.03%	-31.06%
Smithyard Cottage	306307	141850	1.8	11.35	7.54	7.65	1.46%	-32.60%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	9.94	6.94	6.97	0.43%	-29.88%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	14.04	9.43	9.49	0.64%	-32.41%
Washford Hill, Watchett	306484	142253	1.8	7.09	5.25	5.26	0.19%	-25.81%
Williton County Stores	307737	140954	1.8	39.46	27.67	28.46	2.86%	-27.88%

Table 12E 53: Worst-case predicted 2016 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_2 ($\mu g/m^3$)	2016 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2016 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/baseline' (worst-case)
39 Five Bells	306532	142144	1.8	7.13	7.17	7.18	0.14%	0.70%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.99	9.23	9.27	0.43%	3.11%
Kafue, 33 Five Bells	306662	142083	1.8	7.12	7.17	7.17	0.00%	0.70%
Post Office, Williton	307714	141012	1.8	24.66	26.08	26.67	2.26%	8.15%
Smithyard Cottage	306307	141850	1.8	11.35	11.98	12.13	1.25%	6.87%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	9.94	10.29	10.33	0.39%	3.92%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	14.04	14.80	14.88	0.54%	5.98%
Washford Hill, Watchett	306484	142253	1.8	7.09	7.13	7.13	0.00%	0.56%
Williton County Stores	307737	140954	1.8	39.46	41.95	42.74	1.88%	8.31%

Table 12E 54: Predicted 2021 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$)	2021 'with development' NO_2 ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	7.13	4.43	4.43	0.00%	-37.87%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.99	5.13	5.15	0.39%	-42.71%
Kafue, 33 Five Bells	306662	142083	1.8	7.12	4.43	4.44	0.23%	-37.64%
Post Office, Williton	307714	141012	1.8	24.66	11.44	11.84	3.50%	-51.99%
Smithyard Cottage	306307	141850	1.8	11.35	5.57	5.66	1.62%	-50.13%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	9.94	5.41	5.43	0.37%	-45.37%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	14.04	6.90	6.94	0.58%	-50.57%
Washford Hill, Watchett	306484	142253	1.8	7.09	4.42	4.42	0.00%	-37.66%
Williton County Stores	307737	140954	1.8	39.46	18.84	19.49	3.45%	-50.61%

Table 12E 55: Worst-case predicted 2021 NO_2 annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_2 ($\mu g/m^3$)	2021 'without development' NO_2 ($\mu g/m^3$) (worst-case)	2021 'with development' NO_2 ($\mu g/m^3$) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/baseline' (worst-case)
39 Five Bells	306532	142144	1.8	7.13	7.17	7.18	0.14%	0.70%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.99	9.23	9.27	0.43%	3.11%
Kafue, 33 Five Bells	306662	142083	1.8	7.12	7.17	7.17	0.00%	0.70%
Post Office, Williton	307714	141012	1.8	24.66	26.08	26.67	2.26%	8.15%
Smithyard Cottage	306307	141850	1.8	11.35	11.98	12.13	1.25%	6.87%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	9.94	10.29	10.33	0.39%	3.92%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	14.04	14.80	14.88	0.54%	5.98%
Washford Hill, Watchett	306484	142253	1.8	7.09	7.13	7.13	0.00%	0.56%
Williton County Stores	307737	140954	1.8	39.46	41.95	42.75	1.91%	8.34%

Table 12E 56: Predicted 2013 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' PM_{10} ($\mu g/m^3$)	2013 'without development' PM_{10} ($\mu g/m^3$)	2013 'with development' PM_{10} ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	18.28	17.53	17.53	0.01%	-4.10%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	18.51	17.73	17.74	0.04%	-4.17%
Kafue, 33 Five Bells	306662	142083	1.8	18.28	17.53	17.53	0.01%	-4.10%
Post Office, Williton	307714	141012	1.8	20.85	19.70	19.85	0.77%	-4.78%
Smithyard Cottage	306307	141850	1.8	18.61	17.83	17.86	0.15%	-4.03%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	18.60	17.81	17.82	0.04%	-4.20%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	19.08	18.23	18.25	0.08%	-4.36%
Washford Hill, Watchett	306484	142253	1.8	18.28	17.53	17.53	0.01%	-4.10%
Williton County Stores	307737	140954	1.8	23.56	21.98	22.30	1.44%	-5.36%

Table 12E 57: Predicted 2016 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' PM_{10} ($\mu g/m^3$)	2016 'without development' PM_{10} ($\mu g/m^3$)	2016 'with development' PM_{10} ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	18.28	17.18	17.18	0.01%	-6.03%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	18.51	17.34	17.35	0.04%	-6.26%
Kafue, 33 Five Bells	306662	142083	1.8	18.28	17.18	17.18	0.01%	-6.04%
Post Office, Williton	307714	141012	1.8	20.85	19.01	19.13	0.63%	-8.26%
Smithyard Cottage	306307	141850	1.8	18.61	17.42	17.44	0.13%	-6.25%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	18.60	17.41	17.41	0.04%	-6.36%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	19.08	17.76	17.77	0.07%	-6.85%
Washford Hill, Watchett	306484	142253	1.8	18.28	17.18	17.18	0.01%	-6.03%
Williton County Stores	307737	140954	1.8	23.56	20.98	21.18	0.96%	-10.12%

Table 12E 58: Predicted 2021 PM_{10} annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' PM_{10} (µg/m^3)	2021 'without development' PM_{10} (µg/m^3)	2021 'with development' PM_{10} (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	18.28	16.82	16.82	0.01%	-7.98%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	18.51	16.96	16.96	0.03%	-8.36%
Kafue, 33 Five Bells	306662	142083	1.8	18.28	16.82	16.82	0.01%	-7.99%
Post Office, Williton	307714	141012	1.8	20.85	18.33	18.43	0.54%	-11.61%
Smithyard Cottage	306307	141850	1.8	18.61	17.02	17.04	0.11%	-8.44%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	18.60	17.01	17.01	0.03%	-8.51%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	19.08	17.30	17.31	0.06%	-9.29%
Washford Hill, Watchett	306484	142253	1.8	18.28	16.82	16.82	0.01%	-7.98%
Williton County Stores	307737	140954	1.8	23.56	19.94	20.11	0.84%	-14.65%

Table 12E 59: Predicted 2013 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ (µg/m^3)	2013 'without development' $PM_{2.5}$ (µg/m^3)	2013 'with development' $PM_{2.5}$ (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	7.92	7.45	7.45	0.02%	-5.97%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.10	7.59	7.60	0.08%	-6.18%
Kafue, 33 Five Bells	306662	142083	1.8	7.92	7.45	7.45	0.02%	-5.98%
Post Office, Williton	307714	141012	1.8	9.90	9.02	9.12	1.20%	-7.87%
Smithyard Cottage	306307	141850	1.8	8.18	7.66	7.68	0.26%	-6.01%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	8.17	7.65	7.65	0.07%	-6.27%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	8.54	7.96	7.97	0.13%	-6.71%
Washford Hill, Watchett	306484	142253	1.8	7.92	7.45	7.45	0.01%	-5.97%
Williton County Stores	307737	140954	1.8	12.01	10.67	10.90	2.14%	-9.22%

Table 12E 60: Predicted 2016 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ (µg/m^3)	2016 'without development' $PM_{2.5}$ (µg/m^3)	2016 'with development' $PM_{2.5}$ (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	7.92	7.23	7.23	0.01%	-8.78%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.10	7.34	7.34	0.06%	-9.33%
Kafue, 33 Five Bells	306662	142083	1.8	7.92	7.23	7.23	0.01%	-8.78%
Post Office, Williton	307714	141012	1.8	9.90	8.47	8.55	0.96%	-13.69%
Smithyard Cottage	306307	141850	1.8	8.18	7.39	7.40	0.21%	-9.43%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	8.17	7.38	7.39	0.06%	-9.55%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	8.54	7.62	7.63	0.11%	-10.67%
Washford Hill, Watchett	306484	142253	1.8	7.92	7.22	7.22	0.01%	-8.77%
Williton County Stores	307737	140954	1.8	12.01	9.81	9.95	1.40%	-17.18%

Table 12E 61: Predicted 2021 $PM_{2.5}$ annual mean concentrations for human receptor locations along road transport routes in the Williton Model.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' $PM_{2.5}$ ($\mu g/m^3$)	2021 'without development' $PM_{2.5}$ ($\mu g/m^3$)	2021 'with development' $PM_{2.5}$ ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
39 Five Bells	306532	142144	1.8	7.92	7.01	7.01	0.01%	-11.51%
Bohays Lodge, Smithyard Lane	306413	141003	1.8	8.10	7.09	7.10	0.05%	-12.37%
Kafue, 33 Five Bells	306662	142083	1.8	7.92	7.01	7.01	0.01%	-11.52%
Post Office, Williton	307714	141012	1.8	9.90	7.94	8.00	0.78%	-19.19%
Smithyard Cottage	306307	141850	1.8	8.18	7.13	7.14	0.17%	-12.66%
Tropiquaria Zoo (back), Washford Cross	305800	141016	1.8	8.17	7.13	7.13	0.04%	-12.71%
Tropiquaria Zoo (front), Washford Cross	305809	140925	1.8	8.54	7.30	7.31	0.09%	-14.43%
Washford Hill, Watchett	306484	142253	1.8	7.92	7.01	7.01	0.01%	-11.50%
Williton County Stores	307737	140954	1.8	12.01	8.94	9.05	1.17%	-24.64%

Table 12E 62: Predicted 2013 NO_x concentrations for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x (µg/m^3)	2013 'without development' NO_x (µg/m^3)	2013 'with development' NO_x (µg/m^3)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Annual Mean								
Main Eco Receptor 1a	320773	145365	1.8	20.90	16.53	25.32	53.22%	21.15%
Main Eco Receptor 2a	320737	145278	1.8	20.68	16.37	24.96	52.49%	20.65%
Main Eco Receptor 3a	320710	145161	1.8	22.90	18.01	28.66	59.15%	25.15%
Main Eco Receptor 1b	320778	145365	1.8	19.33	15.37	22.69	47.68%	17.36%
Main Eco Receptor 2b	320742	145278	1.8	19.21	15.27	22.47	47.17%	17.01%
Main Eco Receptor 3b	320715	145161	1.8	20.77	16.43	25.09	52.71%	20.79%
Main Eco Receptor 1c	320783	145365	1.8	18.21	14.53	20.80	43.14%	14.22%
Main Eco Receptor 2c	320747	145278	1.8	18.14	14.48	20.68	42.84%	14.01%
Main Eco Receptor 3c	320720	145161	1.8	19.31	15.35	22.64	47.52%	17.24%
Comb Eco Receptor 1a	326296	142034	1.8	11.98	9.91	11.19	12.86%	-6.59%
Comb Eco Receptor 2a	326068	142304	1.8	11.98	9.92	10.87	9.60%	-9.29%
Comb Eco Receptor 1b	326301	142034	1.8	11.97	9.91	11.12	12.19%	-7.15%
Comb Eco Receptor 2b	326068	142309	1.8	11.98	9.91	10.81	9.05%	-9.75%
Comb Eco Receptor 1c	326306	142034	1.8	11.97	9.91	11.06	11.59%	-7.64%
Comb Eco Receptor 2c	326068	142314	1.8	11.98	9.91	10.76	8.58%	-10.13%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x ($\mu g/m^3$)	2013 'without development' NO_x ($\mu g/m^3$)	2013 'with development' NO_x ($\mu g/m^3$)	% change 2013 'with development' compared to 2013 'without development'	% change 2013 'with development' compared to 2009 'model verification/baseline'
Daily Mean								
Main Eco Receptor 1a	320773	145365	1.8	62.07	48.06	84.41	75.61%	35.99%
Main Eco Receptor 2a	320737	145278	1.8	61.18	47.41	82.78	74.62%	35.31%
Main Eco Receptor 3a	320710	145161	1.8	63.59	49.19	86.48	75.83%	36.01%
Main Eco Receptor 1b	320778	145365	1.8	56.13	43.67	74.19	69.88%	32.16%
Main Eco Receptor 2b	320742	145278	1.8	55.49	43.19	73.12	69.28%	31.77%
Main Eco Receptor 3b	320715	145161	1.8	56.36	43.83	74.28	69.47%	31.80%
Main Eco Receptor 1c	320783	145365	1.8	51.74	40.42	66.96	65.67%	29.40%
Main Eco Receptor 2c	320747	145278	1.8	51.28	40.07	66.18	65.14%	29.05%
Main Eco Receptor 3c	320720	145161	1.8	51.36	40.13	66.11	64.75%	28.72%
Comb Eco Receptor 1a	326296	142034	1.8	25.15	20.72	26.00	25.47%	3.35%
Comb Eco Receptor 2a	326068	142304	1.8	24.85	20.49	26.23	28.04%	5.58%
Comb Eco Receptor 1b	326301	142034	1.8	25.14	20.71	25.76	24.38%	2.47%
Comb Eco Receptor 2b	326068	142309	1.8	24.84	20.48	25.86	26.29%	4.14%
Comb Eco Receptor 1c	326306	142034	1.8	25.13	20.71	25.55	23.41%	1.67%
Comb Eco Receptor 2c	326068	142314	1.8	24.83	20.48	25.55	24.78%	2.90%

Table 12E 63: Worst-case predicted 2013 NO_x concentrations for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x ($\mu g/m^3$)	2013 'without development' NO_x ($\mu g/m^3$) (worst-case)	2013 'with development' NO_x ($\mu g/m^3$) (worst-case)	% change 2013 'with development' compared to 2013 'without development' (worst-case)	% change 2013 'with development' compared to 2009 'model verification/baseline' (worst-case)
Annual Mean								
Main Eco Receptor 1a	320773	145365	1.8	20.90	20.99	34.44	64.08%	64.79%
Main Eco Receptor 2a	320737	145278	1.8	20.68	20.77	33.91	63.25%	63.94%
Main Eco Receptor 3a	320710	145161	1.8	22.90	23.01	39.30	70.81%	71.62%
Main Eco Receptor 1b	320778	145365	1.8	19.33	19.41	30.61	57.72%	58.34%
Main Eco Receptor 2b	320742	145278	1.8	19.21	19.28	30.30	57.14%	57.74%
Main Eco Receptor 3b	320715	145161	1.8	20.77	20.86	34.10	63.49%	64.19%
Main Eco Receptor 1c	320783	145365	1.8	18.21	18.27	27.86	52.46%	53.00%
Main Eco Receptor 2c	320747	145278	1.8	18.14	18.20	27.69	52.11%	52.64%
Main Eco Receptor 3c	320720	145161	1.8	19.31	19.38	30.54	57.53%	58.14%
Comb Eco Receptor 1a	326296	142034	1.8	11.98	11.98	13.96	16.55%	16.61%
Comb Eco Receptor 2a	326068	142304	1.8	11.98	11.99	13.47	12.35%	12.41%
Comb Eco Receptor 1b	326301	142034	1.8	11.97	11.98	13.86	15.69%	15.74%
Comb Eco Receptor 2b	326068	142309	1.8	11.98	11.98	13.38	11.64%	11.69%
Comb Eco Receptor 1c	326306	142034	1.8	11.97	11.98	13.76	14.92%	14.98%
Comb Eco Receptor 2c	326068	142314	1.8	11.98	11.98	13.30	11.03%	11.09%

Receptor name	X(m)	Y(m)	Z(m)	2009 ‘model verification/baseline’ NO_x ($\mu g/m^3$)	2013 ‘without development’ NO_x ($\mu g/m^3$) (worst-case)	2013 ‘with development’ NO_x ($\mu g/m^3$) (worst-case)	% change 2013 ‘with development’ compared to 2013 ‘without development’ (worst-case)	% change 2013 ‘with development’ compared to 2009 ‘model verification/baseline’ (worst-case)
Daily Mean								
Main Eco Receptor 1a	320773	145365	1.8	62.07	62.42	118.03	89.08%	90.17%
Main Eco Receptor 2a	320737	145278	1.8	61.18	61.53	115.67	87.99%	89.07%
Main Eco Receptor 3a	320710	145161	1.8	63.59	63.95	121.06	89.29%	90.38%
Main Eco Receptor 1b	320778	145365	1.8	56.13	56.44	103.16	82.77%	83.77%
Main Eco Receptor 2b	320742	145278	1.8	55.49	55.79	101.60	82.12%	83.10%
Main Eco Receptor 3b	320715	145161	1.8	56.36	56.66	103.29	82.29%	83.27%
Main Eco Receptor 1c	320783	145365	1.8	51.74	52.01	92.64	78.11%	79.03%
Main Eco Receptor 2c	320747	145278	1.8	51.28	51.54	91.50	77.52%	78.43%
Main Eco Receptor 3c	320720	145161	1.8	51.36	51.62	91.39	77.06%	77.96%
Comb Eco Receptor 1a	326296	142034	1.8	25.15	25.18	33.37	32.56%	32.68%
Comb Eco Receptor 2a	326068	142304	1.8	24.85	24.87	33.82	35.99%	36.11%
Comb Eco Receptor 1b	326301	142034	1.8	25.14	25.16	33.01	31.18%	31.29%
Comb Eco Receptor 2b	326068	142309	1.8	24.84	24.86	33.25	33.73%	33.86%
Comb Eco Receptor 1c	326306	142034	1.8	25.13	25.15	32.68	29.93%	30.04%
Comb Eco Receptor 2c	326068	142314	1.8	24.83	24.86	32.76	31.76%	31.92%

Table 12E 64: Predicted 2016 NO_x concentrations for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x ($\mu g/m^3$)	2016 'without development' NO_x ($\mu g/m^3$)	2016 'with development' NO_x ($\mu g/m^3$)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
Annual Mean								
Main Eco Receptor 1a	320773	145365	1.8	20.90	13.92	18.18	30.61%	-13.00%
Main Eco Receptor 2a	320737	145278	1.8	20.68	13.80	17.96	30.17%	-13.18%
Main Eco Receptor 3a	320710	145161	1.8	22.90	15.08	20.24	34.20%	-11.60%
Main Eco Receptor 1b	320778	145365	1.8	19.33	13.01	16.56	27.28%	-14.34%
Main Eco Receptor 2b	320742	145278	1.8	19.21	12.94	16.43	26.98%	-14.46%
Main Eco Receptor 3b	320715	145161	1.8	20.77	13.85	18.04	30.30%	-13.14%
Main Eco Receptor 1c	320783	145365	1.8	18.21	12.36	15.39	24.58%	-15.44%
Main Eco Receptor 2c	320747	145278	1.8	18.14	12.32	15.33	24.41%	-15.52%
Main Eco Receptor 3c	320720	145161	1.8	19.31	13.00	16.53	27.19%	-14.39%
Comb Eco Receptor 1a	326296	142034	1.8	11.98	8.74	9.46	8.26%	-20.97%
Comb Eco Receptor 2a	326068	142304	1.8	11.98	8.75	9.28	6.14%	-22.52%
Comb Eco Receptor 1b	326301	142034	1.8	11.97	8.74	9.42	7.83%	-21.29%
Comb Eco Receptor 2b	326068	142309	1.8	11.98	8.74	9.25	5.78%	-22.78%
Comb Eco Receptor 1c	326306	142034	1.8	11.97	8.74	9.39	7.44%	-21.56%
Comb Eco Receptor 2c	326068	142314	1.8	11.98	8.74	9.22	5.48%	-23.00%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x (µg/m^3)	2016 'without development' NO_x (µg/m^3)	2016 'with development' NO_x (µg/m^3)	% change 2016 'with development' compared to 2016 'without development'	% change 2016 'with development' compared to 2009 'model verification/baseline'
Daily Mean								
Main Eco Receptor 1a	320773	145365	1.8	62.07	39.61	57.17	44.32%	-7.89%
Main Eco Receptor 2a	320737	145278	1.8	61.18	39.10	56.17	43.67%	-8.18%
Main Eco Receptor 3a	320710	145161	1.8	63.59	40.49	58.49	44.46%	-8.01%
Main Eco Receptor 1b	320778	145365	1.8	56.13	36.17	50.92	40.79%	-9.29%
Main Eco Receptor 2b	320742	145278	1.8	55.49	35.79	50.26	40.42%	-9.42%
Main Eco Receptor 3b	320715	145161	1.8	56.36	36.29	51.01	40.56%	-9.49%
Main Eco Receptor 1c	320783	145365	1.8	51.74	33.62	46.45	38.17%	-10.23%
Main Eco Receptor 2c	320747	145278	1.8	51.28	33.35	45.97	37.84%	-10.35%
Main Eco Receptor 3c	320720	145161	1.8	51.36	33.39	45.95	37.63%	-10.52%
Comb Eco Receptor 1a	326296	142034	1.8	25.15	18.20	21.11	16.02%	-16.06%
Comb Eco Receptor 2a	326068	142304	1.8	24.85	18.01	21.33	18.47%	-14.14%
Comb Eco Receptor 1b	326301	142034	1.8	25.14	18.19	20.98	15.32%	-16.57%
Comb Eco Receptor 2b	326068	142309	1.8	24.84	18.00	21.12	17.34%	-14.96%
Comb Eco Receptor 1c	326306	142034	1.8	25.13	18.19	20.86	14.68%	-17.02%
Comb Eco Receptor 2c	326068	142314	1.8	24.83	17.99	20.94	16.38%	-15.66%

Table 12E 65: Worst-case predicted 2016 NO_x concentrations for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x ($\mu g/m^3$)	2016 'without development' NO_x ($\mu g/m^3$) (worst-case)	2016 'with development' NO_x ($\mu g/m^3$) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/baseline' (worst-case)
Annual Mean								
Main Eco Receptor 1a	320773	145365	1.8	20.90	20.97	31.64	50.87%	51.36%
Main Eco Receptor 2a	320737	145278	1.8	20.68	20.75	31.17	50.21%	50.69%
Main Eco Receptor 3a	320710	145161	1.8	22.90	22.98	35.90	56.22%	56.78%
Main Eco Receptor 1b	320778	145365	1.8	19.33	19.39	28.28	45.82%	46.25%
Main Eco Receptor 2b	320742	145278	1.8	19.21	19.26	28.00	45.36%	45.78%
Main Eco Receptor 3b	320715	145161	1.8	20.77	20.84	31.34	50.41%	50.89%
Main Eco Receptor 1c	320783	145365	1.8	18.21	18.26	25.86	41.64%	42.02%
Main Eco Receptor 2c	320747	145278	1.8	18.14	18.19	25.71	41.36%	41.74%
Main Eco Receptor 3c	320720	145161	1.8	19.31	19.37	28.21	45.67%	46.10%
Comb Eco Receptor 1a	326296	142034	1.8	11.98	11.98	13.89	15.95%	16.00%
Comb Eco Receptor 2a	326068	142304	1.8	11.98	11.99	13.39	11.75%	11.80%
Comb Eco Receptor 1b	326301	142034	1.8	11.97	11.98	13.79	15.09%	15.14%
Comb Eco Receptor 2b	326068	142309	1.8	11.98	11.98	13.31	11.04%	11.09%
Comb Eco Receptor 1c	326306	142034	1.8	11.97	11.98	13.69	14.33%	14.38%
Comb Eco Receptor 2c	326068	142314	1.8	11.98	11.98	13.23	10.44%	10.48%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x ($\mu g/m^3$)	2016 'without development' NO_x ($\mu g/m^3$) (worst-case)	2016 'with development' NO_x ($\mu g/m^3$) (worst-case)	% change 2016 'with development' compared to 2016 'without development' (worst-case)	% change 2016 'with development' compared to 2009 'model verification/baseline' (worst-case)
Daily Mean								
Main Eco Receptor 1a	320773	145365	1.8	62.07	62.34	106.39	70.67%	71.41%
Main Eco Receptor 2a	320737	145278	1.8	61.18	61.44	104.32	69.79%	70.52%
Main Eco Receptor 3a	320710	145161	1.8	63.59	63.86	109.13	70.87%	71.62%
Main Eco Receptor 1b	320778	145365	1.8	56.13	56.36	93.44	65.78%	66.46%
Main Eco Receptor 2b	320742	145278	1.8	55.49	55.71	92.07	65.26%	65.93%
Main Eco Receptor 3b	320715	145161	1.8	56.36	56.59	93.61	65.43%	66.10%
Main Eco Receptor 1c	320783	145365	1.8	51.74	51.94	84.18	62.05%	62.68%
Main Eco Receptor 2c	320747	145278	1.8	51.28	51.48	83.18	61.59%	62.21%
Main Eco Receptor 3c	320720	145161	1.8	51.36	51.55	83.13	61.24%	61.86%
Comb Eco Receptor 1a	326296	142034	1.8	25.15	25.17	32.99	31.09%	31.17%
Comb Eco Receptor 2a	326068	142304	1.8	24.85	24.86	33.68	35.45%	35.55%
Comb Eco Receptor 1b	326301	142034	1.8	25.14	25.16	32.51	29.20%	29.29%
Comb Eco Receptor 2b	326068	142309	1.8	24.84	24.85	33.11	33.21%	33.30%
Comb Eco Receptor 1c	326306	142034	1.8	25.13	25.15	32.18	27.97%	28.05%
Comb Eco Receptor 2c	326068	142314	1.8	24.83	24.85	32.62	31.25%	31.37%

Table 12E 66: Predicted 2021 NO_x concentrations for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x ($\mu g/m^3$)	2021 'without development' NO_x ($\mu g/m^3$)	2021 'with development' NO_x ($\mu g/m^3$)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
Annual Mean								
Main Eco Receptor 1a	320773	145365	1.8	20.90	10.87	11.81	8.62%	-43.52%
Main Eco Receptor 2a	320737	145278	1.8	20.68	10.78	11.70	8.49%	-43.44%
Main Eco Receptor 3a	320710	145161	1.8	22.90	11.66	12.80	9.72%	-44.12%
Main Eco Receptor 1b	320778	145365	1.8	19.33	10.25	11.03	7.62%	-42.96%
Main Eco Receptor 2b	320742	145278	1.8	19.21	10.20	10.96	7.53%	-42.91%
Main Eco Receptor 3b	320715	145161	1.8	20.77	10.82	11.74	8.53%	-43.48%
Main Eco Receptor 1c	320783	145365	1.8	18.21	9.80	10.47	6.82%	-42.51%
Main Eco Receptor 2c	320747	145278	1.8	18.14	9.77	10.43	6.77%	-42.48%
Main Eco Receptor 3c	320720	145161	1.8	19.31	10.24	11.01	7.59%	-42.96%
Comb Eco Receptor 1a	326296	142034	1.8	11.98	7.33	7.62	4.01%	-36.33%
Comb Eco Receptor 2a	326068	142304	1.8	11.98	7.33	7.54	2.83%	-37.06%
Comb Eco Receptor 1b	326301	142034	1.8	11.97	7.33	7.61	3.77%	-36.47%
Comb Eco Receptor 2b	326068	142309	1.8	11.98	7.33	7.53	2.63%	-37.18%
Comb Eco Receptor 1c	326306	142034	1.8	11.97	7.33	7.59	3.56%	-36.60%
Comb Eco Receptor 2c	326068	142314	1.8	11.98	7.33	7.51	2.47%	-37.27%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x (µg/m^3)	2021 'without development' NO_x (µg/m^3)	2021 'with development' NO_x (µg/m^3)	% change 2021 'with development' compared to 2021 'without development'	% change 2021 'with development' compared to 2009 'model verification/baseline'
Daily Mean								
Main Eco Receptor 1a	320773	145365	1.8	62.07	29.77	33.60	12.85%	-45.87%
Main Eco Receptor 2a	320737	145278	1.8	61.18	29.42	33.13	12.63%	-45.84%
Main Eco Receptor 3a	320710	145161	1.8	63.59	30.36	34.28	12.89%	-46.09%
Main Eco Receptor 1b	320778	145365	1.8	56.13	27.42	30.65	11.80%	-45.39%
Main Eco Receptor 2b	320742	145278	1.8	55.49	27.16	30.34	11.68%	-45.33%
Main Eco Receptor 3b	320715	145161	1.8	56.36	27.50	30.73	11.74%	-45.48%
Main Eco Receptor 1c	320783	145365	1.8	51.74	25.68	28.49	10.96%	-44.93%
Main Eco Receptor 2c	320747	145278	1.8	51.28	25.50	28.26	10.86%	-44.88%
Main Eco Receptor 3c	320720	145161	1.8	51.36	25.52	28.27	10.80%	-44.94%
Comb Eco Receptor 1a	326296	142034	1.8	25.15	15.16	16.30	7.56%	-35.19%
Comb Eco Receptor 2a	326068	142304	1.8	24.85	15.02	16.42	9.30%	-33.93%
Comb Eco Receptor 1b	326301	142034	1.8	25.14	15.15	16.22	7.05%	-35.49%
Comb Eco Receptor 2b	326068	142309	1.8	24.84	15.01	16.32	8.68%	-34.30%
Comb Eco Receptor 1c	326306	142034	1.8	25.13	15.15	16.16	6.70%	-35.69%
Comb Eco Receptor 2c	326068	142314	1.8	24.83	15.01	16.24	8.16%	-34.61%

Table 12E 67: Worst-case predicted 2021 NO_x concentrations for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x (µg/m^3)	2021 'without development' NO_x (µg/m^3) (worst-case)	2021 'with development' NO_x (µg/m^3) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/baseline' (worst-case)
Annual Mean								
Main Eco Receptor 1a	320773	145365	1.8	20.90	21.53	27.21	26.40%	30.20%
Main Eco Receptor 2a	320737	145278	1.8	20.68	21.30	26.85	26.06%	29.81%
Main Eco Receptor 3a	320710	145161	1.8	22.90	23.66	30.55	29.10%	33.40%
Main Eco Receptor 1b	320778	145365	1.8	19.33	19.86	24.59	23.84%	27.20%
Main Eco Receptor 2b	320742	145278	1.8	19.21	19.72	24.38	23.60%	26.92%
Main Eco Receptor 3b	320715	145161	1.8	20.77	21.39	26.99	26.17%	29.93%
Main Eco Receptor 1c	320783	145365	1.8	18.21	18.66	22.71	21.71%	24.71%
Main Eco Receptor 2c	320747	145278	1.8	18.14	18.59	22.59	21.57%	24.55%
Main Eco Receptor 3c	320720	145161	1.8	19.31	19.83	24.54	23.77%	27.12%
Comb Eco Receptor 1a	326296	142034	1.8	11.98	12.01	13.99	16.54%	16.82%
Comb Eco Receptor 2a	326068	142304	1.8	11.98	12.01	13.40	11.53%	11.81%
Comb Eco Receptor 1b	326301	142034	1.8	11.97	12.00	13.87	15.54%	15.82%
Comb Eco Receptor 2b	326068	142309	1.8	11.98	12.01	13.29	10.70%	10.98%
Comb Eco Receptor 1c	326306	142034	1.8	11.97	12.00	13.76	14.65%	14.93%
Comb Eco Receptor 2c	326068	142314	1.8	11.98	12.01	13.21	10.01%	10.28%

Receptor name	X(m)	Y(m)	Z(m)	2009 'model verification/baseline' NO_x (µg/m^3)	2021 'without development' NO_x (µg/m^3) (worst-case)	2021 'with development' NO_x (µg/m^3) (worst-case)	% change 2021 'with development' compared to 2021 'without development' (worst-case)	% change 2021 'with development' compared to 2009 'model verification/baseline' (worst-case)
Daily Mean								
Main Eco Receptor 1a	320773	145365	1.8	62.07	64.64	88.08	36.26%	41.92%
Main Eco Receptor 2a	320737	145278	1.8	61.18	63.70	86.52	35.82%	41.42%
Main Eco Receptor 3a	320710	145161	1.8	63.59	66.26	90.37	36.40%	42.13%
Main Eco Receptor 1b	320778	145365	1.8	56.13	58.32	78.16	34.02%	39.25%
Main Eco Receptor 2b	320742	145278	1.8	55.49	57.64	77.09	33.76%	38.93%
Main Eco Receptor 3b	320715	145161	1.8	56.36	58.56	78.40	33.88%	39.11%
Main Eco Receptor 1c	320783	145365	1.8	51.74	53.65	70.89	32.13%	36.99%
Main Eco Receptor 2c	320747	145278	1.8	51.28	53.15	70.11	31.90%	36.72%
Main Eco Receptor 3c	320720	145161	1.8	51.36	53.23	70.13	31.75%	36.56%
Comb Eco Receptor 1a	326296	142034	1.8	25.15	25.29	33.43	32.20%	32.90%
Comb Eco Receptor 2a	326068	142304	1.8	24.85	24.96	34.38	37.73%	38.37%
Comb Eco Receptor 1b	326301	142034	1.8	25.14	25.28	32.86	30.01%	30.70%
Comb Eco Receptor 2b	326068	142309	1.8	24.84	24.95	33.70	35.08%	35.71%
Comb Eco Receptor 1c	326306	142034	1.8	25.13	25.27	32.36	28.07%	28.75%
Comb Eco Receptor 2c	326068	142314	1.8	24.83	24.95	33.13	32.78%	33.42%

Table 12E 68: Additional nitrogen deposition rates for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2013 'with development' N deposition (kg N ha^{-1} y^{-1})	2016 'with development' N deposition (kg N ha^{-1} y^{-1})	2021 'with development' N deposition (kg N ha^{-1} y^{-1})
Main Eco Receptor 1a	320773	145365	1.8	1.27	0.61	0.13
Main Eco Receptor 2a	320737	145278	1.8	1.24	0.60	0.13
Main Eco Receptor 3a	320710	145161	1.8	1.53	0.74	0.16
Main Eco Receptor 1b	320778	145365	1.8	1.05	0.51	0.11
Main Eco Receptor 2b	320742	145278	1.8	1.04	0.50	0.11
Main Eco Receptor 3b	320715	145161	1.8	1.25	0.60	0.13
Main Eco Receptor 1c	320783	145365	1.8	0.90	0.44	0.10
Main Eco Receptor 2c	320747	145278	1.8	0.89	0.43	0.10
Main Eco Receptor 3c	320720	145161	1.8	1.05	0.51	0.11

Table 12E 69: Worst-case additional nitrogen deposition rates for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2013 'with development' N deposition (kg N ha^{-1} y^{-1}) (worst-case)	2016 'with development' N deposition (kg N ha^{-1} y^{-1}) (worst-case)	2021 'with development' N deposition (kg N ha^{-1} y^{-1}) (worst-case)
Main Eco Receptor 1a	320773	145365	1.8	1.94	1.54	0.82
Main Eco Receptor 2a	320737	145278	1.8	1.89	1.50	0.80
Main Eco Receptor 3a	320710	145161	1.8	2.35	1.86	0.99
Main Eco Receptor 1b	320778	145365	1.8	1.61	1.28	0.68
Main Eco Receptor 2b	320742	145278	1.8	1.59	1.26	0.67
Main Eco Receptor 3b	320715	145161	1.8	1.91	1.51	0.81
Main Eco Receptor 1c	320783	145365	1.8	1.38	1.09	0.58
Main Eco Receptor 2c	320747	145278	1.8	1.37	1.08	0.58
Main Eco Receptor 3c	320720	145161	1.8	1.61	1.27	0.68

Table 12E 70: Additional acid deposition rates for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2013 'with development' acid deposition (keq ha^{-1} y^{-1})	2016 'with development' acid deposition (keq ha^{-1} y^{-1})	2021 'with development' acid deposition (keq ha^{-1} y^{-1})
Main Eco Receptor 1a	320773	145365	1.8	0.09	0.04	0.01
Main Eco Receptor 2a	320737	145278	1.8	0.09	0.04	0.01
Main Eco Receptor 3a	320710	145161	1.8	0.11	0.05	0.01
Main Eco Receptor 1b	320778	145365	1.8	0.08	0.04	0.01
Main Eco Receptor 2b	320742	145278	1.8	0.07	0.04	0.01
Main Eco Receptor 3b	320715	145161	1.8	0.09	0.04	0.01
Main Eco Receptor 1c	320783	145365	1.8	0.06	0.03	0.01
Main Eco Receptor 2c	320747	145278	1.8	0.06	0.03	0.01
Main Eco Receptor 3c	320720	145161	1.8	0.07	0.04	0.01

Table 12E 71: Worst-case additional acid deposition rates for ecological receptor locations.

Receptor name	X(m)	Y(m)	Z(m)	2013 ‘with development’ acid deposition (keq ha^{-1} y^{-1}) (worst-case)	2016 ‘with development’ acid deposition (keq ha^{-1} y^{-1}) (worst-case)	2021 ‘with development’ acid deposition (keq ha^{-1} y^{-1}) (worst-case)
Main Eco Receptor 1a	320773	145365	1.8	0.14	0.11	0.06
Main Eco Receptor 2a	320737	145278	1.8	0.14	0.11	0.06
Main Eco Receptor 3a	320710	145161	1.8	0.17	0.13	0.07
Main Eco Receptor 1b	320778	145365	1.8	0.12	0.09	0.05
Main Eco Receptor 2b	320742	145278	1.8	0.11	0.09	0.05
Main Eco Receptor 3b	320715	145161	1.8	0.14	0.11	0.06
Main Eco Receptor 1c	320783	145365	1.8	0.10	0.08	0.04
Main Eco Receptor 2c	320747	145278	1.8	0.10	0.08	0.04
Main Eco Receptor 3c	320720	145161	1.8	0.11	0.09	0.05

APPENDIX 12F: INPUT PARAMETERS AND RESULTS OF ADMS 4 ASSESSMENT OF MARINE VESSEL EMISSIONS

APPENDIX 12F: INPUT PARAMETERS AND RESULTS OF ADMS 4 ASSESSMENT OF MARINE VESSEL EMISSIONS

Table 12F.1: Stack Parameters and Emission Rates for Marine Vessel Emissions to Air

	Value	Units
Parameters		
Stack internal diameter	0.5	m
Stack height	15	m
Exit velocity	30	m/s
Ambient temperature of discharge gases	280	˚C
Stack location	319550,146500	
Emission rates		
SO_2	0.29	g/s
NO_x	0.60	g/s
PM_{10}	0.30	g/s

Table 12F.2: Locations of Human and Ecological Discrete Receptors

Receptor	Receptor Location		Distance From Closest Source (m)	Bearing From Source (degrees)
	Easting	Northing		
Human Receptors				
Trighern Farm	322655	145238	3352	112
Zipe Farm	321934	144561	3073	129
Wick Farm	321578	144620	2765	133
Doggetts	320601	144647	2071	150
Knighton Farm	319375	144512	1996	185
Shurton village	320185	144256	2332	164
Bullen Farm	319150	144550	1991	192
Point south of Knighton	319250	144250	2270	188
Burton village	319350	144050	2458	185
Warren's Farm	319950	144150	2537	173
Newnham Bridge	320650	144150	2582	155
Wick village	321550	144550	2793	134
Gunter's Grove	321150	144150	2876	146
Point west of Wick	321250	144650	2512	137
Caravan Park	321750	143950	3368	139
Wick Park Cottage	321650	143550	3621	145
Farringdon Hill Farm	321350	143450	3542	149
Kennels south Farringdon	321350	143250	3715	151
Idson Farm	322550	144350	3570	126
Upper Cock Farm	322950	143450	4568	132
Lower Cock Farm	323350	143350	4936	130
Woolstone Farm	323750	144350	4718	117
Chalcott Farm	323350	144850	4159	114
Whitewick Farm	323550	145250	4130	107
Stolford Farm	323250	145850	3676	101
Browns Cottage	323150	145150	3804	111
Little Dowdens Farm	322750	145650	3311	105
Cole Pool	319215	143680	2841	186
Stogursey	320260	143185	3390	168
Wick House Farm	321676	144544	2835	134
West End Cottage	322691	145607	3265	106
Transient Human Receptors				
Footpath - Benhole Lane (North)	319561	145814	686	179
Footpath - Benhole Lane (South)	319715	144975	1534	174
Footpath - Coastal	319858	146152	465	139
Pixies Mound	320890	145573	1630	125

Note: Distances and bearings were calculated from the assumed location of closets vessel during berth at the wharf.

Table 12F.3: NO_2 Concentrations at Human Receptor Locations

Receptor	Annual Mean				99.79%-ile 1-hour Mean			
	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	40	0.03	6.83	17.1%	200	0.23	13.83	6.9%
Zipe Farm	40	0.03	6.83	17.1%	200	0.29	13.89	6.9%
Wick Farm	40	0.03	6.83	17.1%	200	0.28	13.88	6.9%
Doggetts	40	0.02	6.82	17.1%	200	0.35	13.95	7.0%
Knighton Farm	40	0.02	6.82	17.1%	200	0.47	14.07	7.0%
Shurton village	40	0.02	6.82	17.0%	200	0.33	13.93	7.0%
Bullen Farm	40	0.02	6.82	17.1%	200	0.42	14.02	7.0%
Point south of Knighton	40	0.02	6.82	17.0%	200	0.38	13.98	7.0%
Burton village	40	0.02	6.82	17.0%	200	0.39	13.99	7.0%
Warren`s Farm	40	0.02	6.82	17.0%	200	0.34	13.94	7.0%
Newnham Bridge	40	0.01	6.81	17.0%	200	0.25	13.85	6.9%
Wick village	40	0.03	6.83	17.1%	200	0.30	13.90	6.9%
Gunter`s Grove	40	0.02	6.82	17.0%	200	0.24	13.84	6.9%
Point west of Wick	40	0.03	6.83	17.1%	200	0.33	13.93	7.0%
Caravan Park	40	0.02	6.82	17.0%	200	0.23	13.83	6.9%
Wick Park Cottage	40	0.01	6.81	17.0%	200	0.18	13.78	6.9%
Farringdon Hill Farm	40	0.01	6.81	17.0%	200	0.18	13.78	6.9%
Kennels S Farringdon	40	0.01	6.81	17.0%	200	0.17	13.77	6.9%
Idson Farm	40	0.02	6.82	17.1%	200	0.25	13.85	6.9%
Upper Cock Farm	40	0.01	6.81	17.0%	200	0.17	13.77	6.9%
Lower Cock Farm	40	0.01	6.81	17.0%	200	0.18	13.78	6.9%
Woolstone Farm	40	0.02	6.82	17.0%	200	0.16	13.76	6.9%
Chalcott Farm	40	0.02	6.82	17.1%	200	0.18	13.78	6.9%
Whitewick Farm	40	0.02	6.82	17.1%	200	0.21	13.81	6.9%
Stolford Farm	40	0.02	6.82	17.1%	200	0.21	13.81	6.9%
Browns Cottage	40	0.03	6.83	17.1%	200	0.20	13.80	6.9%
Little Dowdens Farm	40	0.03	6.83	17.1%	200	0.23	13.83	6.9%
Cole Pool	40	0.01	6.81	17.0%	200	0.34	13.94	7.0%
Stogursey	40	0.01	6.81	17.0%	200	0.25	13.85	6.9%
Wick House Farm	40	0.03	6.83	17.1%	200	0.28	13.88	6.9%
West End Cottage	40	0.03	6.83	17.1%	200	0.24	13.84	6.9%
Footpath - Benhole Lane (South)	-	-	-	-	200	0.59	14.19	7.1%
Footpath - Benhole Lane (North)	-	-	-	-	200	1.75	15.35	7.7%
Footpath - Coastal	-	-	-	-	200	2.59	16.19	8.1%
Pixies Mound	-	-	-	-	200	0.54	14.14	7.1%

Table 12F.4: PM_{10} Concentrations at Human Receptor Locations

Receptor	Annual Mean				90.41%-ile 24-hour Mean			
	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	40	0.02	18.22	45.6%	50	0.08	36.48	73.0%
Zipe Farm	40	0.02	18.22	45.5%	50	0.06	36.46	72.9%
Wick Farm	40	0.02	18.22	45.5%	50	0.07	36.47	72.9%
Doggetts	40	0.02	18.22	45.5%	50	0.06	36.46	72.9%
Knighton Farm	40	0.02	18.22	45.5%	50	0.06	36.46	72.9%
Shurton village	40	0.01	18.21	45.5%	50	0.05	36.45	72.9%
Bullen Farm	40	0.02	18.22	45.5%	50	0.06	36.46	72.9%
Point south of Knighton	40	0.01	18.21	45.5%	50	0.05	36.45	72.9%
Burton village	40	0.01	18.21	45.5%	50	0.05	36.45	72.9%
Warren`s Farm	40	0.01	18.21	45.5%	50	0.05	36.45	72.9%
Newnham Bridge	40	0.01	18.21	45.5%	50	0.04	36.44	72.9%
Wick village	40	0.02	18.22	45.5%	50	0.07	36.47	72.9%
Gunter`s Grove	40	0.01	18.21	45.5%	50	0.04	36.44	72.9%
Point west of Wick	40	0.02	18.22	45.5%	50	0.07	36.47	72.9%
Caravan Park	40	0.01	18.21	45.5%	50	0.04	36.44	72.9%
Wick Park Cottage	40	0.01	18.21	45.5%	50	0.03	36.43	72.9%
Farringdon Hill Farm	40	0.01	18.21	45.5%	50	0.03	36.43	72.9%
Kennels S Farringdon	40	0.01	18.21	45.5%	50	0.02	36.42	72.8%
Idson Farm	40	0.02	18.22	45.5%	50	0.05	36.45	72.9%
Upper Cock Farm	40	0.01	18.21	45.5%	50	0.03	36.43	72.9%
Lower Cock Farm	40	0.01	18.21	45.5%	50	0.03	36.43	72.9%
Woolstone Farm	40	0.01	18.21	45.5%	50	0.04	36.44	72.9%
Chalcott Farm	40	0.02	18.22	45.5%	50	0.05	36.45	72.9%
Whitewick Farm	40	0.02	18.22	45.5%	50	0.05	36.45	72.9%
Stolford Farm	40	0.02	18.22	45.5%	50	0.06	36.46	72.9%
Browns Cottage	40	0.02	18.22	45.5%	50	0.06	36.46	72.9%
Little Dowdens Farm	40	0.02	18.22	45.6%	50	0.08	36.48	73.0%
Cole Pool	40	0.01	18.21	45.5%	50	0.04	36.44	72.9%
Stogursey	40	0.01	18.21	45.5%	50	0.03	36.43	72.9%
Wick House Farm	40	0.02	18.22	45.5%	50	0.07	36.47	72.9%
West End Cottage	40	0.02	18.22	45.6%	50	0.08	36.48	73.0%

Table 12F.5: PM_{10} Concentrations at Human Receptor Locations

Receptor	Annual Mean			
	AQS	PC	PEC	%PEC of AQS
Trighern Farm	25	0.02	7.92	31.7%
Zipe Farm	25	0.02	7.92	31.7%
Wick Farm	25	0.02	7.92	31.7%
Doggetts	25	0.02	7.92	31.7%
Knighton Farm	25	0.02	7.92	31.7%
Shurton village	25	0.01	7.91	31.6%
Bullen Farm	25	0.02	7.92	31.7%
Point south of Knighton	25	0.01	7.91	31.7%
Burton village	25	0.01	7.91	31.6%
Warren`s Farm	25	0.01	7.91	31.6%
Newnham Bridge	25	0.01	7.91	31.6%
Wick village	25	0.02	7.92	31.7%
Gunter`s Grove	25	0.01	7.91	31.6%
Point west of Wick	25	0.02	7.92	31.7%
Caravan Park	25	0.01	7.91	31.6%
Wick Park Cottage	25	0.01	7.91	31.6%
Farringdon Hill Farm	25	0.01	7.91	31.6%
Kennels S Farringdon	25	0.01	7.91	31.6%
Idson Farm	25	0.02	7.92	31.7%
Upper Cock Farm	25	0.01	7.91	31.6%
Lower Cock Farm	25	0.01	7.91	31.6%
Woolstone Farm	25	0.01	7.91	31.7%
Chalcott Farm	25	0.02	7.92	31.7%
Whitewick Farm	25	0.02	7.92	31.7%
Stolford Farm	25	0.02	7.92	31.7%
Browns Cottage	25	0.02	7.92	31.7%
Little Dowdens Farm	25	0.02	7.92	31.7%
Cole Pool	25	0.01	7.91	31.6%
Stogursey	25	0.01	7.91	31.6%
Wick House Farm	25	0.02	7.92	31.7%
West End Cottage	25	0.02	7.92	31.7%

Table 12F.6: SO_2 Concentrations at Human Receptor Locations

Receptor	99.9%-ile 15-minute Mean				99.73%-ile of 1-hour Mean				99.18%-ile of 24-hour Mean			
	AQO	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Trighern Farm	266	0.51	4.11	1.54%	350	0.30	3.90	1.11%	125	0.14	3.74	2.99%
Zipe Farm	266	0.68	4.28	1.61%	350	0.37	3.97	1.14%	125	0.11	3.71	2.97%
Wick Farm	266	0.77	4.37	1.64%	350	0.38	3.98	1.14%	125	0.13	3.73	2.99%
Doggetts	266	0.69	4.29	1.61%	350	0.45	4.05	1.16%	125	0.17	3.77	3.02%
Knighton Farm	266	0.90	4.50	1.69%	350	0.62	4.22	1.21%	125	0.27	3.87	3.09%
Shurton village	266	0.80	4.40	1.65%	350	0.42	4.02	1.15%	125	0.13	3.73	2.98%
Bullen Farm	266	0.85	4.45	1.67%	350	0.55	4.15	1.19%	125	0.22	3.82	3.05%
Point south of Knighton	266	0.85	4.45	1.67%	350	0.50	4.10	1.17%	125	0.17	3.77	3.02%
Burton village	266	0.79	4.39	1.65%	350	0.53	4.13	1.18%	125	0.18	3.78	3.03%
Warren`s Farm	266	0.73	4.33	1.63%	350	0.43	4.03	1.15%	125	0.14	3.74	2.99%
Newnham Bridge	266	0.58	4.18	1.57%	350	0.34	3.94	1.12%	125	0.11	3.71	2.96%
Wick village	266	0.70	4.30	1.61%	350	0.37	3.97	1.14%	125	0.13	3.73	2.98%
Gunter`s Grove	266	0.51	4.11	1.55%	350	0.31	3.91	1.12%	125	0.10	3.70	2.96%
Point west of Wick	266	0.77	4.37	1.64%	350	0.45	4.05	1.16%	125	0.14	3.74	2.99%
Caravan Park	266	0.50	4.10	1.54%	350	0.30	3.90	1.11%	125	0.08	3.68	2.94%
Wick Park Cottage	266	0.43	4.03	1.51%	350	0.24	3.84	1.10%	125	0.08	3.68	2.94%
Farringdon Hill Farm	266	0.42	4.02	1.51%	350	0.23	3.83	1.10%	125	0.07	3.67	2.93%
Kennels S Farringdon	266	0.39	3.99	1.50%	350	0.22	3.82	1.09%	125	0.06	3.66	2.93%
Idson Farm	266	0.59	4.19	1.57%	350	0.34	3.94	1.12%	125	0.09	3.69	2.95%
Upper Cock Farm	266	0.51	4.11	1.55%	350	0.22	3.82	1.09%	125	0.07	3.67	2.93%
Lower Cock Farm	266	0.41	4.01	1.51%	350	0.22	3.82	1.09%	125	0.06	3.66	2.93%
Woolstone Farm	266	0.35	3.95	1.49%	350	0.22	3.82	1.09%	125	0.08	3.68	2.95%
Chalcott Farm	266	0.44	4.04	1.52%	350	0.24	3.84	1.10%	125	0.10	3.70	2.96%

Receptor	99.9%-ile 15-minute Mean				99.73%-ile of 1-hour Mean				99.18%-ile of 24-hour Mean			
	AQO	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS	AQS	PC	PEC	%PEC of AQS
Whitewick Farm	266	0.52	4.12	1.55%	350	0.26	3.86	1.10%	125	0.10	3.70	2.96%
Stolford Farm	266	0.51	4.11	1.55%	350	0.28	3.88	1.11%	125	0.10	3.70	2.96%
Browns Cottage	266	0.44	4.04	1.52%	350	0.27	3.87	1.10%	125	0.11	3.71	2.97%
Little Dowdens Farm	266	0.63	4.23	1.59%	350	0.31	3.91	1.12%	125	0.14	3.74	2.99%
Cole Pool	266	0.69	4.29	1.61%	350	0.43	4.03	1.15%	125	0.13	3.73	2.98%
Stogursey	266	0.50	4.10	1.54%	350	0.30	3.90	1.12%	125	0.06	3.66	2.93%
Wick House Farm	266	0.73	4.33	1.63%	350	0.37	3.97	1.13%	125	0.13	3.73	2.98%
West End Cottage	266	0.63	4.23	1.59%	350	0.32	3.92	1.12%	125	0.14	3.74	2.99%
Footpath - Benhole Lane (South)	266	1.15	4.75	1.79%	350	0.77	4.37	1.25%	-	-	-	-
Footpath - Benhole Lane (North)	266	2.80	6.40	2.41%	350	2.36	5.96	1.70%	-	-	-	-
Footpath - Coastal	266	4.30	7.90	2.97%	350	3.55	7.15	2.04%	-	-	-	-
Pixies Mound	266	1.15	4.75	1.79%	350	0.72	4.32	1.24%	-	-	-	-

Table 12F.7: NO_x Concentrations at Ecological Receptor Locations

Receptor	Annual Mean				24-hour Mean			
	AQS	PC	PEC	%PEC of AQS	EAL	PC	PEC	%PEC of AQS
Bridgwater Bay SSSI/ Severn Estuary SPA/SAC/Ramsar	30	1.06	12.56	41.9%	75	7.48	30.48	40.6%
Bridgwater Bay NNR	30	1.03	12.53	41.8%	75	7.48	30.48	40.6%

Table 12F.8: SO_2 Concentrations at Ecological Receptor Locations

Receptor	Annual Mean			
	AQS	PC	PEC	%PEC of AQS
Bridgwater Bay SSSI/Severn Estuary SPA/SAC/Ramsar	20	0.51	2.31	11.6%
Bridgwater Bay NNR	20	0.50	2.30	11.5%

Table 12F.9: Deposition Rates at Ecological Receptor Locations

Receptor	Nitrogen Deposition (kg N ha^{-1} y^{-1})	Acid Deposition (keq ha^{-1} y^{-1})
Bridgwater Bay SSSI/Severn Estuary SPA/SAC/Ramsar	0.15	0.07
Bridgwater Bay NNR	0.15	0.07

APPENDIX 13A: AGRICULTURAL LAND CLASSIFICATION SURVEY REPORT

EDF Energy

Land at Hinkley Point, Somerset

Investigation of Soils and Agricultural Land Classification

Reading Agricultural Consultants

June 2009

1. Introduction

1.1 Instruction

1.1.1 Reading Agricultural Consultants Ltd (RAC) is instructed by EDF Energy to investigate the Agricultural Land Classification (ALC) of an area to the west of Hinkley Point power station in Somerset. This investigation has been conducted by a combination of detailed field investigation and a comprehensive review of previous surveys in the area.

1.1.2 The first ALC survey of parts of the site that has been identified was a 1982 study by ADAS for the Ministry of Agriculture Fisheries and Food (MAFF). This was followed by an ALC survey by RAC in 1988 which was supplemented by further soil resource surveys later in the same year. The present-day site boundary is a little different to that used in the previous RAC studies and therefore supplementary fieldwork has been carried out in 2009 to cover the new ground and to check the previous work against revisions to the ALC classification system.

2. Site and Climatic Characteristics

2.1 General features, Land Form and Drainage

2.1.1 The total area considered is about 84 ha, the boundary being shown in red on Figure RAC 1. The land is bounded principally by other agricultural land, but has a power station to the east and Bridgwater Bay to the north. Existing use of the agricultural land is largely arable, without irrigation, and the land was mostly under field crops at the time of survey. There are several agricultural buildings within the site boundary, but they appear to be mainly derelict.

2.1.2 The land forms an undulating plain over the most part, with an overall fall to the north. There is a series of parallel east-west ridges with a south-facing scarp face as the southern boundary. Slopes are convexo-concave, sometimes with a pronounced midslope rectilinear element. The altitude of most of the site falls between about 9 and 35 m aOD. Microtopography is usually smooth to gently undulating. The soils have generally good drainage being of wetness class (WC) WC**I**, but with some areas of imperfect drainage (WC**III**) where there is underlying clay.

2.2 Climatic Factors

2.2.1 Local climatic factors have been interpolated from the Meteorological Office's standard 5 km grid point data set for the centre of the site at a representative altitude. Climatic factors are given in Table 1. The local climate has slightly higher rainfall than is typical for lowland England and the area can be considered moist. Temperatures are warm. The moisture deficits are moderate to moderately large. The FCD regime is slightly longer than the average for lowland England and can be considered to be slightly unfavourable for providing opportunities for landworks. In summary the climate is warm and moist.

Table 1: Local climatic factors

Average annual rainfall (AAR)	771 mm
Accumulated temperature > 0°C (AT0)	1,547 day°
Field Capacity Day regime (FCD)	167 days
Average moisture deficit, wheat (MDw)	105 mm
Average moisture deficit, potatoes (MDp)	98 mm

2.3 Soil Parent Materials and Soil Types

2.3.1 Hinkley Point lies on the southern margin of the Bristol Channel sedimentary basin. The basin is formed from a synclinal trough filled with sediments of Devonian to Jurassic age. West of the site area, Mesozoic rocks of Jurassic and Triassic age are exposed along the cliff line towards Watchet, whilst to the east of the site the Lower Lias cliff line gives way to the flat low-lying ground of the River Parrett estuary which forms an extensive area of Quaternary sedimentation known as the Somerset Levels.

2.3.2 The geological sequence beneath the overlying soils of the site consists of interbedded mudstones and thin limestones of the Lower Lias and Langport Formation, extending downwards into the Mercia Mudstone Group consisting of siltstones and mudstones. Figure RAC2 illustrates schematically, in block diagram form, the ground surface features and the sub-surface geology of the site area. The geology of the site is essentially that of a block of rock strata gently dipping to the north

2.3.3 The soil parent material is interbedded mudstones, siltstones and limestones. The mudstone and siltstone give soils with clayey poorly permeable subsoils whilst the limestone gives soils which are shallow over rock and stony.

2.3.4 The soils of the site have been mapped at a scale of 1” to the mile by the Soil Survey of England and Wales, and described in the memoir “The Soils of the Mendip District of Somerset” by D C Findlay, 1965. This scale was not sufficiently detailed to allow clear separation of the soil types present and the whole site was mapped as having soils of the Evesham series, which are imperfectly drained calcareous soils with poorly permeable subsoil.

2.3.5 All the soils are calcareous and are slightly alkaline. The topsoils are of clay loam to clay and are usually about 250-300mm thick. Subsoils vary according to the underlying geology being poorly permeable and clayey over mudstone, but generally appear to be somewhat permeable or freely permeable over other rock types. Limestone bands are associated with shallow stony soils, particularly on the higher parts of the site.

3. Agricultural Land Quality

3.1 Soil Survey Methods

3.1.1 The preliminary RAC soil survey was carried out in late July 1988, followed by further, more detailed work in mid-August. The survey was carried out using hand auger and spade, much in the manner of the 2009 fieldwork described below. In all some 102 observations were made giving a survey intensity of about 1.3 observations per hectare. The location of observations is given on Figure RAC4. The interpretation of the findings was made difficult by the impending introduction on 1 January 1989 by MAFF of revised and more detailed criteria for assessing land quality. The classification was therefore made according to the published draft of the forthcoming revised guidelines, and has been checked against the later guidelines as part of this study.

3.1.2 The additional fieldwork carried out in 2009 consisted of some twenty one soil profiles which were examined using an Edelman (Dutch) auger and spade. The location of observations is also indicated on Figure RAC4. Observation density on the newly surveyed areas of agricultural land is about 1 site per ha, and the overall survey intensity is about 1.5 per hectare with the inclusion of the 1988 observations. At each observation point the following characteristics were assessed for each soil horizon up to a maximum of 120 cm or any impenetrable layer: soil texture; significant stoniness; colour (including local gley and mottle colours); consistency; structural condition; free carbonate; and depth.

3.1.3 Soil Wetness Class (WC) was inferred from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling and/or poorly permeable subsoil layers at least 15 cm thick.

3.1.4 Soil droughtiness was investigated by the calculation of moisture balance equations. Crop-adjusted Available Profile Water (AP) is estimated from texture, stoniness and depth, and then compared to a calculated moisture deficit (MD) for the standard crops, wheat and potatoes. The MD is a function of potential evapotranspiration and rainfall. Grading of the land can be affected if the AP is insufficient to balance the MD. When a profile is found with significant stoniness, sufficient to prevent penetration of a hand auger, then it is assumed, for the purposes of calculating droughtiness, that similar levels of stoniness continues to the full 1.2 m depth considered.

3.1.5 Four soil samples were subject to laboratory determination of particle size analysis, pH and the nutrients phosphorous, potassium, and magnesium. Results are given in Appendix 1.

3.2 Previous Survey Results

3.2.1 An ALC survey covering a portion of the site was carried out by MAFF in 1982, and is reproduced as Figure RAC3 with the current survey boundary overlain. This 1982 survey was made according to the ALC system prevalent at the time which had three divisions to Grade 3. The predominant land classification on the 1982 map is Subgrade 3c, which is low medium quality agricultural land.

3.2.2 The 1988 RAC ALC survey covered most of the present day site and showed the site to be principally Subgrade 3b, which is moderate quality agricultural land. The Subgrade 3c was removed from the ALC system with the 1988 revision, though there were so many fundamental differences introduced then that there is no direct or close parity between similarly named units mapped before and after 1988. A band of Subgrade 3a, good quality agricultural land, crosses the site over the southern half.

3.3 ALC and Main Limitations on the Agricultural Land

3.3.1 The principal constraints to agriculture are:

- seasonal soil wetness; from soil profile impermeability and the presence of heavy-textured impermeable layers in soil profiles, exacerbated by the slightly longer than average field capacity period of 167 days in this district in an average year, which combine to limit soil workability and the opportunity days for landworks;

- superficial stoniness, often associated with shallow soil depth, which makes cultivation, seed-bed preparation and seed sowing difficult;

- locally steep gradient, often associated with an uneven land form in some fields and occasional rock outcrops, which hinder cultivations;

- exposure to strong winds, sometimes salt-laden, which may damage crops.

3.3.2 Overall, these factors generally restrict the range of arable cropping to autumn-sown cereal and oilseed rape crops, or grass which is restricted considerably in its use by grazing livestock. The timing of cultivations and other landwork, as well as carefully controlled access for livestock, is especially important for successful farming and satisfactory crop yields. The limitation is usually to Subgrade 3b, moderate quality land, but where conditions are slightly more favourable the limitation is to Subgrade 3a, good quality land.

3.3.3 Across the southernmost part of the site, which is a steep south-facing scarp, gradients in excess of 7° limit the land quality to no better than Subgrade 3b, and gradients in excess of 11°, but less than 18°, limit the land quality to no better than Grade 4. The downgrading is based on the hazardous nature of operating agricultural equipment on steep slopes.

3.3.4 The areas of the various ALC grades are given in Table 2 and are mapped on Figure RAC5, which is a combination of the 1988 survey results supplemented by the 2009 survey. Approximately 70% of the site is classified as moderate quality agricultural land (Subgrade 3b), with Subgrade 3a land (which falls within the category of the 'best and most versatile land (Grades 1, 2, and 3a)) accounting for 24% of the agricultural land on the site. The remaining 6% is poor quality Grade 4 land.

Table 2: ALC Areas

Grade	Description	Area (ha)	Area (% of agric. land)
Subgrade 3a	Good quality	19.5	24
Subgrade 3b	Moderate quality	57.0	70
Grade 4	Poor quality	5.5	6
Total agricultural		82.0	100
	Best and most versatile	19.5	24
Non agricultural		2.0	
Total Area		84.0	

Appendix 1: Soil Laboratory Analytical Data

Laboratory data from augerings

Determinand	Site 9	Site 11	Site 14	Site 19	Units
Sand 2.00-0.063mm	11	10	13	29	% w/w
Silt 0.063-0.002mm	43	36	32	34	% w/w
Clay <0.002mm	46	54	55	37	% w/w
Texture	Clay	Clay	Clay	Clay	

Determinand	Site 9	Site 11	Site 14	Site 19	Units
Soil pH	7.6	7.7	7.8	7.6	
Phosphorus (P)	7	12	9	37	mg/l (av)
Potassium (K)	176	324	331	284	mg/l (av)
Magnesium (Mg)	283	129	190	94	mg/l (av)

Figure A1.1: Limiting percentages of sand silt and clay fractions for particle-size class

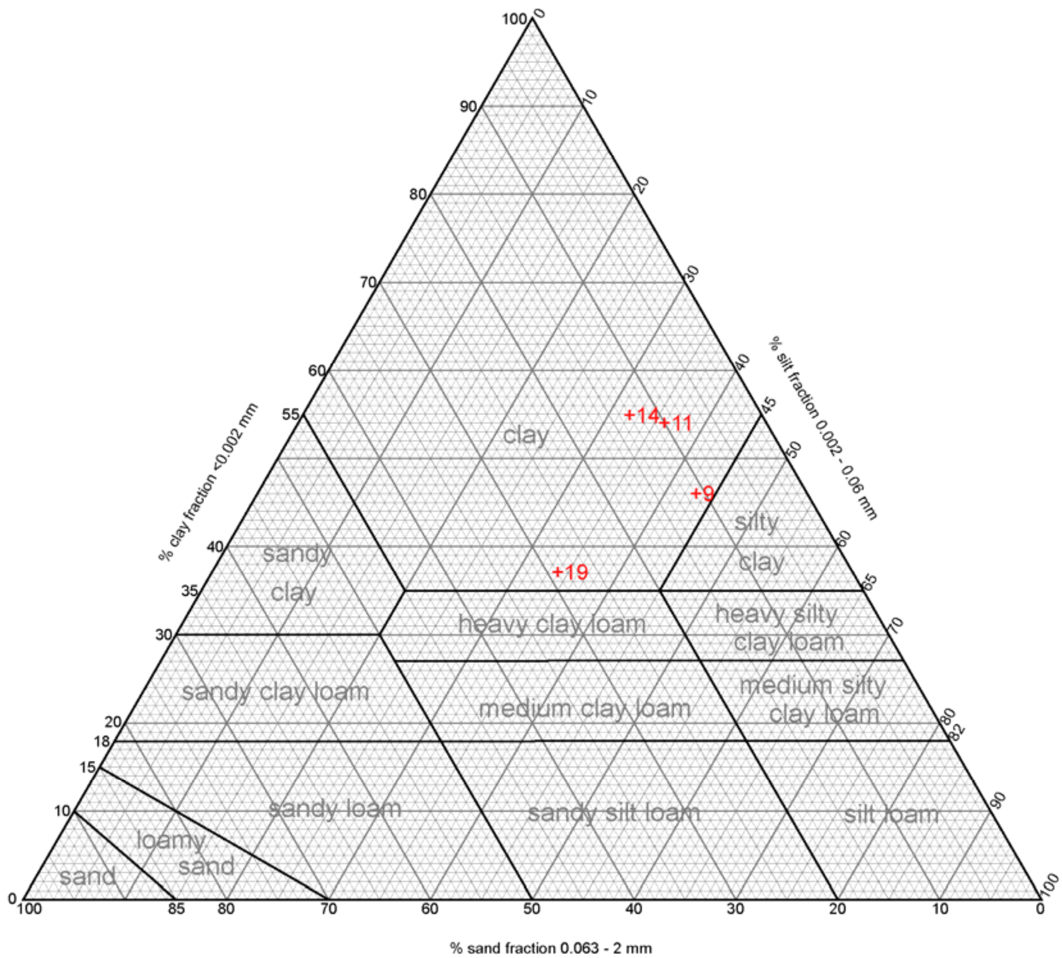
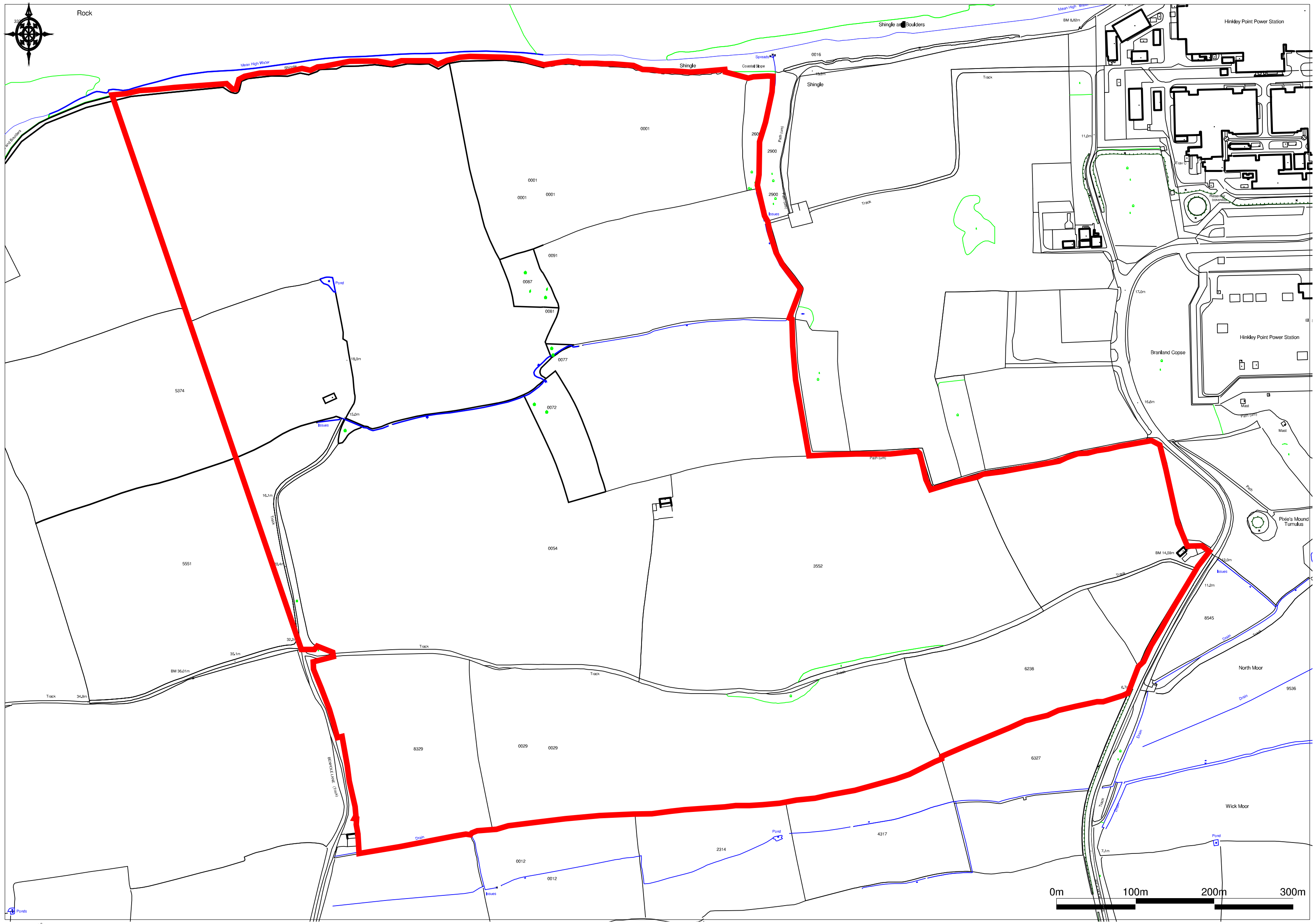


Figure RAC1: Location

Site: Hinkley C

Client: EDF Energy



NORTH

Scale 1: 7,500

15/May/09

Reading Agricultural Consultants

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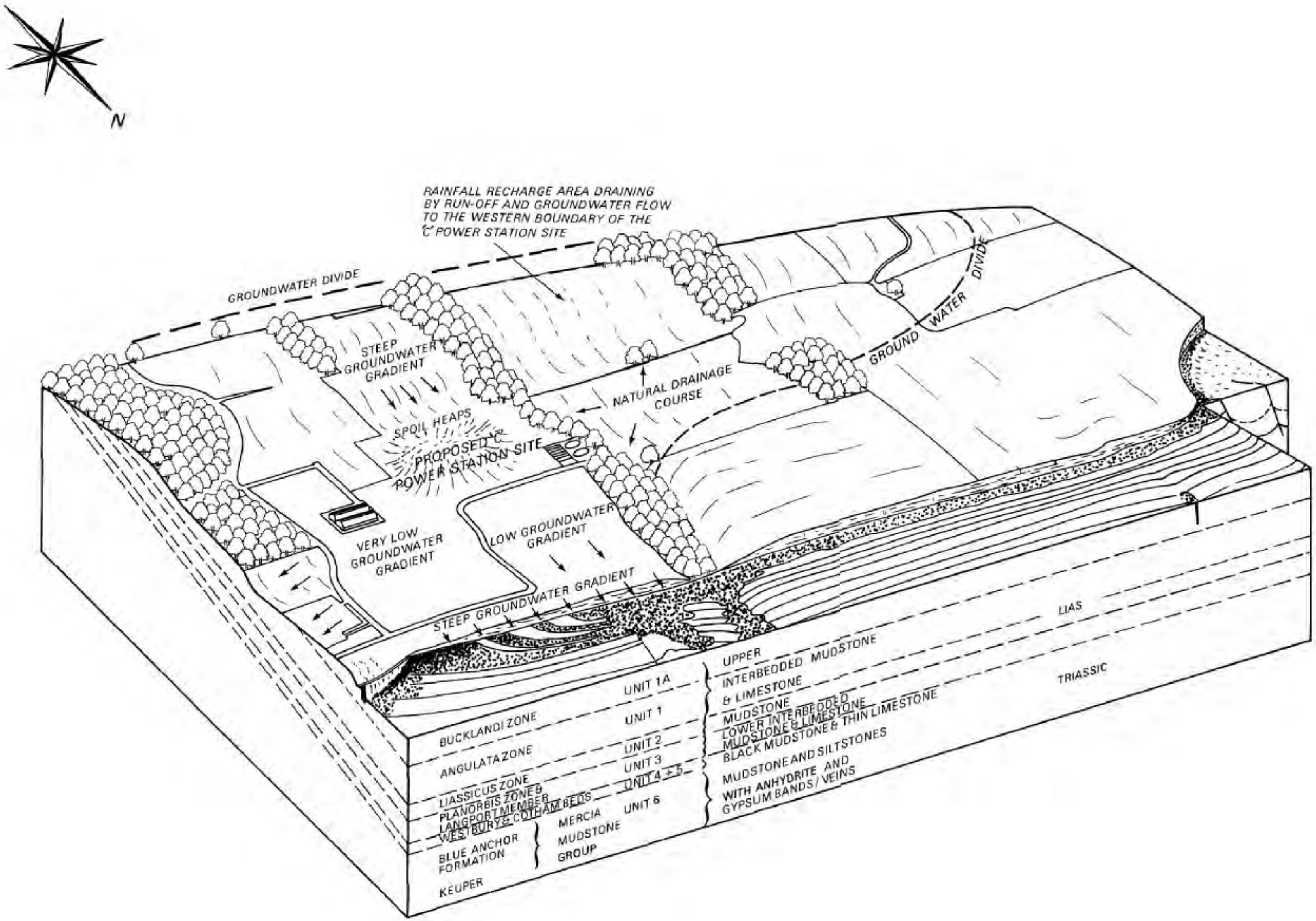
www.readingagricultural.co.uk

Figure RAC2: Geology

Site: Hinkley C

Client: EDF Energy



After CEGB 1987

NORTH

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Scale 1: 7,500

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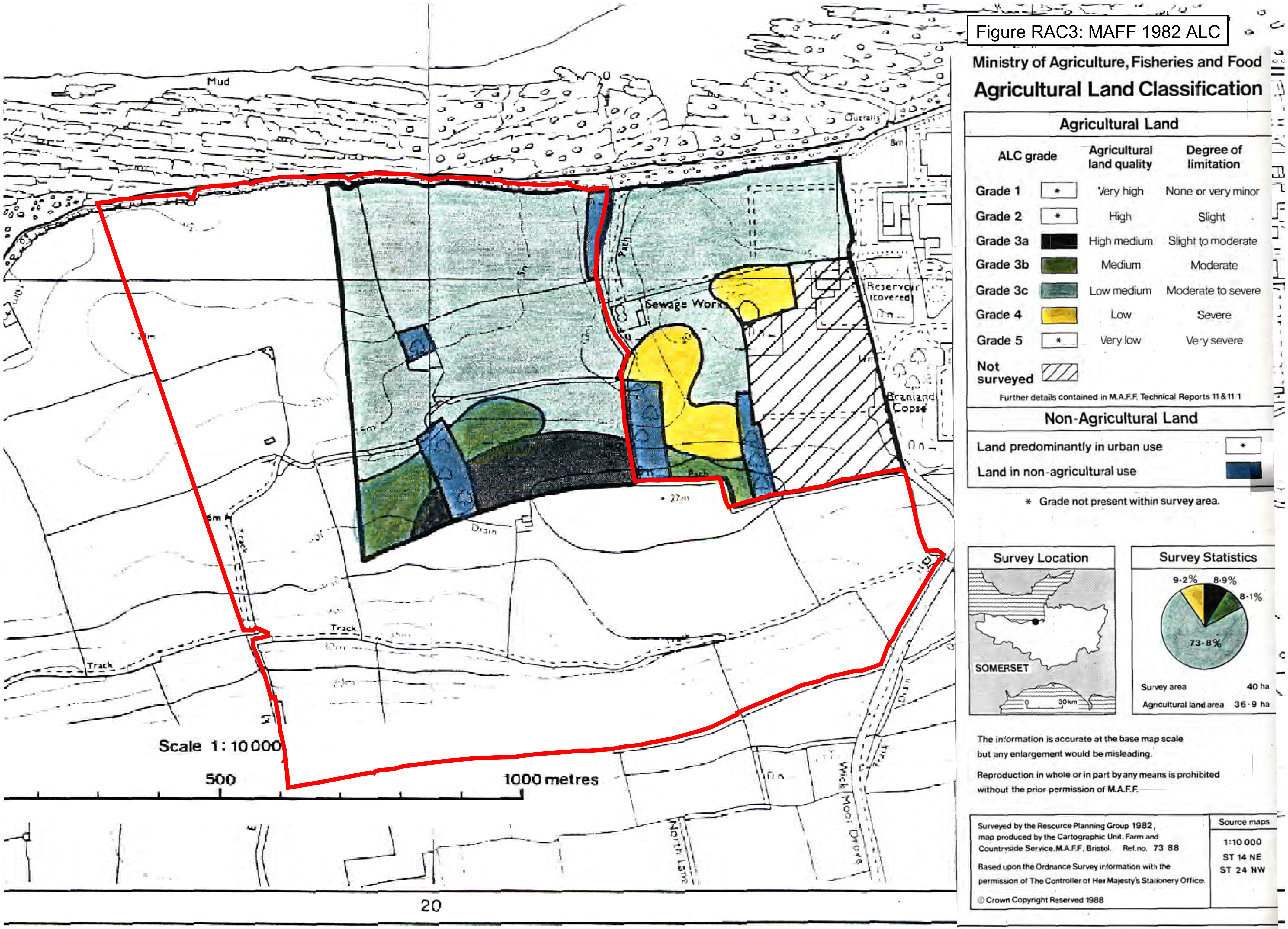
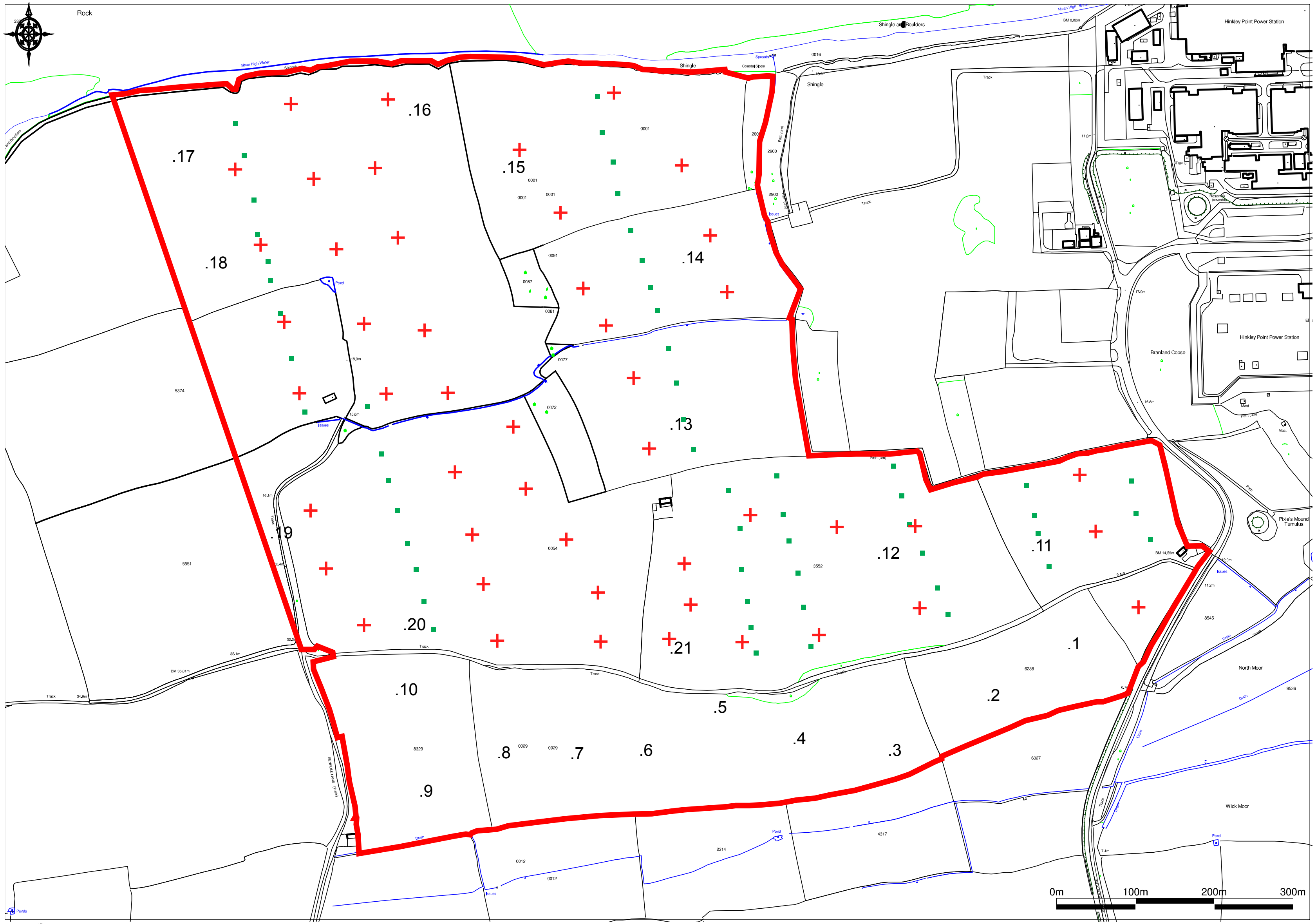


Figure RAC3: MAFF 1982 ALC

Figure RAC 4: Observations

Site: Hinkley C

Client: EDF Energy



Survey Area

.15 2009 Auger Observation

+ July 1988 Observation

▪ Other auger observation

NORTH

Scale 1: 7,500

15/May/09

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Figure RAC5: ALC

Site: Hinkley C

Client: EDF Energy

	*	Grade 1 - excellent quality
	*	Grade 2 - very good quality
19.5 ha		Subgrade 3a - good quality
57.0 ha		Subgrade 3b - moderate quality
5.5 ha		Grade 4 - poor quality
	*	Grade 5 - very poor quality
2.0 ha		Non-agricultural
	*	Not Present

NORTH

Scale 1: 7,500

15/May/09

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EDF Energy

Land at Hinkley Point, Somerset

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Reading Agricultural Consultants

May 2010

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1.1.2 The first ALC survey of parts of the site that has been identified was a 1982 study by ADAS for the Ministry of Agriculture Fisheries and Food (MAFF). This was followed by an ALC survey by RAC in 1988 which was supplemented by further soil resource surveys later in the same year.

1.1.3 In 2009, a larger ALC survey was carried out that included land to the west and south of the 1988 survey. This covered new ground and checked the previous work against revisions to the ALC classification system.

1.1.4 The present-day site boundary incorporates land to the south of the 2009 survey and therefore supplementary fieldwork has been carried out in 2010 to cover the new ground and build upon the findings of the previous surveys.

2. Site and Climatic Characteristics

2.1 General features, Land Form and Drainage

2.1.1 The total area considered is about 171 ha, the boundary being shown in red on Figure RAC4547-1. The land is bounded principally by other agricultural land, but has a power station to the east and Bridgwater Bay to the north. There are some residential developments close to the southern site border.

2.1.2 Existing use of the agricultural land is largely arable, without irrigation, and the land was mostly under field crops at the time of survey. There are several agricultural buildings within the northern half of the site, but they appear to be mainly derelict.

2.1.3 The site is divided centrally by a valley running east to west with land to the north and south consisting of broad interfluves.

2.1.4 Land to the north of the valley forms an undulating plain over the most part, with an overall fall to the north. There is a series of parallel east-west ridges with a south-facing scarp face forming the northern side of the valley. Slopes are convexo-concave, sometimes with a pronounced midslope rectilinear element.

2.1.5 The land to the south of the valley forms a broad flat top ridge over the most part. Gentle slopes are present towards the southern boundary where another valley system is present along and to the south of the southern boundary. Gradients increase in steepness with proximity to the central valley, but level off within the valley to give a relatively broad flat valley bottom.

2.1.6 The altitude of most of the site falls between about 5 and 35 m aOD. Microtopography is usually smooth to gently undulating. The northern soils have generally good drainage being of wetness class (WC) WCI, but with some areas of imperfect drainage (WCIII) where there is underlying clay. The southern soils mainly lie on the valley interfluve and exhibit variable wetness characteristics ranging from moderately well to imperfectly drained (WC II-III). The valley bottom soils are affected by a high water table and act as a receiving site for local rainfall. As such, the soils are poorly drained being of wetness class (WC) IV.

2.2 Climatic Factors

2.2.1 Local climatic factors have been interpolated from the Meteorological Office's standard 5 km grid point data set for the centre of the site at a representative altitude. Climatic factors are given in Table 1. The local climate has slightly higher rainfall than is typical for lowland England and the area can be considered moist. Temperatures are warm. The moisture deficits are moderate to moderately large. The Field Capacity Day (FCD) regime is slightly longer than the average for lowland England and can be considered to be slightly unfavourable for providing opportunities for landworks. In summary the climate is warm and moist.

Table 1: Local climatic factors

Average annual rainfall (AAR)	771 mm
Accumulated temperature > 0°C (AT0)	1,547 day°
Field Capacity Day regime (FCD)	167 days
Average moisture deficit, wheat (MDw)	105 mm
Average moisture deficit, potatoes (MDp)	98 mm

2.3 Soil Parent Materials and Soil Types

2.3.1 Hinkley Point lies on the southern margin of the Bristol Channel sedimentary basin. The basin is formed from a synclinal trough filled with sediments of Devonian to Jurassic age. West of the site area, Mesozoic rocks of Jurassic and Triassic age are exposed along the cliff line towards Watchet, whilst to the east of the site the Lower Lias cliff line gives way to the flat low-lying ground of the River Parrett estuary which forms an extensive area of Quaternary sedimentation known as the Somerset Levels.

2.3.2 The geological sequence beneath the overlying soils of much of the site consists of interbedded mudstones and thin limestones of the Lower Lias and Langport Formation, extending downwards into the Mercia Mudstone Group consisting of siltstones and mudstones. Where depressed areas are present, superficial alluvial deposits become the dominant soil parent material. Figure RAC4547-2 illustrates schematically, in block diagram form, the ground surface features and the sub-surface geology of the northern area.

2.3.3 The soils of the site have been mapped at a scale of 1" to one mile by the Soil Survey of England and Wales, and described in the memoir "The Soils of the Mendip District of Somerset" by D C Findlay, 1965. This map shows four principal soil types as being present at this site, with the majority of the higher interfluve land having soils of the Evesham series, which are imperfectly drained calcareous soils with poorly permeable subsoil.

2.3.4 The central valley system largely consists of soils of the Butleigh series. These soils are formed over fine textured alluvium and colluvium derived from the calcareous shales and clays of the Lower Lias. They are clayey and often found on flat or gently sloping land which receives drainage from adjoining high ground in the winter. The internal drainage is slow and soils may be affected by a fluctuating water table.

2.3.5 Further west and on the north side of the central valley the Butleigh soils give way to a small area of Worcester series soil. These soils are derived from Keuper Marl and typically consist of clay loam over stoneless clay with a characteristic reddish colour. Gleying features can be obscured by the dusky red hue but the abundance of concretionary manganiferous deposits indicates some drainage impedance.

2.3.6 A thin strip of Compton series soils runs along the southern boundary where the land begins to slope gently into a depressed area located off site. These soils are developed on extensive tracts of alluvium and colluviums derived from the Keuper Marl. They are typically clayey with drainage ranging from imperfect to poor, depending on the thickness of alluvium and the depth to the permanent water table. Surface layers may suffer temporary waterlogging due to slow percolation but prolonged flooding is rare. However, the small area of the site mapped as having these soils proved to have shallow stony soils probably derived from gravelly Head. These soils are probably of the Huntsworth series, and are formed from Head over Lias clay, are relatively free draining and do not contain much clay or stone derived from the underlying Lias.

2.3.7 In summary, the majority of the soils consist of well structured clay topsoils with moderately structured clay upper subsoils and weakly structured calcareous clay lower subsoils that constitute a poorly permeable layer. Soils are shallower over rock on the shoulders of the slopes where there is a pronounced change in slope angle. Wet alluvial heavy clay bottom soils are present alongside the stream in the valley with well structured, organic-rich topsoil over poorly permeable heavy clay subsoil.

3. Agricultural Land Quality

3.1 Soil Survey Methods

3.1.1 The preliminary RAC soil survey was carried out in late July 1988, followed by further, more detailed work in mid-August. The survey was carried out using hand auger and spade, much in the manner of the 2009 and 2010 fieldwork described below. Some 102 observations were made in the northern part of the current site, giving a survey intensity of about 1.3 observations per hectare. The location of observations is given on Figure RAC4547-1. The interpretation of the findings of the original 1988 surveys was made in accordance with the then impending introduction in January 1989 by MAFF of revised and more detailed criteria for assessing agricultural land quality. The classification was therefore made according to the published draft of the forthcoming revised guidelines, and has been checked against the later guidelines as part of the later study.

3.1.2 Further fieldwork carried out in 2009 consisted of some twenty one soil profiles which were examined using an Edelman (Dutch) auger and spade. The location of observations is also indicated on Figure RAC4547-1. Observation density on the surveyed areas of agricultural land was about one site per ha.

3.1.3 The most recent fieldwork was carried out in February 2010 and included examination of 64 profiles. The location of the new observations is also indicated on Figure RAC4547-1. Observation density on the newly surveyed area is about one site per ha, and the overall survey intensity is about 1.1 per hectare with the inclusion of the 1988 and 2009 observations.

3.1.4 At each observation point the following characteristics were assessed for each soil horizon up to a maximum of 120 cm or any impenetrable layer: soil texture; significant stoniness; colour (including local gley and mottle colours); consistency; structural condition; free carbonate; and depth. Extensive use was made of archaeological trenches, which were open at the time of survey, and which allowed many observations to be made of soil structural characteristics.

3.1.5 Soil Wetness Class (WC) was inferred from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling and/or poorly permeable subsoil layers at least 15 cm thick.

3.1.6 Soil droughtiness was investigated by the calculation of moisture balance equations. Crop-adjusted Available Profile Water (AP) is estimated from texture, stoniness and depth, and then compared to a calculated moisture deficit (MD) for the standard crops, wheat and potatoes. The MD is a function of potential evapotranspiration and rainfall. Grading of the land can be affected if the AP is insufficient to balance the MD. When a profile is found with significant stoniness, sufficient to prevent penetration of a hand auger, then it is assumed, for the purposes of calculating droughtiness, that similar levels of stoniness continues to the full 1.2 m depth considered.

3.1.7 Eight soil samples were subject to laboratory determination of particle size analysis, pH and the nutrients, phosphorous, potassium and magnesium. The samples collected in 2010 were also analysed for organic matter content using the Walkley-Black method. Results are given in Appendix 1.

3.2 Previous Survey Results

3.2.1 An ALC survey covering a portion of the site was carried out by MAFF in 1982. This survey was made according to the ALC system prevalent at the time which had three subdivisions to Grade 3. The predominant land classification on the 1982 map is Subgrade 3c, which is low medium quality agricultural land.

3.2.2 The 1988 RAC ALC survey covered most of the northern half of the current site and showed the site to be principally Subgrade 3b, which is moderate quality agricultural land. The Subgrade 3c was removed from the ALC system with the 1988 revision, though there were so many fundamental differences introduced then that there is no direct or close parity between similarly named units mapped before and after 1988. A band of Subgrade 3a, good quality agricultural land, crosses the site.

3.3 ALC and Main Limitations on the Agricultural Land

3.3.1 The principal constraints to agriculture are:

- seasonal soil wetness; from soil profile impermeability and the presence of heavy-textured impermeable layers in soil profiles, exacerbated by the slightly longer than average field capacity period of 167 days in this district in an average year, which combine to limit soil workability and the opportunity days for landworks;

- superficial stoniness, often associated with shallow soil depth, which makes cultivation, seed-bed preparation and seed sowing difficult;

- locally steep gradient, often associated with an uneven land form in some fields and occasional rock outcrops, which hinder cultivations;

- cumulative wetness in the central valley, which is a receiving site, causes prolonged wetness and seriously limits soil workability and the opportunity days for landworks;

- exposure to strong winds, sometimes salt-laden, which may damage crops.

3.3.2 Overall, these factors generally restrict the range of arable cropping to autumn-sown cereal and oilseed rape crops, or grass which is restricted considerably in its use by grazing livestock. The timing of cultivations and other landwork, as well as carefully controlled access for livestock, is especially important for successful farming and satisfactory crop yields. The limitation is usually to Subgrade 3b, moderate quality land, but where conditions are slightly more favourable the limitation is to Subgrade 3a, good quality land.

3.3.3 The steep south-facing scarp slope to the north of the central valley has gradients in excess of 7° which limit the land quality to no better than Subgrade 3b, and gradients in excess of 11°, but less than 18°, limit the land quality to no better than Grade 4. The downgrading is based on the hazardous nature of operating agricultural equipment on steep slopes.

3.3.4 Within the central valley the soil wetness is considered to be severe and, in combination with the heavy clay texture, limits land to no better than Grade 4.

3.3.5 The areas of the various ALC grades are given in Table 2 and are mapped on Figure RAC4547-3, which is a combination of the 1988 survey results supplemented by the 2009 and 2010 surveys. Approximately 73% of the site is classified as moderate quality agricultural land (Subgrade 3b), with Subgrade 3a land (which falls within the category of the ‘best and most versatile land (Grades 1, 2, and 3a)) accounting for 14% of the agricultural land on the site. The remaining 13% is poor quality Grade 4 land.

Table 2: ALC Areas

Grade	Description	Area (ha)	Area (% of agric. land)
Subgrade 3a	Good quality	19.8	14
Subgrade 3b	Moderate quality	102.6	73
Grade 4	Poor quality	18.8	13
Total agricultural		141.2	100
	Best and most versatile	19.8	14
Non agricultural		30.2	
Total Area		171.4	

4. Soil Resources

4.1 Introduction

4.1.1 The soils over the area surveyed comprise topsoil over subsoil. The latter is further divided into upper and lower subsoil layers on the attached plans, principally according to its physical characteristics.

4.1.2 In this description a soil profile is arbitrarily defined as the upper 1.2 metres of the land surface.

4.1.3 Woodland soils (labelled W on figures RAC4547-4 to RAC4547-6) will be similar in their texture and layer thicknesses to the adjacent agricultural land, but their nutrient status and pH may be different. They will also have a seed store of woodland species. These factors will make them not well suited for re-use on agricultural land, but they will have qualities which will be preferred for soils used to establish new woodland or hedgerows.

4.1.4 The land in the north-east quadrant of the site, which is non-agricultural, has been considerably disturbed since the 1982 ALC survey which indicated it was agricultural land. The site has been used for tipping and disposal of waste, as well as construction of car parks and office space. Due to the potential for contamination the soils of this quadrant are not considered to be part of the soil resources of the site. However, there may be potential to utilise some soils from the wooded areas which appear to have been largely undisturbed.

4.2 Topsoil

4.2.1 Topsoils are generally of clay or heavy clay loam texture and slightly stony. Moderately stony topsoil (about 15-20% stones by volume) occurs mainly on the higher ground near Beachborough Barn and near the southern boundary of the south-westernmost field in the northern half of the site. On the southern half of the site soils are shallow over rock where there are pronounced changes in slope angle, though topsoils are usually only slightly stony.

4.2.2 Plan RAC4547-4 shows topsoil types and thicknesses. Most of the topsoil is well suited for re-use and about 250mm thick on the main agricultural areas.

4.2.3 Moderately stony topsoil (A’ on Plan 4547-4) should be stripped, stored and re-used separately from other topsoil.

4.2.4 Heavy clay topsoil of the valley bottom is not well-suited for re-use and should also be stripped, stored and re-used separately from other topsoil. The very wet nature of this part of the site may well lead to problems with soil handling.

4.3 Upper Subsoil

4.3.1 Three main types are identified, A, B and C. Plan RAC4537-5 indicates their distribution. Type A is better quality soil which should be stripped, stored and re-used separately from other upper subsoil, and be used to restore better quality agricultural land. It is slightly stony clay or silty clay loam, sometimes calcareous, and with an average thickness of 200mm to 250mm, generally being slightly thicker on the southern half of the site. It is well suited for re-use as upper subsoil on better quality agricultural restoration. At the west end and on the north side of the central valley the soil is reddish, and this should be stripped, stored and utilised separately from the other upper subsoils.

4.3.2 Type B upper subsoil is moderately well structured and generally represents the soil layer immediately above a poorly permeable clay layer. As such it is of superior quality to the under-lying lower subsoil and generally consists of slightly stony non-calcareous clay. It is generally about 150-250 mm thick. In places, mainly on higher ground but along mid-slope contours elsewhere, it can be calcareous and often overlies fractured limestone. Though only of moderate quality this soil type is the predominant upper subsoil across the site. In places there is no recoverable Type B upper subsoil indicated on Figure RAC4547-5, this is generally due to their either being rock or stones present directly under the topsoil.

4.3.3 Type C upper subsoil is heavy clay alluvium in the valley bottom, is grey and mottled, and only weakly structured. It will have low potential for re-use in any agricultural restoration and will have to be stripped, stored and re-used separately from other upper subsoil. The severe wetness of this part of the site may preclude its recovery. Thickness varies around 250mm.

4.4 Lower Subsoil

4.4.1 Three main types are identified A, B and C. Plan RAC4547-6 illustrates their distribution and thicknesses. Each type identified should be stripped, stored and re-used separately as far as possible.

4.4.2 The better quality lower subsoil (Type A) is not extensive but is similar to Type A upper subsoil and has a working thickness of up to 700mm, but may be limited in thickness by underlying stones or rock. It is well suited for re-use as subsoil, either upper or lower in replaced soil profiles, preferably in association with Type A upper subsoil and topsoil. At the west end and on the north side of the central valley the soil is reddish, and this should be stripped, stored and utilised separately from the other lower subsoils.

4.4.3 The moderate quality lower subsoil (Type B on Plan RAC4547-6) is generally poorly permeable, slightly calcareous clay over the southern half of the site and variably calcareous clay over the northern half. It has a working thickness of up to 700mm, but may be limited in thickness by underlying stones or rock. On the higher ground, limestone bands are common inclusions and these also occur unpredictably on valley sides, probably following contours. This clay is of low permeability and will impede soil drainage. It should therefore only be used in low to moderate quality agricultural restoration, and only be utilised at the base of the profile.

4.4.4 The remaining lower subsoil material (Type C) is of heavy clay texture and is very wet and impermeable. It is normally stoneless and non-calcareous on the bottom of the central valley footslopes and floors. This material is poorly suited to re-use as lower subsoil and there may well be severe difficulties in recovering the resource due to site wetness.

4.4.5 In places there is no recoverable lower subsoil indicated on Figure RAC4547-6; this is generally due to there either being rock or stones present directly under the topsoil or upper subsoil.

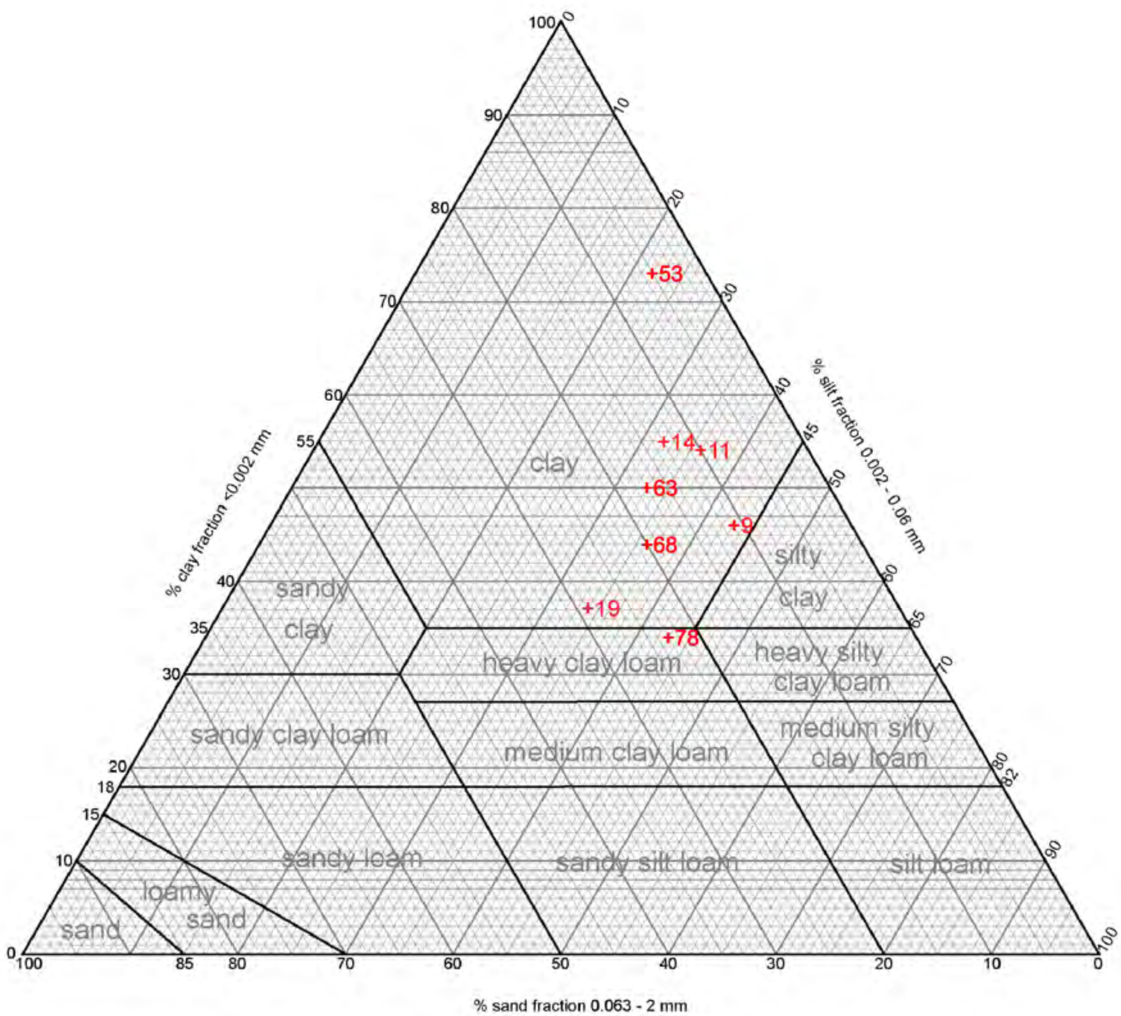
Appendix 1: Soil Laboratory Analytical Data

Laboratory data from augerings

Determinand	Site 9	Site 11	Site 14	Site 19	Site 53	Site 63	Site 68	Site 78	Units
Sand 2.00-0.063mm	11	10	13	29	5	17	20	23	% w/w
Silt 0.063-0.002mm	43	36	32	34	22	33	36	43	% w/w
Clay <0.002mm	46	54	55	37	73	50	44	34	% w/w
Organic matter					8.0	5.0	4.5	3.4	% w/w
Texture	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay Loam	

Determinand	Site 9	Site 11	Site 14	Site 19	Site 53	Site 63	Site 68	Site 78	Units
Soil pH	7.6	7.7	7.8	19	6.3	8.1	8.1	8.4	
Phosphorus (P)	7	12	9	37	5	30	18	14	mg/l (av)
Potassium (K)	176	324	331	284	144	282	293	214	mg/l (av)
Magnesium (Mg)	283	129	190	94	685	87	91	350	mg/l (av)

Figure A1.1: Limiting percentages of sand silt and clay fractions for particle-size class



Appendix 2: Description of the grades, subgrades, and wetness classes (After MAFF 1988)

The ALC grades and subgrades are described below in terms of the types of limitation which can occur, typical cropping range and the expected level and consistency of yield. In practice, the grades are defined by reference to physical characteristics and the grading guidance and cut-offs for limitation factors in Section 3 enable land to be ranked in accordance with these general descriptions. The most productive and flexible land falls into Grades 1 and 2 and Subgrade 3a and collectively comprises about one-third of the agricultural land in England and Wales. About half the land is of moderate quality in Sub grade 3b or poor quality in Grade 4. Although less significant on a national scale such land can be locally valuable to agriculture and the rural economy where poorer farmland predominates. The remainder is very poor quality land in Grade 5, which mostly occurs in the uplands.

Descriptions are also given of other land categories which may be used on ALC maps.

Grade 1 -excellent quality agricultural land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2 -very good quality agricultural land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

Grade 3 --good to moderate quality agricultural land

Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a -good quality agricultural land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b -moderate quality agricultural land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

Grade 4 -poor quality agricultural land

Land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5 -very poor quality agricultural land

Land with very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

Table 11 Definition of Soil Wetness Classes

Wetness Class	Duration of Waterlogging [1]
I	The soil profile is not wet within 70 cm depth for more than 30 days in most years[2].
II	The soil profile is wet within 70 cm depth for 31-90 days in most years *or,* if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 90 days, but not wet within 40 cm depth for more than 30 days in most years.
III	The soil profile is wet within 70 cm depth for 91-180 days in most years *or,* if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31 and 90 days in most years.
IV	The soil profile is wet within 70 cm depth for more than 180 days but not within 40 cm depth for more than 210 days in most years *or,* if there is no slowly permeable layer within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.

V	The soil profile is wet within 40 cm depth for 211- 335 days in most years.
VI	The soil profile is wet within 40 cm depth for more than 335 days in most years.

[1] The number of days specified is not necessarily a continuous period.

[2] 'In most years' is defined as more than 10 out of 20 years.

Soils can be allocated to a wetness class on the basis of quantitative data recorded over a period of many years or by the interpretation of soil profile characteristics, site and climatic factors. Adequate quantitative data will rarely be available for ALC surveys and therefore the interpretative method of field assessment is used to identify soil wetness class in the field. The method adopted here is common to ADAS and the SSLRC.

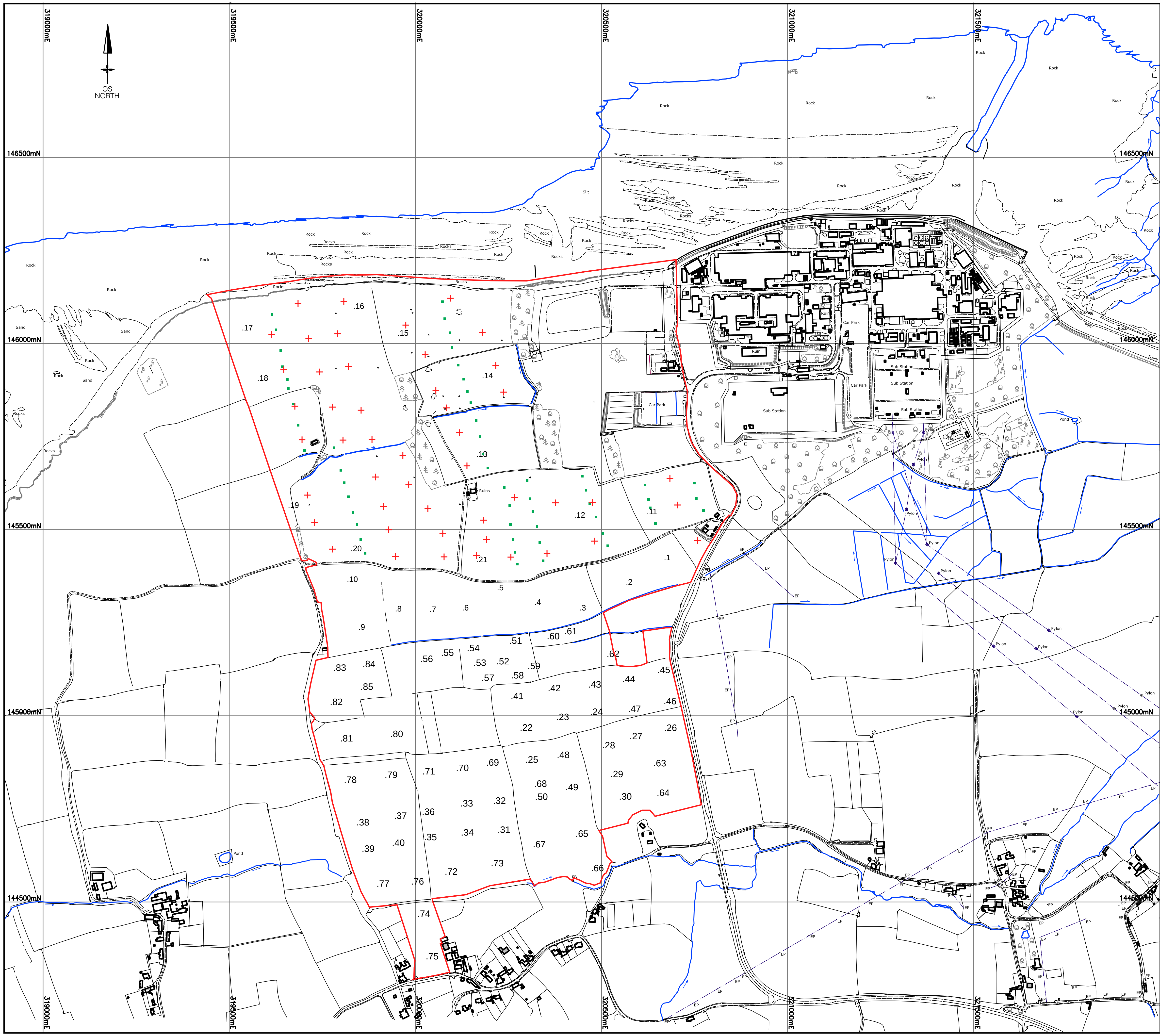


Figure RAC 3: Observations

Survey Area

.37 2010 Auger Observation

.15 2009 Auger Observation

+ July 1988 Observation

▪ Other auger observation

0 50 100m 500m

Figure RAC4547-1: Observations

Site: Hinkley Point ‘C’

Client: EDF

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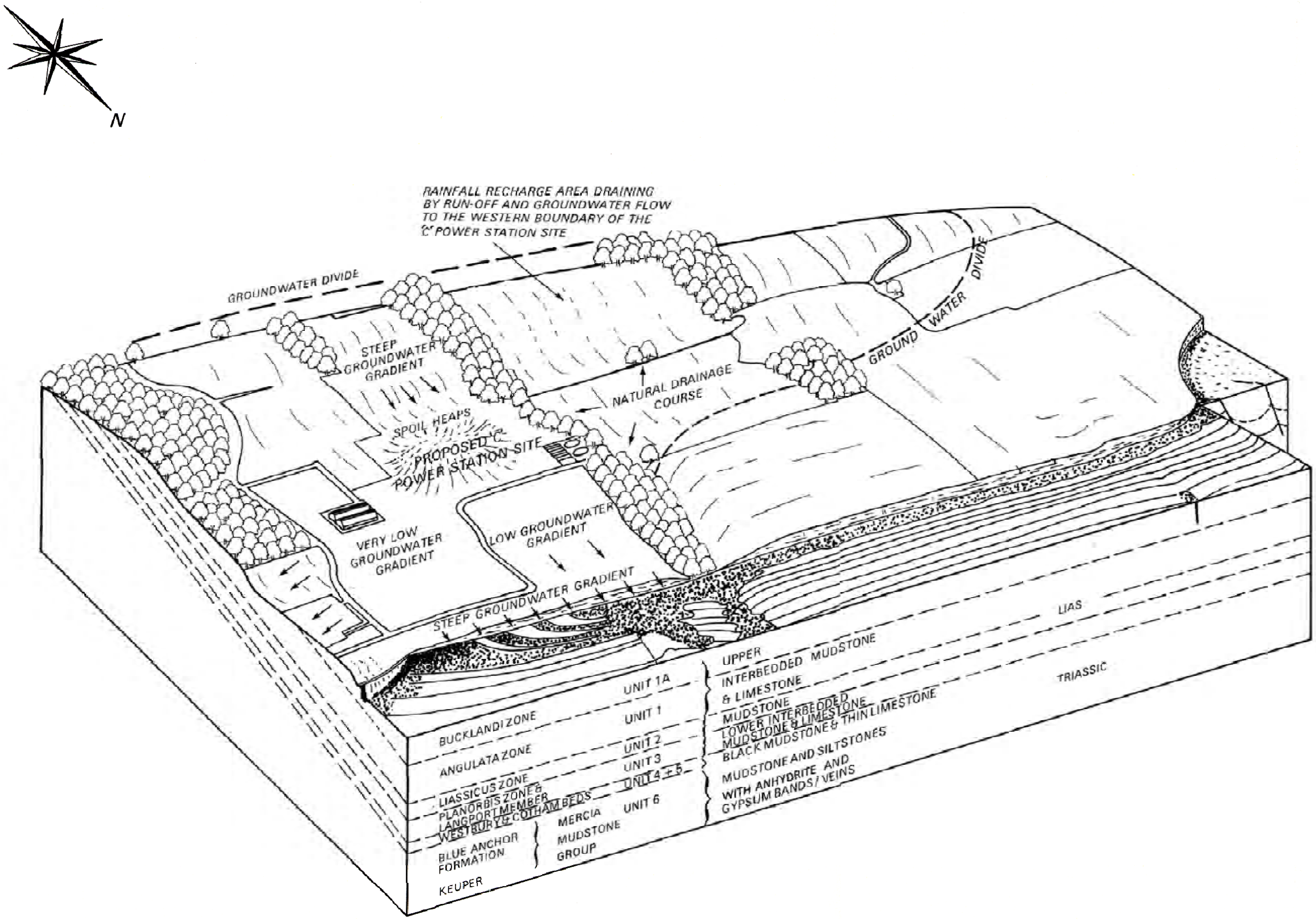

After CEGB 1987

Figure RAC4547-2: Geology

Site: Hinkley C

Client: EDF Energy

05/May/10

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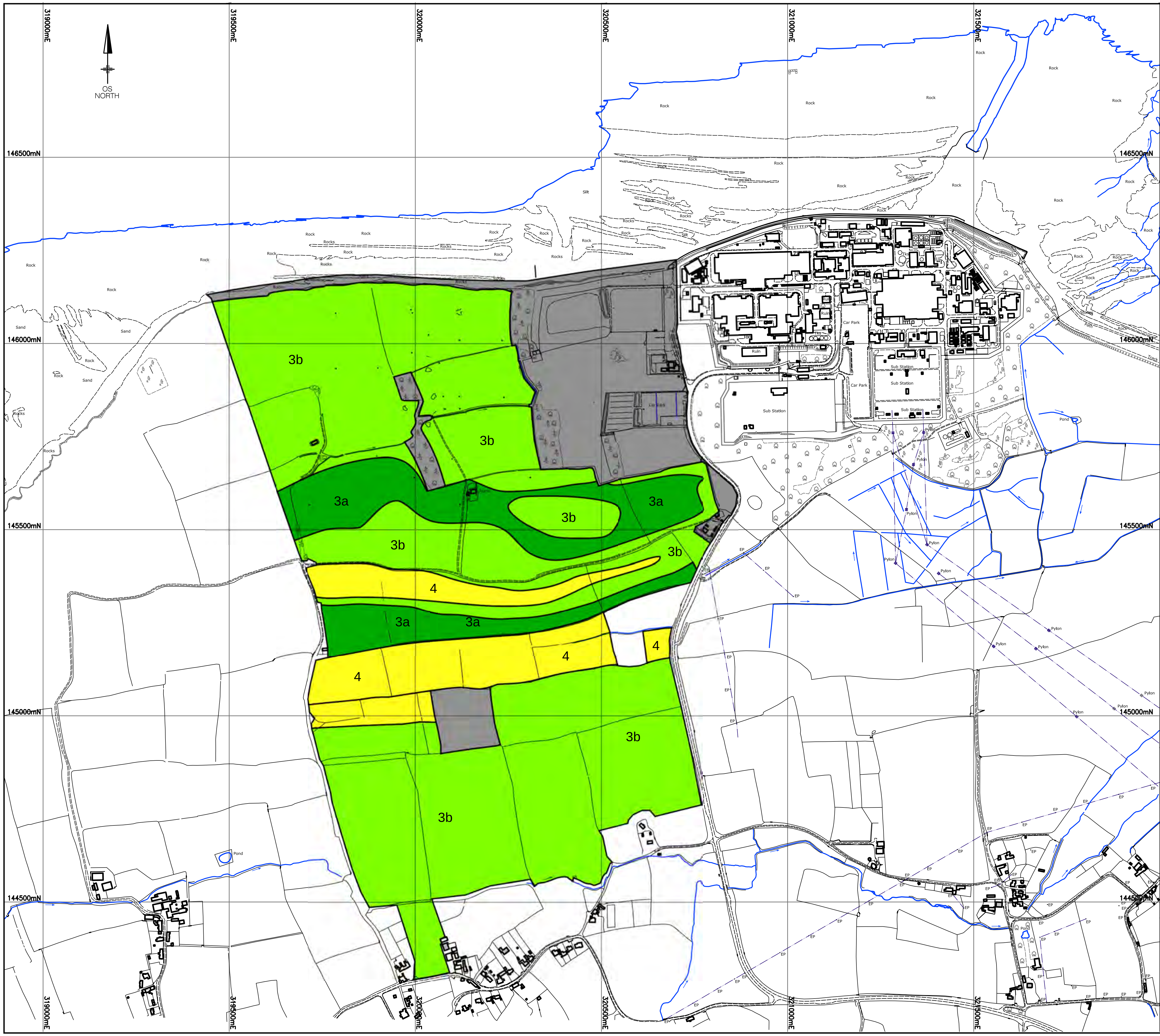

	*	Grade 1 - excellent quality
	*	Grade 2 - very good quality
20 ha		Subgrade 3a - good quality
103 ha		Subgrade 3b - moderate quality
18 ha		Grade 4 - poor quality
	*	Grade 5 - very poor quality
30 ha		Non-agricultural
	*	Not Present

Figure RAC4547-3: Agricultural and Classification

Site: Hinkley Point 'C'

Client: EDF

Scale 1: 10,000 07/May/10

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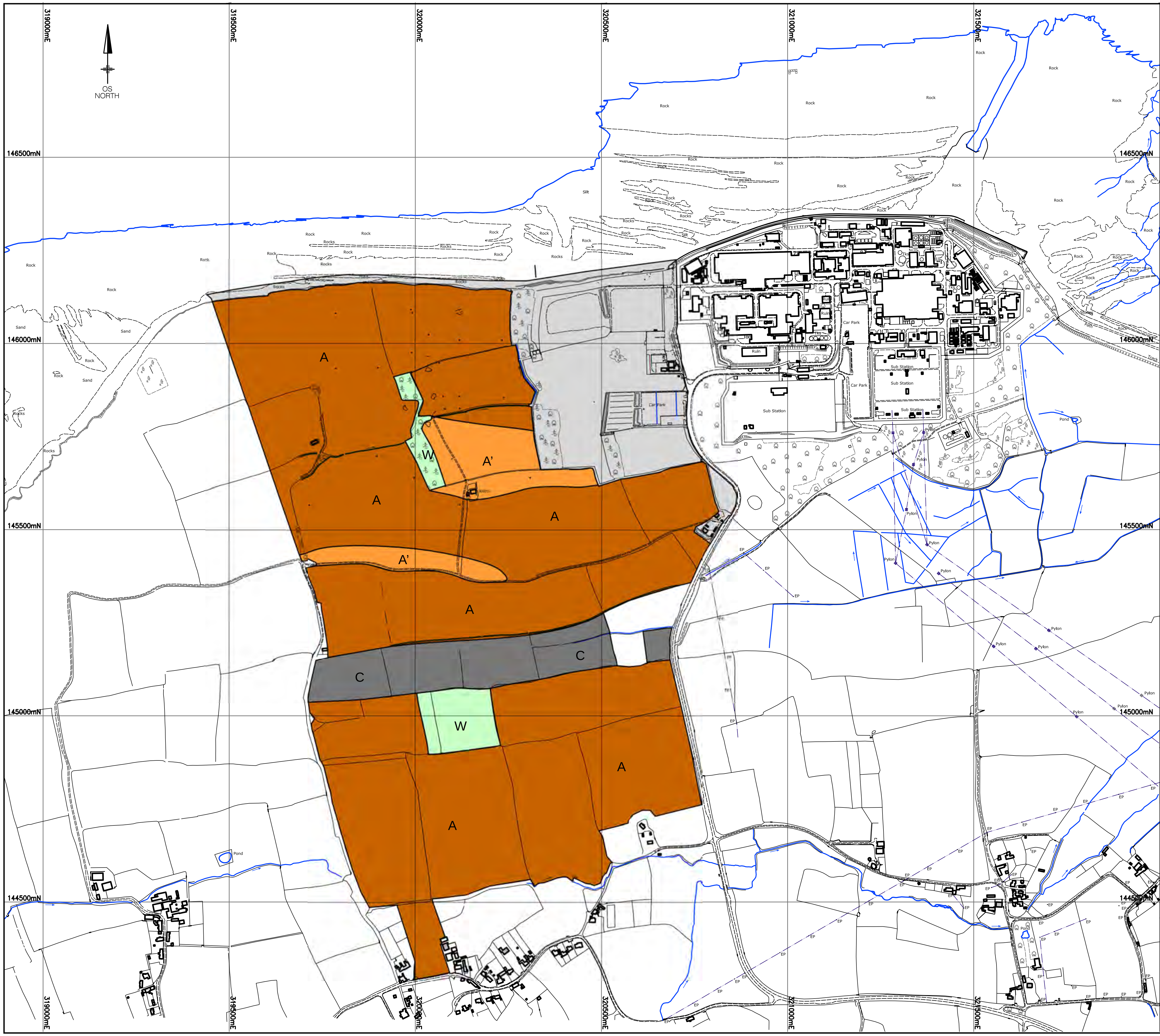

A — 25cm good quality clay or clay loam

A' — 25cm good quality clay or clay loam stony phase

C — 30cm heavy clay alluvium

W — Woodland Soil

No recoverable resource

0 50 100m 500m

Figure RAC4547-4: Topsoil Resources

Site: Hinkley Point 'C'

Client: EDF

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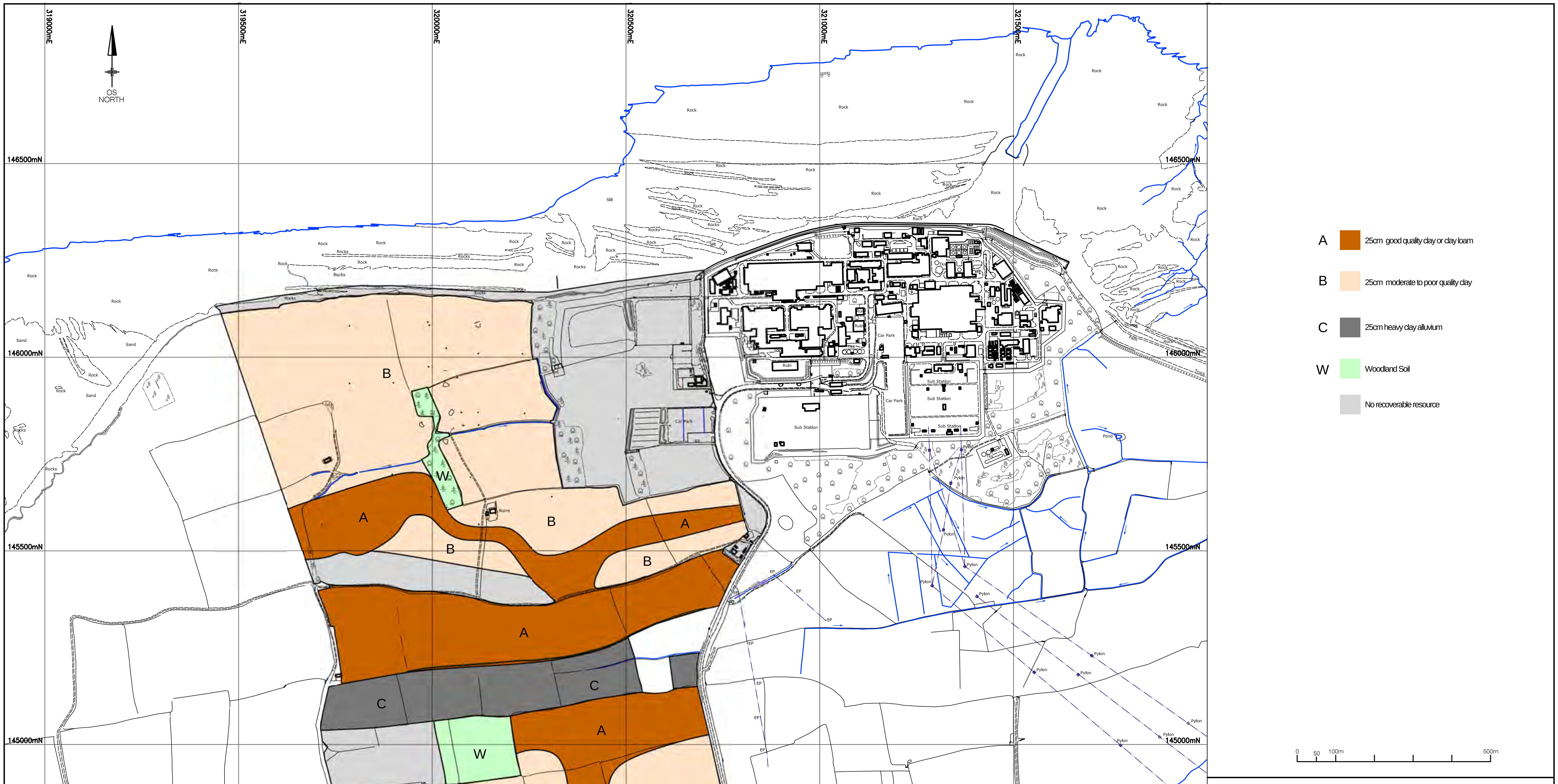

Figure RAC4547-5: Upper Subsoil Resources

Site: Hinkley Point 'C'

Client: EDF

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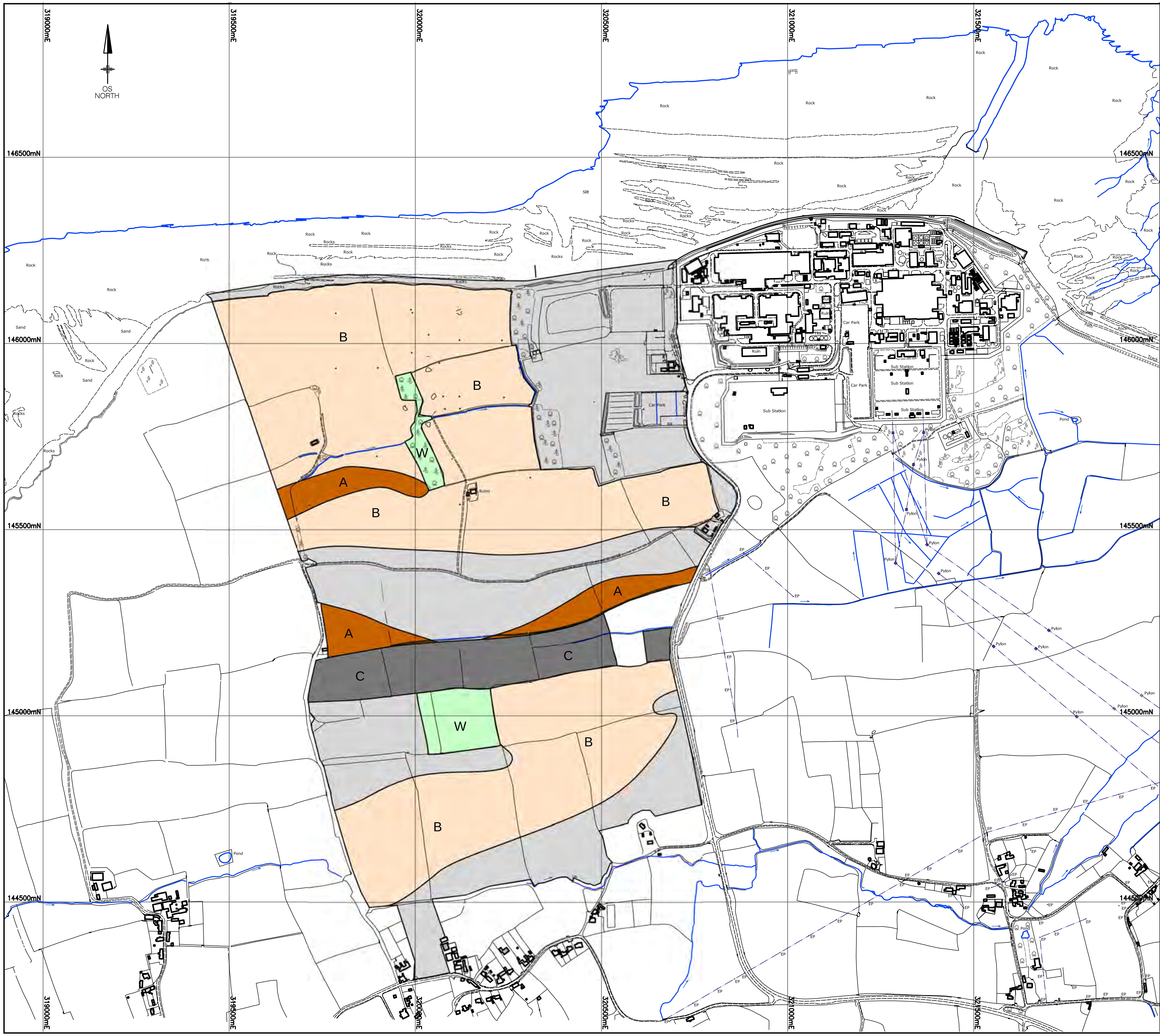

A — 70cm good quality clay or clay loam

B — 70cm poor quality clay

C — 65cm heavy clay alluvium

W — Woodland Soil

No recoverable resource

0 50 100m 500m

Figure RAC4547-6: Lower Subsoil Resources

Site: Hinkley Point 'C'

Client: EDF

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APPENDIX 13B: SOIL WETNESS CLASSIFICATION

APPENDIX 13B: SOIL WETNESS CLASSIFICATION

13B.1.1 Soil wetness is classified according to the depth and duration of waterlogging in the soil profile. Six revised soil wetness classes (MAFF, 1988 (Ref. 13.24)) are identified and are defined below.

Table 13B.1: Definition of Soil Wetness Classes

Wetness Class	Duration of Waterlogging[1]
I	The soil profile is not wet within 70cm depth for more than 30 days in most years[2].
II	The soil profile is wet within 70cm depth for 31-90 days in most years *or,* if there is no slowly permeable layer within 80cm depth, it is wet within 70cm for more than 90 days, but not wet within 40cm depth for more than 30 days in most years.
III	The soil profile is wet within 70cm depth for 91-180 days in most years *or,* if there is no slowly permeable layer within 80cm depth, it is wet within 70cm for more than 180 days, but only wet within 40cm depth for between 31 and 90 days in most years.
IV	The soil profile is wet within 70cm depth for more than 180 days but not within 40cm depth for more than 210 days in most years *or,* if there is no slowly permeable layer within 80cm depth, it is wet within 40 cm depth for 91-210 days in most years.
V	The soil profile is wet within 40cm depth for 211–335 days in most years.
VI	The soil profile is wet within 40cm depth for more than 335 days in most years.

[1] The number of days specified is not necessarily a continuous period.

[2] 'In most years' is defined as more than 10 out of 20 years.

13B.1.2 Soils can be allocated to a wetness class on the basis of quantitative data recorded over a period of many years or by the interpretation of soil profile characteristics, site and climatic factors. Adequate quantitative data will rarely be available for ALC surveys and therefore the interpretative method of field assessment is used to identify soil wetness class in the field. The method adopted here is common to ADAS and the SSLRC.

APPENDIX 13C: AGRICULTURAL LAND CLASSIFICATION (ALC) GRADE DEFINITIONS

APPENDIX 13C: AGRICULTURAL LAND CLASSIFICATION (ALC) GRADE DEFINITIONS

13C.1.1 The ALC grades and subgrades are described below in terms of the types of limitation which can occur, typical cropping range and the expected level and consistency of yield. In practice, the grades are defined by reference to physical characteristics and the grading guidance and cut-offs for limitation factors in Section 3 enable land to be ranked in accordance with these general descriptions. The most productive and flexible land falls into Grades 1 and 2 and Subgrade 3a and collectively comprises about one-third of the agricultural land in England and Wales. About half the land is of moderate quality in Subgrade 3b or poor quality in Grade 4. Although less significant on a national scale such land can be locally valuable to agriculture and the rural economy where poorer farmland predominates. The remainder is very poor quality land in Grade 5, which mostly occurs in the uplands.

13C.1.2 Descriptions are also given of other land categories which may be used on ALC maps.

a) Grade 1 - Excellent Quality Agricultural Land

13C.1.3 Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

b) Grade 2 - Very Good Quality Agricultural Land

13C.1.4 Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

c) Grade 3 – Good-to-moderate Quality Agricultural Land

13C.1.5 Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.

i Subgrade 3a - Good Quality Agricultural Land

13C.1.6 Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

ii Subgrade 3b - Moderate Quality Agricultural Land

13C.1.7 Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

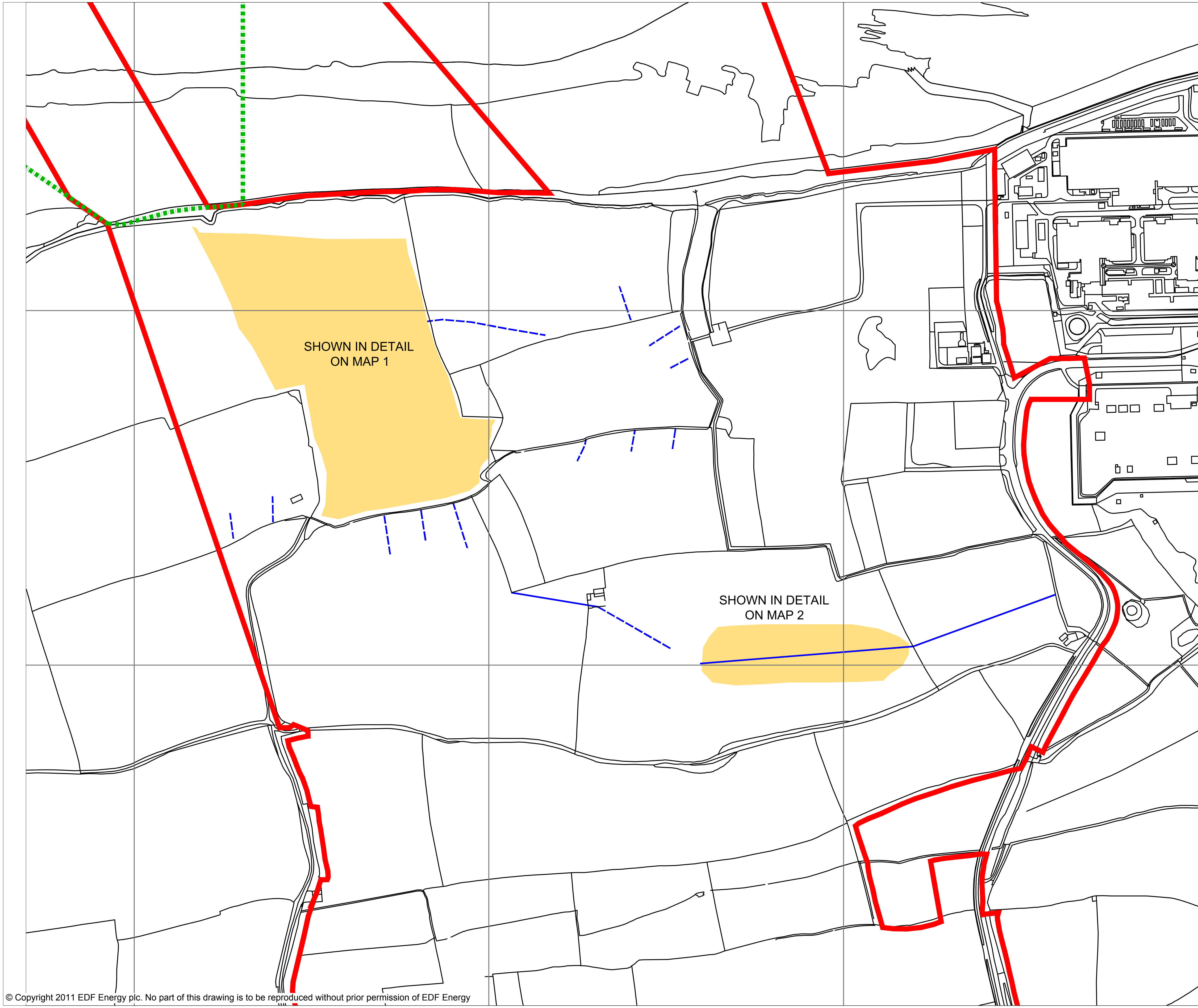
d) Grade 4 - Poor Quality Agricultural Land

13C.1.8 Land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

e) Grade 5 - Very Poor Quality Agricultural Land

13C.1.9 Land with very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

APPENDIX 13D: INDICATIVE LOCATIONS OF LAND DRAINS WITHIN THE SITE



KEY

- HINKLEY POINT C DEVELOPMENT SITE BOUNDARY
- TEMPORARY JETTY HARBOUR LIMITS
- LOCATION OF LAND DRAINS
- APPROXIMATE LOCATION OF LAND DRAINS

N
W E
S

EDF ENERGY

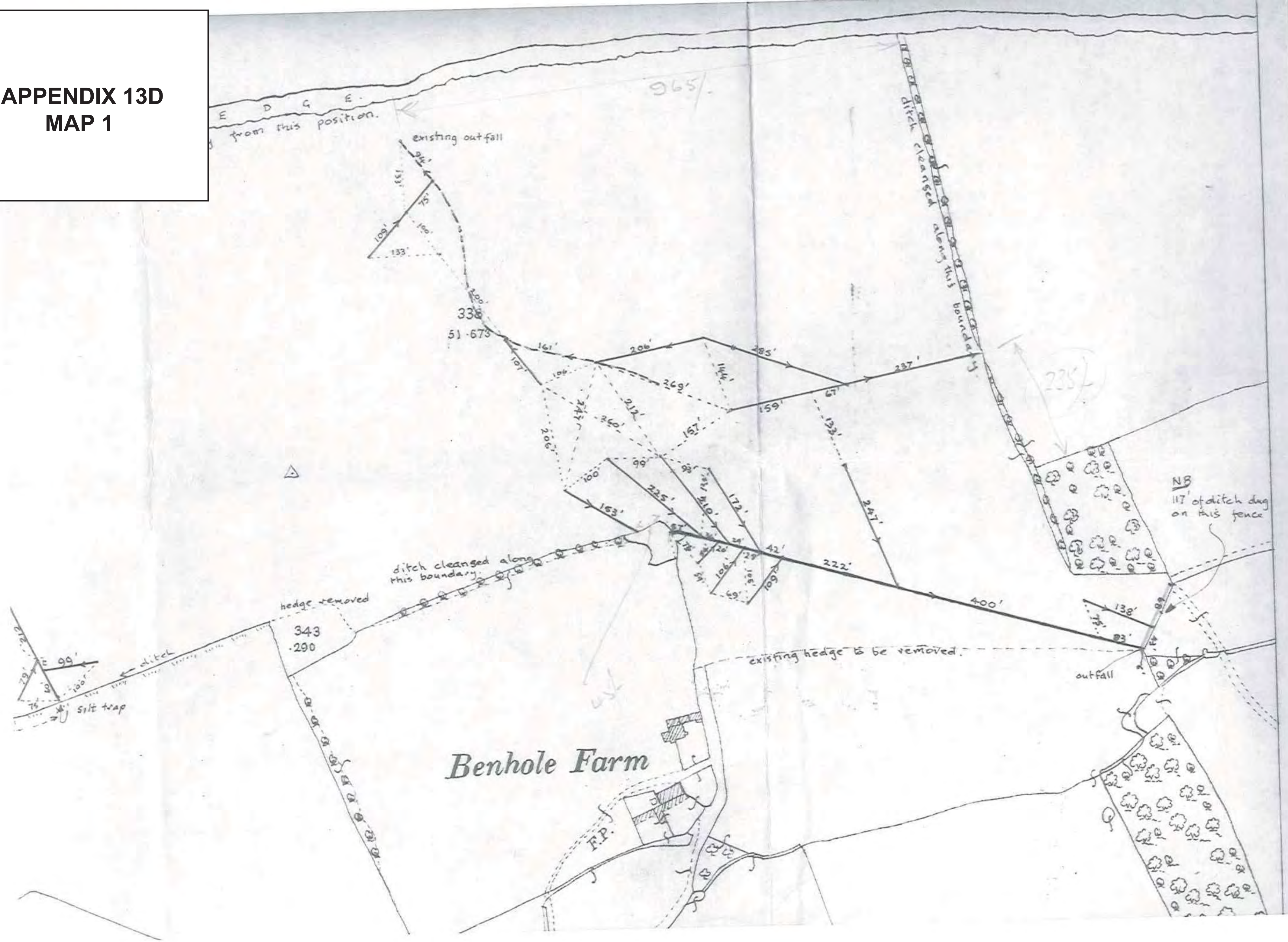
DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 13

FIGURE TITLE:
INDICATIVE LOCATION OF LAND DRAINS WITHIN THE SITE

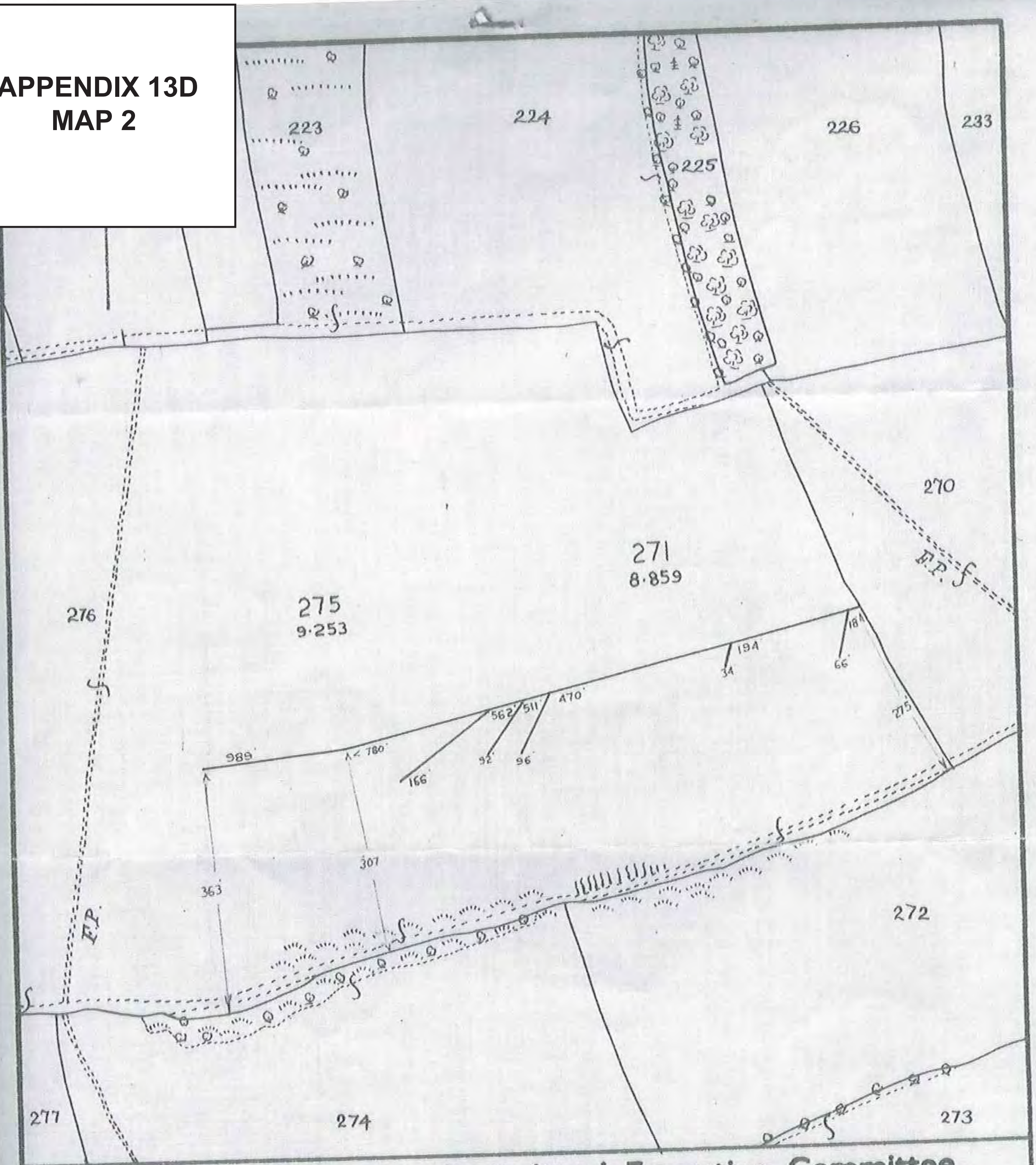
FIGURE NO:		REVISION:
APPENDIX 13 D		01
DATE: SEPT 2011	DRAWN: W.B	SCALE: 1:5,000@A3

SCALE BAR 50m 250m

APPENDIX 13D
MAP 1



APPENDIX 13D
MAP 2



County of Somerset: Agricultural Executive Committee

State Aided Tile Drainage.

Certificate

I certify this plan to be a true record of the tile drainage system as laid down for MR. F. KNOX

at KNIGHTON FARM
STOGURSEY
NR. BRIDGWATER

Somerset

Signed G. Rigg.

Chief Drainage Officer.

Somerset.

Area benefitted 3·88 Acre.	Parish of STOGURSEY	
LEGEND 3" tile drains 4" tile drains 6" tile drains	O.S. Map Som. XXXVII. 7 Edition of 1904 Scale 1/2500th	Reproduced from Ordnance Survey Map Crown copyright reserved.

APPENDIX 13E: PHOTOGRAPHIC APPENDIX

APPENDIX 13E: PHOTOGRAPHIC APPENDIX

Plate 13E.1: View North from main ridge in Built Development Area West, with re-sown permanent pasture in foreground (July, 2008)

Plate 13E.2: View south west from coastal footpath in Built Development Area West, with re-sown permanent grassland in foreground (July, 2008)

Plate 13E.3: Permanent grassland in Built Development Area West, looking East towards Hinkley Point A Power Station (July 2008)

Plate 13E.4: View North in the western part of Built Development Area West, showing wheat in the middle ground and edge of western woodlands (July, 2008)

Plate 13E.5: Looking South from the Green Lane, across the Southern Construction Phase Area, with Holford Stream Valley in the middle ground and mature oil seed rape in the foreground (July 2008)

Plate 13E.6: Looking South from the Green Lane, across the Southern Construction Phase Area, with Holford Stream Valley in the middle ground and mature wheat in the foreground (August 2009)

Plate 13E.7: Looking South West from the ridge in the centre of Built Development Area West, across fields of mature wheat (August, 2008)

APPENDIX 13F: DEFRA CONSULTATION ON ANIMAL BURIAL PITS

AHVLA
Animal Health and
Veterinary Laboratories
Agency

AHVLA, Quantock House, Paul Street, TAUNTON, Somerset TA1 3NX
t 01823 337 922 Night Line 07000 780 141 f 01823 338 170 e AHO.Taunton@ahvla.gsi.gov.uk

RECEIVED
- 1 AUG 2011

Una Magin
AMEC Environment and Infrastructure UK Ltd
Windsor House
Gadbrook Business Centre
Gadbrook Road
NORTHWICH
Cheshire CW9 7TN

Your reference Burialsites/HPC

Our reference 42/01E/05

Date 28 July 2011

Dear Madam

ANIMAL BURIAL SITES – LAND AT HINKLEY POINT (ST202455)

I am in receipt of your faxed letter and map dated 23 July 2011 (hard copy received 28 July 2011.

The Department does not hold records of all burial sites. Burials happened many years ago when individual farmers did not need authorisation to bury animal carcases as a means of disposal.

However current records held at this office do not indicate any recent burials under our authority on land at the above location.

I enclose a map to confirm our response, but if I can be of any further assistance please contact me on 01823 348495.

Yours faithfully

V. J. Langford

Val Langford
Taunton Animal Health Office

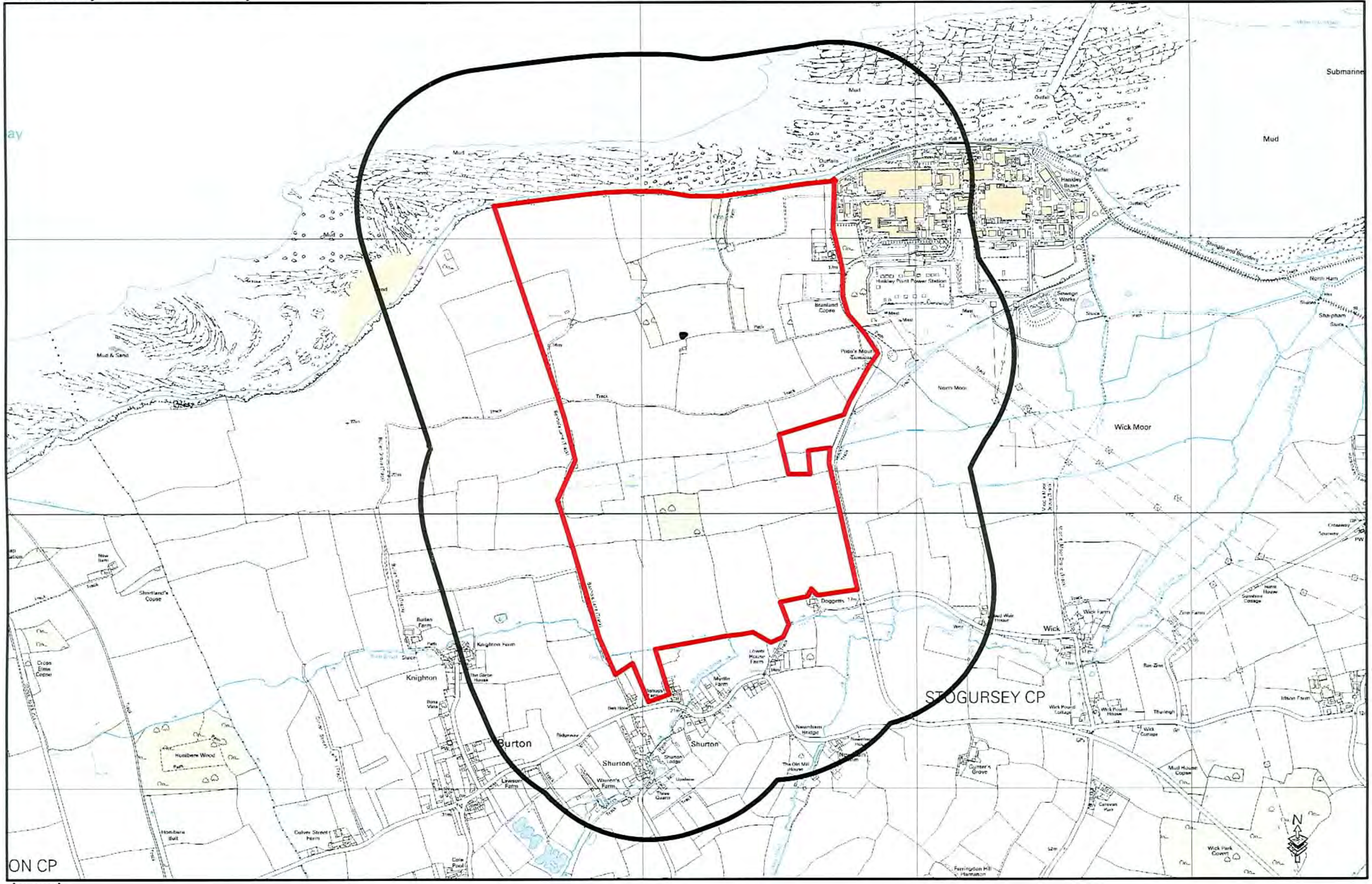
ENC

AH1755

Protect
Produced by Taunton GIS 28 July 2011

0.5km Radius of Land at Hinkley Point (ST202455)

1:17,818



Legend

0.5km_radius_of_land_at_Hinkley_Point

No confirmed FMD Burial Sites

Kilometers
0 0.1 0.2 0.4 0.6 0.8

AHVLA

APPENDIX 14A: GEOLOGICAL CROSS SECTIONS OF THE BUILT DEVELOPMENT AREA WEST

Cross-section layout

ELECTRICITE DE FRANCE
Service Géologie Géotechnique
Rapport n°EDTGG090141A

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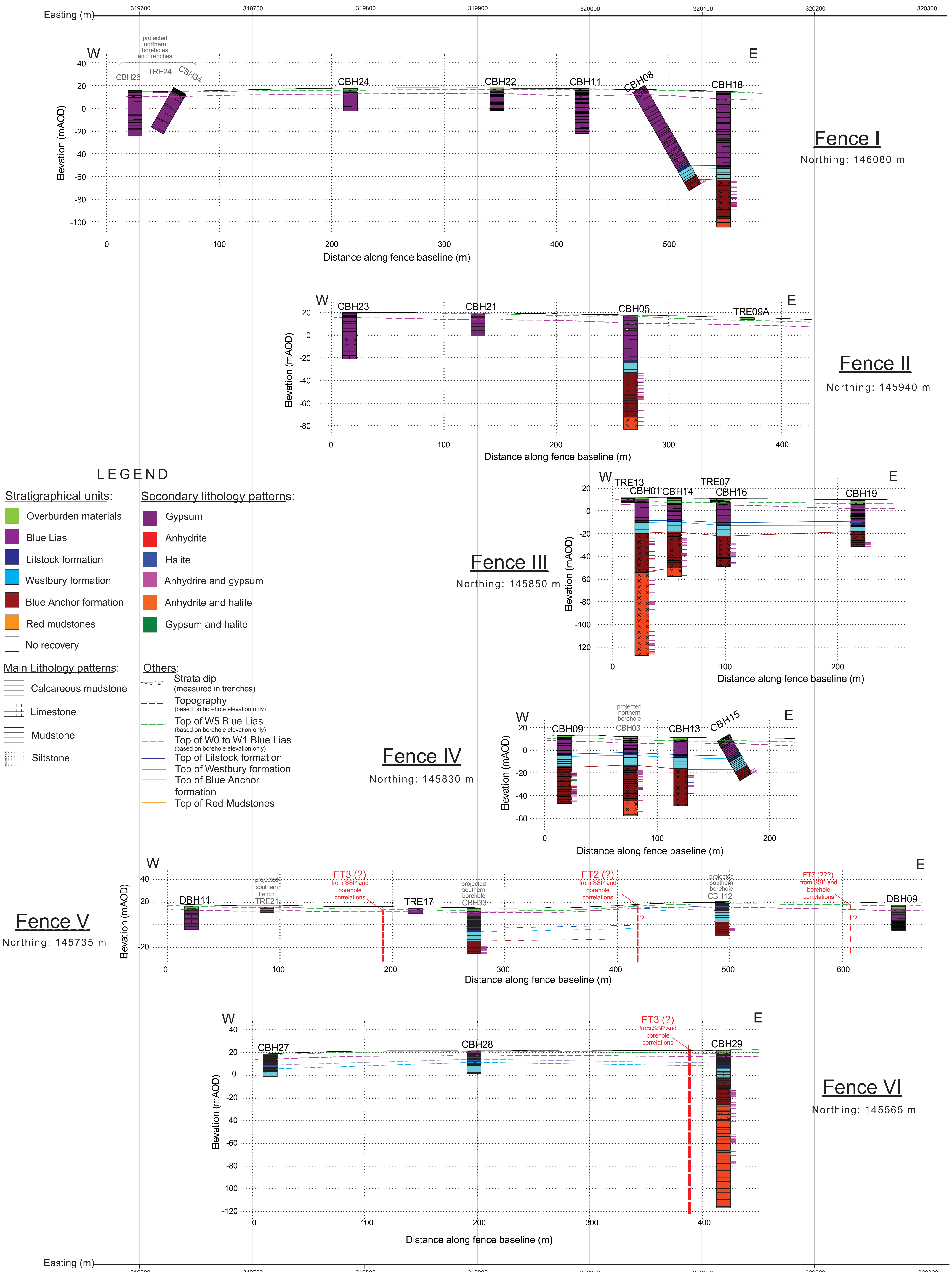
13097 Aix en Provence Cedex 2

AP. 12
Dess. P. LUCQUIAUD
Vérif. L. LEVEQUE

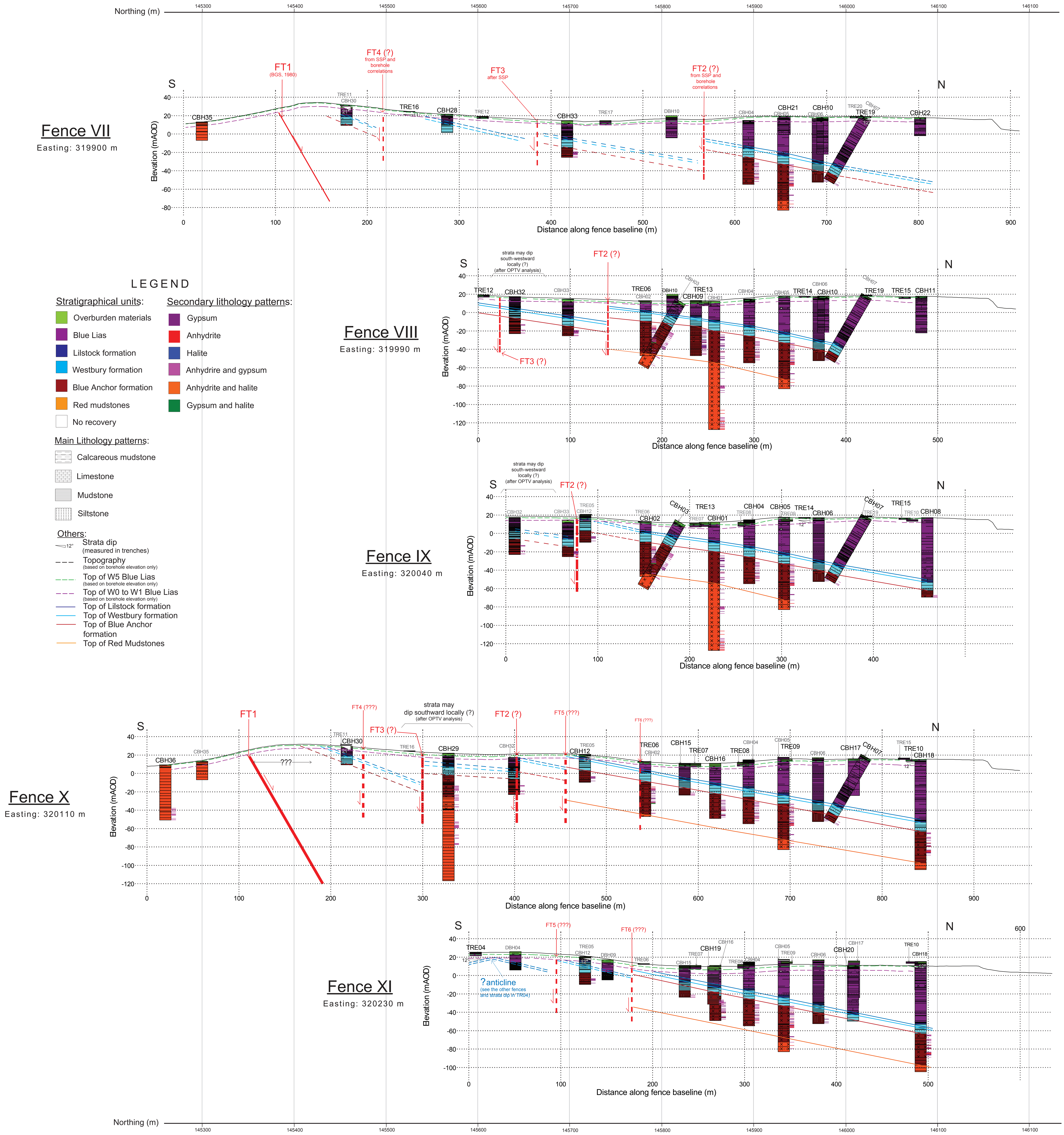


Notes:

o Confidence rate in the interpretation is expressed by the way lines are drawn: the more they are dashed, the more interpretation is subject to uncertainties.
o Projected boreholes and trenches are labeled with small grey letters, whether non-projected ones are labelled with bold normal sized letters. Because of 10° northward dip of the strata, E-W-trending cross-sections are particulary influenced by projection of boreholes with signicantly different northing coordinates. This is why interpreted stratigraphical surfaces do not match precisely stratigraphical limits observed in boreholes, the shift in elevation being related to projection.
o Dip of stratigraphical limits is always represented as apparent dip. Apparent dip is written within brackets and true dip, without brackets.
o Topography has been drawn on the basis of aerial topographic survey.
o Top of W5 and W1/W0 Blue Lias have been drawn on the basis of interpolated limits whose elevation has been measured in boreholes. To obtain these interpolated surfaces, W5 or W1/W0 Blue Lias thickness has been substracted from topography.
o Strata dip is generally about N100°E 8 to 12°N (which means a slope of 14 to 21%), excluding any geological singularity. This is applicable mostly on the northern part of the site and between FT3 and FT1. In these areas, any 10 m shift towards North results in a deepening of gypsum horizons (Blue Anchor formation) of about 2 m.
The areas located between FT3 and FT2 and south of FT1 are not concerned by these considerations (poorly known geological structure).

EPR UK - HINKLEY POINT
WEST-EAST GEOLOGICAL CROSS-SECTIONS

edf	ELECTRICITE DE FRANCE Division Géologie Géotechnique	DIRECTION PRODUCTION INGENIERIE CEIDRE TEGG 905, Av. du Camp de Menthe 13097 Aix en Provence Cedex 2	AP 13a Dess. P. LUCQUIAUD Vérif. L. LEVEQUE



Notes:

o Confidence rate in the interpretation is expressed by the way lines are drawn: the more they are dashed, the more interpretation is subject to uncertainties.
o Projected boreholes and trenches are labeled with small grey letters, whether non-projected ones are labelled with bold normal sized letters. Because of strata attitude (being about N100°E 8 to 12°N), N-S-trending cross-sections are not significantly affected by borehole projection. This is why interpretated stratigraphical surfaces can be drawn on the basis of both projected and non-projected boreholes.
o Dip of stratigraphical limits is always represented as apparent dip. Apparent dip is written within brackets and true dip, without brackets.
o Topography has been drawn on the basis of aerial topographic survey.
o Top of W5 and W1/W0 Blue Lias have been drawn on the basis of interpolated limits whose elevation has been measured in boreholes. To obtain these interpolated surfaces, W5 or W1/W0 Blue Lias thickness has been substracted from topography.
o Strata dip is generally about N100°E 8 to 12°N (which means a slope of 14 to 21%), excluding any geological singularity. This is applicable mostly on the northern part of the site and between FT3 and FT1. In these areas, any 10 m shift towards North results in a deepening of gypsum horizons (Blue Anchor formation) of about 2 m. The areas located between FT3 and FT2 and south of FT1 are not concerned by these considerations (poorly known geological structure).

EPR UK - HINKLEY POINT
SOUTH-NORTH GEOLOGICAL CROSS-SECTIONS

ELECTRICITE DE FRANCE
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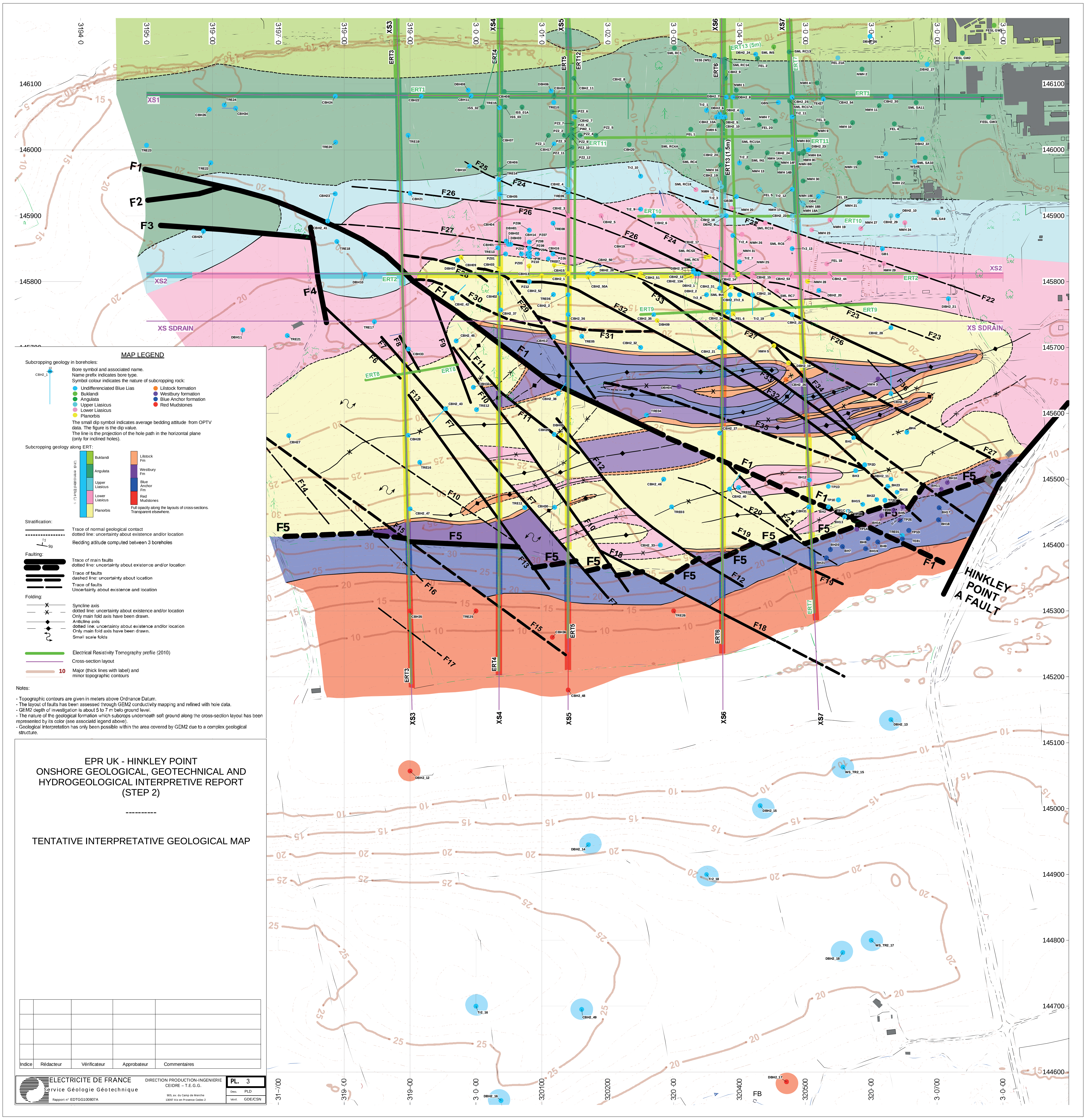
AP 13b

Dess. P. LUCQUIAUD
Vérif. L. LEVEQUE

APPENDIX 14B: GEOLOGICAL CROSS SECTIONS OF THE BUILT DEVELOPMENT AREA EAST



MAP LEGEND

Subcropping geology in boreholes:

CBH2_1

13

Bore symbol and associated name.
Name prefix indicates bore type.
Symbol colour indicates the nature of subcropping rock:

- Undifferenciated Blue Lias
- Buklandi
- Angulata
- Upper Liasicus
- Lower Liasicus
- Planorbis
- Lilstock formation
- Westbury formation
- Blue Anchor formation
- Red Mudstones

The small dip symbol indicates average bedding attitude from OPTV data. The figure is the dip value.
The line is the projection of the hole path in the horizontal plane (only for inclined holes).

Subcropping geology along ERT:

Undi erenciated Blue Li s

- Buklandi
- Angulata
- Upper Liasicus
- Lower Liasicus
- Planorbis
- Lilstock Fm
- Westbury Fm
- Blue Anchor Fm
- Red Mudstones

Full opacity along the layouts of cross-sections. Transparent elsewhere.

Stratification:

Trace of normal geological contact
dotted line: uncertainty about existence and/or location

11
99

Bedding attitude computed between 3 boreholes

Faulting:

Trace of main faults
dotted line: uncertainty about existence and/or location

Trace of faults
dashed line: uncertainty about location

Trace of faults
Uncertainty about existence and location

Folding:

Syncline axis
dotted line: uncertainty about existence and/or location
Only main fold axis have been drawn.

Anticline axis
dotted line: uncertainty about existence and/or location
Only main fold axis have been drawn.

Small scale folds

Electrical Resistivity Tomography profile (2010)

Cross-section layout

10 Major (thick lines with label) and minor topographic contours

Notes:

- Topographic contours are given in meters above Ordnance Datum.
- The layout of faults has been assessed through GEM2 conductivity mapping and refined with hole data.
- GEM2 depth of investigation is about 5 to 7 m belo ground level.
- The nature of the geological formation which subcrops underneath soft ground along the cross-section layout has been represented by its color (see associatd legend above).
- Geological interpretation has only been possible within the area covered by GEM2 due to a complex geological structure.

EPR UK - HINKLEY POINT
ONSHORE GEOLOGICAL, GEOTECHNICAL AND HYDROGEOLOGICAL INTERPRETIVE REPORT (STEP 2)

TENTATIVE INTERPRETATIVE GEOLOGICAL MAP

Indice	Rédacteur	Vérificateur	Approbateur	Commentaires

ELECTRICITE DE FRANCE
Service Géologie Géotechnique
Rapport n° EDTGG100807A

DIRECTION PRODUCTION-INGENIERIE
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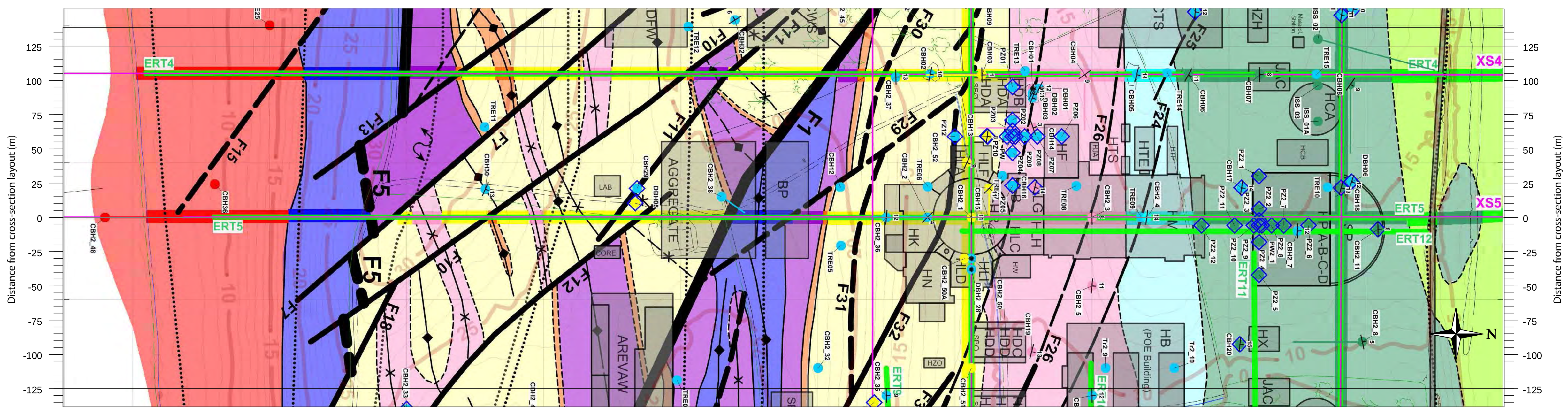
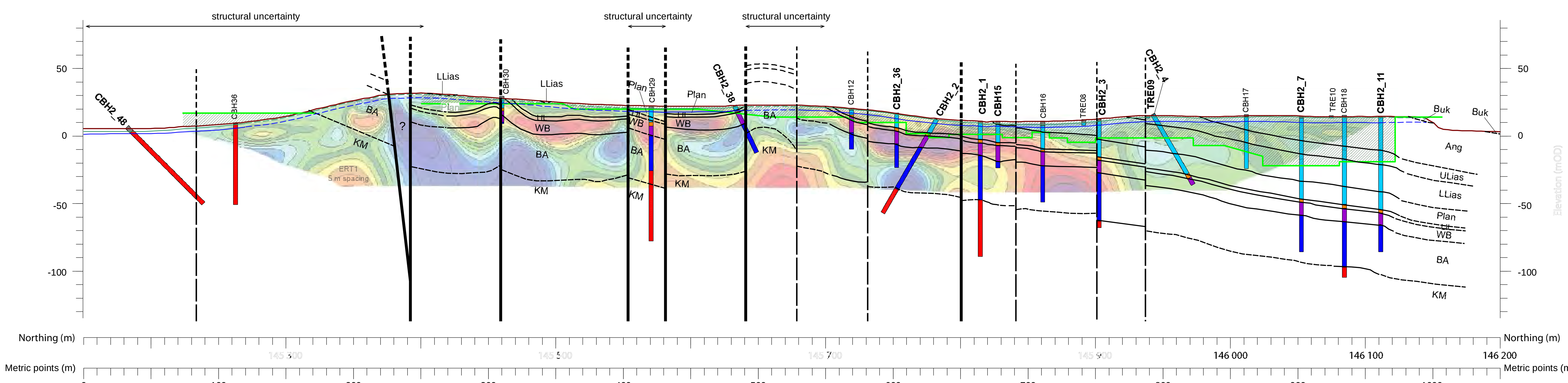
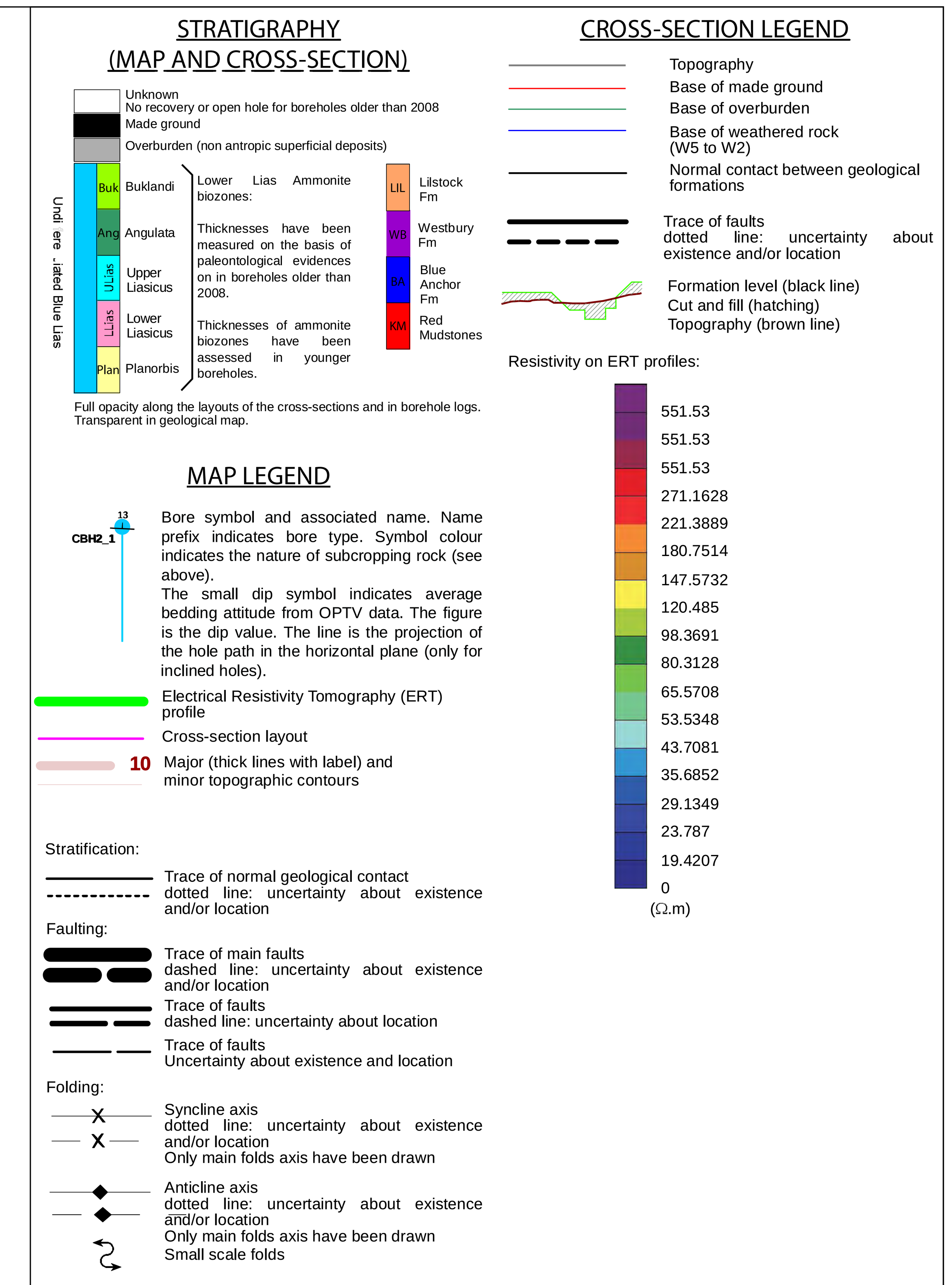
905, av. du Camp de Menthe
13097 Aix en Provence Cedex 2

PL. 3
Dess. PLD
Vérif. GDE/CSN







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ONSHORE GEOLOGICAL, GEOTECHNICAL AND HYDRO-GEOLOGICAL INTERPRETIVE REPORT (STEP 2)

CROSS-SECTION 5

NOTES

1) Topographical contours are given in meters above Ordnance Datum (mOD).

2) The layout of the future buildings and the elevation of the formation level have been extrated from document 1512AU-030-208-GND-4018.
As the exact layout and elevation of the different buildings may change, these elements shall only be considered as indicative.
More specifically, the elevation of the formation level of some buildings is not known by CEIDRE-TEGG.

3) Geological interpretation which is shown on the map has been performed on the basis of borehole data from 1979 to 2011, 1:50 000 geological map from BGS (England and Wales sheet 279) and geophysics from 2008 to 2011. Only stratigraphical data have been used from 1979, 1984 and 1989 boreholes.

4) The exact dip of the inferred faults is not shown on the cross-section because it is difficult to assess on ERT profiles and from the complex tectonic history of the area. This is why most of them have been drawn vertical. However, many clues suggest that most of them have an important dip, typically higher than 60°.

5) Borehole logs may not match exactly the interpretated geology because they have been projected onto cross-section vertical plane. This is particularly visible for projections along E-W cross-sections because strata dip direction is roughly NNW-SSE to NNE-SSW: even a low dip (<6°) can induce a significant increase or decrease of the strata elevation.

6) Interpolation of the ammonite biozones within Blue Lias has been perfomed according to palaetonlogical data from boreholes which date from 1979 to 1989 (FEL, FESL, NWH and SML boreholes) because a dedicated study has been undertaken formerly.
Because no such study has been performed for 2008 to 2011 investigations, the base of each ammonite biozone has been drawn assuming a constant thickness for each biozone. This methodology is supported by the relative standard deviations (standard deviation versus arithmetic mean ratios) of the thickness of each biozone which are low.
Consequently, borehole logs dated from 1979 to 1989 show the measured extents of the biozones whereas borehole logs dated from 2008 to 2011 do not show the extent of the biozones.

The thicknesses which have been used to build the cross-sections are the followings:

True thickness (m)	Ammonite biozones in Blue Lias			
only on vertical boreholes	Angulata	Upper Liasicus	Lower Liasicus	Planorbis
Min	29.74	8.85	20.20	11.01
Average	30.67	9.51	21.47	12.73
Max	31.61	10.53	22.75	13.63
Standard deviation	0.93	0.40	0.84	0.42
Relative standard deviation	0.03	0.04	0.04	0.03
Chosen thickness (m)	31	10	22	13

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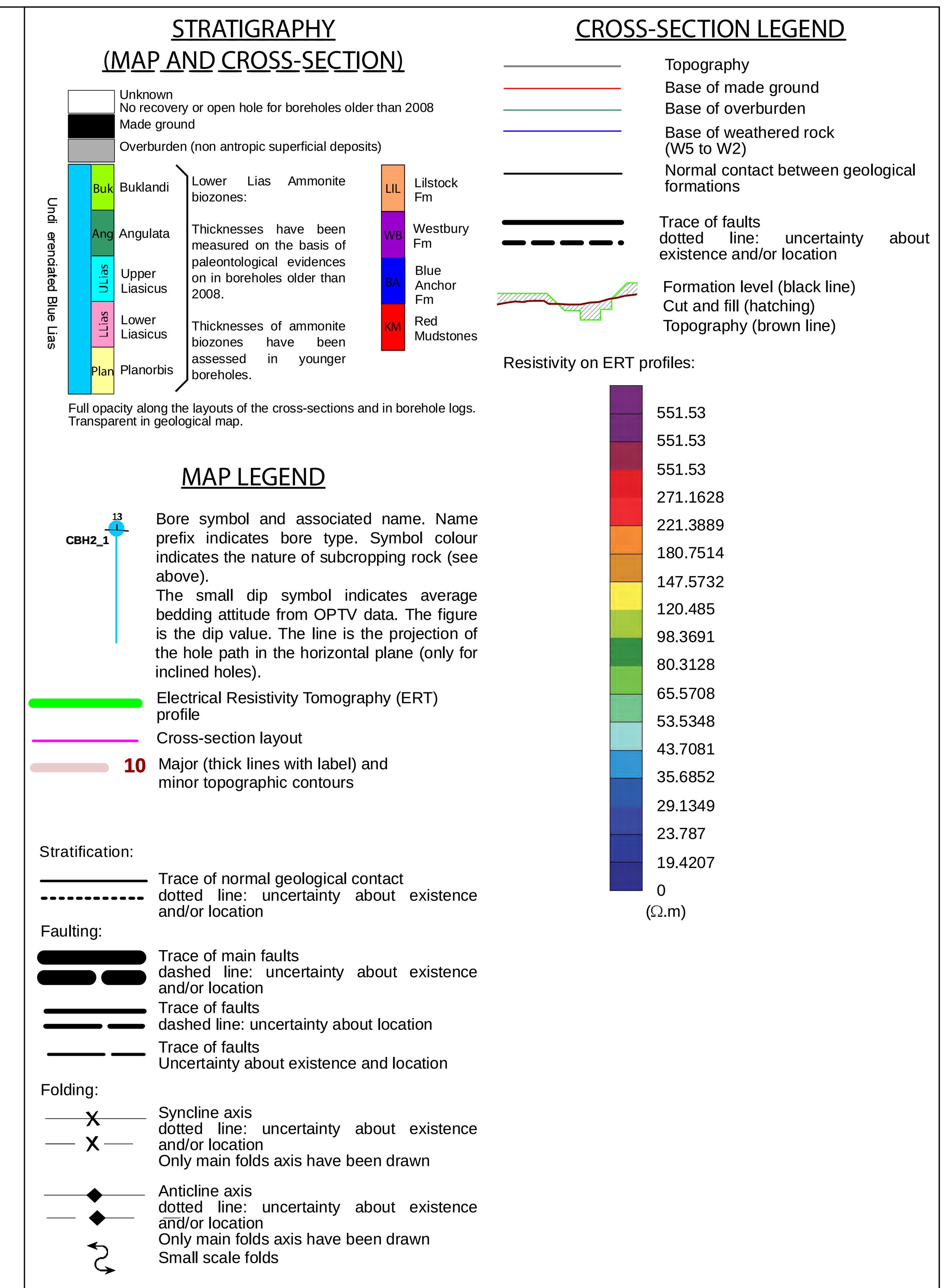
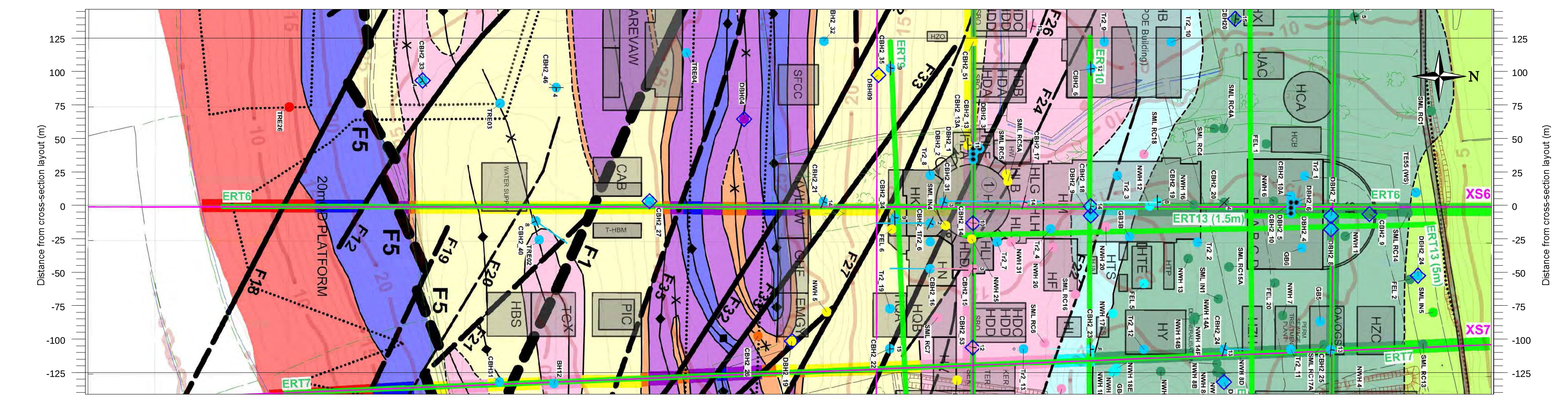
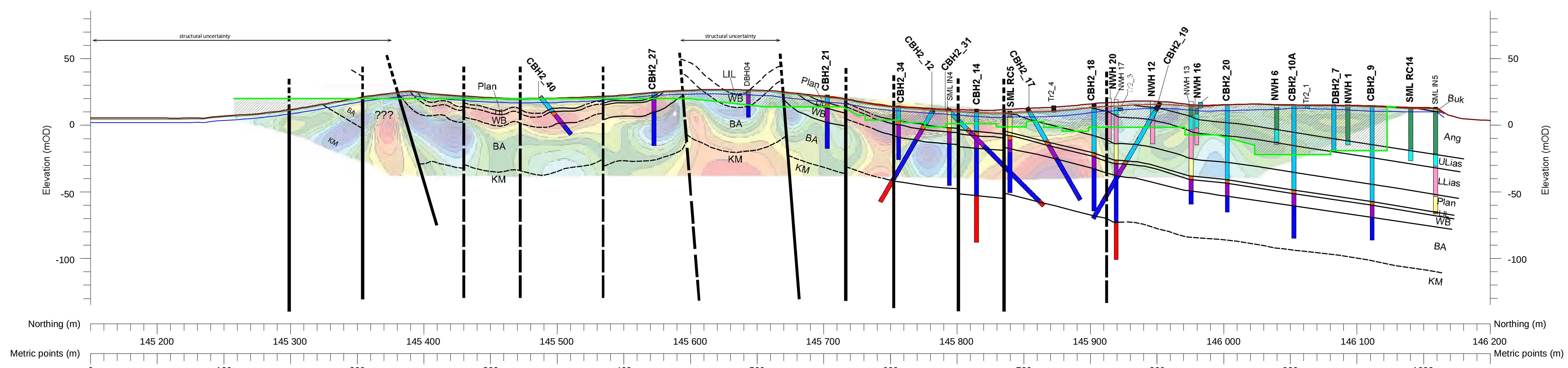
13097 Aix-en-Provence Cedex 2

PL. 12
Dess. PLD
Vérif. GDE/CSN







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5) Borehole logs may not match exactly the interpretated geology because they have been projected onto cross-section vertical plane. This is particularly visible for projections along E-W cross-sections because strata dip direction is roughly NNW-SSE to NNE-SSW: even a low dip (<6°) can induce a significant increase or decrease of the strata elevation.

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Because no such study has been performed for 2008 to 2011 investigations, the base of each ammonite biozone has been drawn assuming a constant thickness for each biozone. This methodology is supported by the relative standard deviations (standard deviation versus arithmetic mean ratios) of the thickness of each biozone which are low.
Consequently, borehole logs dated from 1979 to 1989 show the measured extents of the biozones whereas borehole logs dated from 2008 to 2011 do not show the extent of the biozones.

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Average	30.67	9.51	21.47	12.73
Max	31.61	10.53	22.75	13.63
Standard deviation	0.93	0.40	0.84	0.42
Relative standard deviation	0.03	0.04	0.04	0.03
Chosen thickness (m)	31	10	22	13

EPR UK - HINKLEY POINT
ONSHORE GEOLOGICAL, GEOTECHNICAL AND HYDRO-GEOLOGICAL INTERPRETIVE REPORT (STEP 2)

CROSS-SECTION 6

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PL.	13
Dess.	PLD
Vérif.	GDE/CSN

APPENDIX 14C SUMMARY OF INTRUSIVE INVESTIGATIONS FOR THE HPC DEVELOPMENT SITE

CONTENTS

TABLES

APPENDIX 14C: SUMMARY OF INTRUSIVE INVESTIGATIONS FOR THE HPC DEVELOPMENT SITE

14C.1 Built Development Area West

14C.1.1 The Phase 1 Desk Study and Preliminary Assessment Report (Ref. 14.84) presents the findings of the non-radiological preliminary site investigation of the near surface soils (<0.3m bgl) on the Built Development Area West (BDAW). The investigation was carried out in July 2008 and comprised the excavation of 30 hand auger holes to a depth of 0.3m bgl. Samples comprised natural superficial deposits (locations are presented on **Figure 14.5**). Analytical results, details of methodology, photographic evidence and hand auger descriptions are included within the Phase 1 Desk Study report (Ref. 14.84).

14C.1.2 The Phase 2 Supplementary Investigation (Ref. 14.86) was undertaken to assess the contamination status of the deeper site soils (>0.3m bgl up to 5.0m bgl) on the BDAW and to enable further refinement of the Preliminary Conceptual Site Model (PCSM). The investigation was carried out in October 2008 and was undertaken as part of the extensive first on-shore investigation by Structural Soils Ltd. A total of 26 trial trenches were excavated to a depth of between 0.55m and 5.0m bgl across the BDAW allowing for the collection of 79 soil samples. Sampling locations are presented on **Figure 14.5**. Made Ground was encountered at one location (TRE21) extending to a depth of 0.33m bgl. In all other trenches the materials encountered predominantly comprised superficial drift deposits and weathered bedrock. Analytical results, details of methodology, photographic evidence and trial pit logs are included within the Phase 2 Supplementary Investigation report (Ref. 14.86).

14C.1.3 Limited further investigations on the BDAW were undertaken as part of the second on-shore investigation in 2010, to target historical pond features and the Made Ground encountered in the vicinity of Benhole Farm (i.e. around exploratory location TRE21). Three trial pits were excavated to a maximum depth of 5m bgl (TE82, TE83 and TE84) around TRE21. Made Ground was encountered at all three locations extending to 0.4m bgl. A further four window sample holes (WS85, WS86 and WS87) and one trial pit (TE81) were advanced to a maximum depth of 2.5m bgl and 5m bgl respectively, to target possibly infilled ponds. No Made Ground was encountered at these locations. Analytical results, details of methodology, photographic evidence and trial pit logs are included within the Phase 2 Supplementary Investigation report (Ref. 14.86).

14C.1.4 Selected soil samples collected during the investigations were analysed for a range of determinands including metals and metalloids (arsenic, cadmium, chromium, hexavalent chromium, lead, mercury, copper, nickel, zinc, selenium, water soluble boron), pH, sulphate, total cyanide sulphide, elemental sulphur, Total Petroleum Hydrocarbons (TPH C8-C35), speciated Polyaromatic Hydrocarbons (PAHs), speciated Total Petroleum Hydrocarbons (TPH), Volatile Organic Compounds (VOCs), asbestos and soil organic matter (SOM).

14C.1.5 A preliminary (Tier 1) risk assessment has been undertaken in which the chemical testing data were compared to generic human health, phytotoxic, ecotoxic and built environment SSVs. The results have been divided into natural soils and Made Ground. The results are summarised in **Table 14C.1** and **Table 14C.3**, respectively. A summary of the ecological risk assessments comparing the results to the Stage 1 ecological SSVs and Stage 2 English background soil concentrations, where necessary, are presented in **Table 14C.2** and **Table 14C.4**.

14C.1.6 Where appropriate, the analytical results were subject to further statistical tests, using the statistical approach recommended by CL:AIRE/CIEH ‘Guidance on Comparing Soil Contamination Data with a Critical Concentration) (Ref. 14.71). The 95th Upper Confidence Level (UCL) of the true population mean for each contaminant has been compared to the Critical Concentrations (Tier 1 SSV) to determine whether the site soils contain a potential source of contaminant which may pose an unacceptable risk. For the purpose of the statistical analysis all the BDAW data for natural soils samples were treated as belonging to the same ‘population’ (in statistical terms), with a second ‘population’ applied to samples taken from the Made Ground. The calculated UCLs are presented in **Table 14C.1** and **Table 14C.3**.

Table 14C.1: Summary of Chemical Analysis Results for Natural Soils on the Built Development Area West and Preliminary Tier 1 Risk Assessment

Determinand	Range of Concentrations	UCL	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedences of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Total Arsenic	<5 – 35.2	17.5~	635[1]	-	50*	0 (68)	-	0
Total Cadmium	<0.5 – 12.0	2.0~	230[1]	-	3	0 (68)	-	**2**
Total Chromium	17 – 81	55.6	8,840[1,10]	-	600	0 (68)	-	0
Hexavalent Chromium	<2	NC	35[1]	-	-	0 (7)	-	-
Total Lead	10 – 165	53.3~	7,502	-	500	0 (68)	-	0
Total Mercury (inorganic)	<0.5-0.6	NC	3,640[1]	-	1	0 (68)	-	0
Total Nickel	25 – 90	56.5	1,790[1]	110[8]	-	0 (68)	0 (68)	-
Total Copper	24 – 179	61.7~	71,700[1]	200[8]	-	0 (68)	0 (68)	-
Total Zinc	30 – 340	155.8~	665,000[1]	450[4]	-	0 (68)	0 (68)	-
Total Selenium	<0.5 – 3.1	1.8	13,000[1]	-	3	0 (68)	-	**1**
Boron (water soluble)	<0.5 – 5.1	1.3~	192,000[1]	3[4]	-	0 (68)	**1** (68)	-
pH (pH units)	5.9 – 8.5	8.0	5.5-8.5[3]	5.5-8.5[3]	<5 to >8	0 (68)	0 (68)	**23**
Total Sulphate (% SO4)	<0.05 – 0.40	0.39	-	-	0.2/0.24[11]	- (4)	-	**2/2**
Total Cyanide	<1	NC	16,000[1,FC]	-	25[FC]	0 (4)	-	0
Sulphide	<2	NC	250 [4]	-	250	0 (4)	-	0
Elemental Sulphur	<10	NC	5000 [4]	-	5000	0 (4)	-	0
Asbestos	None Detected	-	Presence of fibres[9]	-	-	0 (17)	-	-
Total TPH C8-C35	<5-72	17.5~	500[5]	-	50	0 (28)	-	**1**
Naphthalene	<0.1	NC	76.4[1]	-	50	0 (55)	-	0
Acenaphthylene	<0.1	NC	86.1^[1]	-	50	0 (55)	-	0

Determinand	Range of Concentrations	UCL	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedences of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Acenaphthene	<0.1	NC	57.0^[1]	-	50	0 (55)	-	0
Fluorene	<0.1	NC	30.9^[1]	-	50	0 (55)	-	0
Phenanthrene	<0.1	NC	21,900[1]	-	50	0 (55)	-	0
Anthracene	<0.1	NC	525,000[1]	-	50	0 (55)	-	0
Fluoranthene	<0.1 – 0.2	0.1~	22,600[1]	-	50	0 (55)	-	0
Pyrene	<0.1 – 0.2	0.1~	54,200[1]	-	50	0 (55)	-	0
Benzo(a)anthracene	<0.1	NC	89.5[1]	-	50	0 (55)	-	0
Chrysene	<0.1	NC	137[1]	-	50	0 (55)	-	0
Benzo(b)fluoranthene	<0.1	NC	100[1]	-	50	0 (55)	-	0
Benzo(k)fluoranthene	<0.1	NC	141[1]	-	50	0 (55)	-	0
Benzo (a) Pyrene	<0.1 – 0.1	0.1~	14.1[1]	-	50	0 (55)	-	0
Indeno(1,2,3-cd)pyrene	<0.1	NC	60[1]	-	50	0 (55)	-	0
Dibenzo(a,h)anthracene	<0.1	NC	12.7[1]	-	50	0 (55)	-	0
Benzo(ghi)perylene	<0.1	NC	654[1]	-	50	0 (55)	-	0
PAH (EPA 16 total)	<0.1 – 0.4	0.1~	100[5]	-	50	0 (55)	-	0
TPH Aromatic C5-C7	<0.01	NC	28.1[1,6]	-	50	0 (11)	-	0
TPH Aromatic C7-C8	<0.01	NC	869^[1,7]	-	50	0 (11)	-	0
TPH Aromatic C8-C10	<0.1	NC	613^[1]	-	50	0 (11)	-	0
TPH Aromatic C10-C12	<0.1	NC	364^[1]	-	50	0 (11)	-	0
TPH Aromatic C12-C16	<0.1	NC	169^[1]	-	50	0 (11)	-	0
TPH Aromatic C16-C21	<0.1	NC	28,200[1]	-	50	0 (11)	-	0
TPH Aromatic C21-C35	<0.1 – 3.0	2.2	28,000[1]	-	50	0 (11)	-	0

Determinand	Range of Concentrations	UCL	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedences of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
TPH Aliphatic C5-C6	<0.01	NC	304^[1]	-	50	0 (11)	-	0
TPH Aliphatic C6-C8	<0.01	NC	144^[1]	-	50	0 (11)	-	0
TPH Aliphatic C8-C10	<0.1	NC	78^[1]	-	50	0 (11)	-	0
TPH Aliphatic C10-C12	<0.1	NC	48^[1]	-	50	0 (11)	-	0
TPH Aliphatic C12-C16	<0.1 – 0.1	0.10	24^[1]	-	50	0 (11)	-	0
TPH Aliphatic C16-C21	<0.1 – 0.2	NC	1,590,000[1]	-	50	0 (11)	-	0
TPH Aliphatic C21-C35	<0.1 – 2.4	1.92	1,590,000[1]	-	50	0 (11)	-	0
Sum of TPH C6-C40	<0.1 – 4.4	2.54	500[5]	-	50	0 (11)	-	0
Benzene	<0.01	NC	28.1[1]	-	-	0 (31)	-	-
Toluene	<0.01	NC	869^[1]	-	-	0 (31)	-	-
Ethyl Benzene	<0.01	NC	518^[1]	-		0 (31)	-	-
m&p Xylene	<0.01	NC	576^[1,P-]	-	-	0 (31)	-	-
o-xylene	<0.01	NC	478^[1]	-	-	0 (31)	-	-
Other VOC compounds	<0.01	-	-	-	-	- (31)	-	-
Soil Organic Matter	0.3-0.5	-	-	-	-	- (3)	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

* Wessex Water revised threshold for arsenic. Wessex Water Soil Survey Guidance

FC Based on the value for Free cyanide as no total cyanide screening value exists

P Assessment of combined concentrations of both m and p isomers, based on the lower Tier 1 concentration for p xylenes.

^ In line with the Environment Agency approach in the published SGVs the GAC presented has been capped at the soil saturation limit

NC Not calculated as values below the limit of detection

~ Statistical outliers have been retained in the dataset as these values are not considered to represent a separate population

The UCL value is for deeper (>0.3m) natural soils only, retrieved during the Phase 2 Supplementary Investigation

1. Internally derived EDF Energy SSV using CLEA v1.06 using all the same standard parameters that the Environment Agency or LQM used to derive standard SGVs for commercial and industrial end use with the exception the SOM has been set to 1%
2. Defra/EA (2002). R & D Publication SGV 10. Soil Guideline Values for Lead Contamination
3. BS3882:2007 Specification for topsoil and requirements for use
4. Former ICRCL 59/83 (N.B Paper withdrawn by Defra in 2004)
5. The Hazardous Waste (England and Wales) Regulations 2005. Inert Waste Threshold
6. Benzene Tier 1 Risk Assessment concentration for Aromatic TPH C5-C7 fraction
7. Toluene Tier 1 Risk Assessment for Aromatic TPH C7-C8 fraction
8. Statutory Instrument 1989 No 1263, ‘Sludge Use in Agriculture Regulations’ (1989), pH value >7
9. Tier 1 screening criteria is based on presence or absence of fibres
10. Chromium III values used for chromium SSV as 2009-2010 investigations on BDAE and BDAW have not identified any chromium VI above LOD (2 mg/kg)
11. BRE Special Digest SD1 Specification (3rd Edition, 2005)

Table 14C.2: Summary of Stage 1 Ecological Risk Assessment for Natural Soils on the Built Development Area West

Determinant	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values
Total Arsenic	<5 – 35.2	68	18[2a]/43[2c]/46[2d]	**13**[2a]/0[2c]/0[2d]	1.37-143[b]	0
Total Cadmium	<0.5 – 12.0	68	1.15[1]	**25**	0.1-1.78[b]	**9**
Total Chromium	17 – 81	68	21.1[1]	**67**	3.89-236[b]	0
Hexavalent Chromium	<2	7	-	-	-	-
Total Lead	10 – 165	68	167.9[1]	0	-	-
Total Mercury (inorganic)	<0.5-0.6	68	0.06[1]	**68**^	0.07-1.22[b]	0
Total Nickel	25 – 90	68	25.1[1]	**67**	2.13-88.9[b]	**1**
Total Copper	24– 179	68	88.4[1]	**1**	4.8-75.2[b]	**1**
Total Zinc	30 – 340	68	90.1[1]	**40**	17.7-442[b]	0
Total Selenium	0.6 – 3.1	68	0.52[2a]/4.1[2b] /1.2[2c]/0.63[2d]	**66**[2a]/0[2b]/**51**[2c]/**61**[2d]	0.2-1.8[b1]	**23**
Boron (water soluble)	<0.5 – 5.1	68	-	-	-	-
pH (pH units)	5.9 – 8.5	68	-	-	-	-
Total Sulphate (% as SO_4)	<0.05 – 0.40	4	-	-	-	-
Total Cyanide	<1	4	-	-	-	-
Sulphide	<2	4	-	-	-	-
Elemental Sulphur	<10	4	-	-	-	-
Asbestos	None Detected	17	3080[4]	-	-	-
Total TPH C8-C35	<5 - 72	28	3,080[4]	0	-	-
Naphthalene	<0.1	55	17[3]	0	-	-
Acenaphthylene	<0.1	55	-	-	-	-
Acenaphthene	<0.1	55	-	-	-	-

Determinant	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values
Fluorene	<0.1	55	-	-	-	-
Phenanthrene	<0.1	55	31[3]	0	-	-
Anthracene	<0.1	55	1.6[3]	0	-	-
Fluoranthene	<0.1 – 0.2	55	260[3]	0	-	-
Pyrene	<0.1 – 0.2	55	-	-	-	-
Benzo(a)anthracene	<0.1	55	2.5[3]	0	-	-
Chrysene	<0.1	55	35[3]	0	-	-
Benzo(b)fluoranthene	<0.1	55	-	-	-	-
Benzo(k)fluoranthene	<0.1	55	38[3]	0	-	-
Benzo (a) Pyrene	<0.1 – 0.1	55	0.15[1]	0	-	-
Indeno(1,2,3-cd)pyrene	<0.1	55	1.9[3]	0	-	-
Dibenzo(a,h)anthracene	<0.1	55	-	-	-	-
Benzo(ghi)perylene	<0.1	55	33[3]	0	-	-
PAH (EPA 16 total)	<0.1 – 0.4	55	29[2b LM]/100[2d LM]	0	-	-
TPH Aromatic C5-C7	<0.01	11	-	-	-	-
TPH Aromatic C7-C8	<0.01	11	-	-	-	-
TPH Aromatic C8-C10	<0.1	11	-	-	-	-
TPH Aromatic C10-C12	<0.1	11	-	-	-	-
TPH Aromatic C12-C16	<0.1	11	-	-	-	-
TPH Aromatic C16-C21	<0.1	11	-	-	-	-
TPH Aromatic C21-C35	<0.1 – 3.0	11	-	-	-	-
TPH Aliphatic C5-C6	<0.01	11	-	-	-	-

Determinant	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values
TPH Aliphatic C6-C8	<0.01	11	-	-	-	-
TPH Aliphatic C8-C10	<0.1	11	-	-	-	-
TPH Aliphatic C10-C12	<0.1	11	-	-	-	-
TPH Aliphatic C12-C16	<0.1 – 0.1	11	-	-	-	-
TPH Aliphatic C16-C21	<0.1 – 0.2	11	-	-	-	-
TPH Aliphatic C21-C35	<0.1 – 2.4	11	-	-	-	-
Sum of TPH C6-C40	<0.1 – 4.4	11	3,080[4]	0	-	-
Benzene	<0.01	31	130[3]	0	-	-
Toluene	<0.01	31	0.3[1]	0	-	-
Ethyl Benzene	<0.01	31	110[3]	0	-	-
m&p Xylene	<0.01	31	17[3]	0	-	-
o-xylene	<0.01	31	17[3]	0	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

^ - LOD is greater than screening value

1. Proposed SSV. Environment Agency, Guidance on the Use of Soil Screening Values in Ecological Risk Assessment (Science Report SC070009/SR2b)
2. Ecological Soil Screening Levels, US EPA

2a SSL for Plants

2b SSL for Soil Invertebrates

2c SSL for Wildlife (Avian)

2d SSL for Wildlife (Mammalian)

LM Low Molecular weight

HM High Molecular Weight

3. Dutch RIVM Serious Risk Concentrations for Ecosystems - Ecotoxicological SRCeco Soil Values
4. Commercial TPH Value for Fine Soils. (Sum of C6 – C35 aliphatic and aromatic hydrocarbon guideline values). Canadian Wide Standard for Petroleum Hydrocarbons in Soil Canadian Council of Ministers of Environment (CCME) 2008.

b. Range of Concentrations Recorded in rural soils in England. UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency

b1 Reported range for selenium in normal soils in the UK (Adriano 2001). UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency

Table 14C.3: Summary of Chemical Analysis Results for Made Ground on the Built Development Area West and Preliminary Tier 1 Risk Assessment

Determinand	Range of Concentrations	UCL	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV(WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Total Arsenic	6.7 - 17.6	17.6	635[1]	-	50*	0 (4)	-	0
Total Cadmium	1.3 – 1.8	1.8	230[1]	-	3	0 (4)	-	0
Total Chromium	33 – 53	54.4	8,840[1,10]	-	600	0 (4)	-	0
Hexavalent Chromium	<2	NC	35[1]	-	-	0 (2)	-	-
Total Lead	36 – 100	96.9	7,502	-	500	0 (4)	-	0
Total Mercury (inorganic)	<0.5	NC	3,640[1]	-	1	0 (4)	-	0
Total Nickel	32 – 59	61.6	1,790[1]	110[8]	-	0 (4)	0 (4)	-
Total Copper	44 – 67	67.1	71,700[1]	200[8]	-	0 (4)	0 (4)	-
Total Zinc	285 – 687	648.6	665,000[1]	450[4]	-	0 (4)	**1** (4)	-
Total Selenium	0.6 – 2.6	2.3~	13,000[1]	-	3	0 (4)	-	0
Boron (water soluble)	1.3 – 2.7	3.2	192,000[1]	3[4]	-	0 (3)	0 (3)	-
pH (pH units)	7.5 – 7.9	8.1	5.5-8.5[3]	5.5-8.5[3]	<5 to >8	0 (3)	0 (3)	0
Total Sulphate (% SO_4)	<0.05	NC	-	-	0.2/0.24[11]	- (2)	-	0/0
Total Cyanide	<1 – 3	7.4	16,000[1,FC]	-	25[FC]	0 (2)	-	-
Sulphide	<2	NC	250 [4]	-	250	0 (2)	-	-
Elemental Sulphur	<10	NC	5000 [4]	-	5000	0 (2)	-	-
Asbestos	None detected	-	Presence of fibres[9]	-	-	0 (2)	-	-
Total TPH C8-C35	<5	NC	500[5]	-	50	0 (2)	-	0
Naphthalene	<0.1	NC	76.4[1]	-	50	0 (3)	-	0
Acenaphthylene	<0.1	NC	86.1^[1]	-	50	0 (3)	-	0

Determinand	Range of Concentrations	UCL	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV(WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Acenaphthene	<0.1	NC	57.0^[1]	-	50	0 (3)	-	0
Fluorene	<0.1	NC	30.9^[1]	-	50	0 (3)	-	0
Phenanthrene	<0.1	NC	21,900[1]	-	50	0 (3)	-	0
Anthracene	<0.1	NC	525,000[1]	-	50	0 (3)	-	0
Fluoranthene	<0.1	NC	22,600[1]	-	50	0 (3)	-	0
Pyrene	<0.1	NC	54,200[1]	-	50	0 (3)	-	0
Benzo(a)anthracene	<0.1	NC	89.5[1]	-	50	0 (3)	-	0
Chrysene	<0.1	NC	137[1]	-	50	0 (3)	-	0
Benzo(b)fluoranthene	<0.1	NC	100[1]	-	50	0 (3)	-	0
Benzo(k)fluoranthene	<0.1	NC	141[1]	-	50	0 (3)	-	0
Benzo (a) Pyrene	<0.1	NC	14.1[1]	-	50	0 (3)	-	0
Indeno(1,2,3-cd)pyrene	<0.1	NC	60[1]	-	50	0 (3)	-	0
Dibenzo(a,h)anthracene	<0.1	NC	12.7[1]	-	50	0 (3)	-	0
Benzo(ghi)perylene	<0.1	NC	654[1]	-	50	0 (3)	-	0
PAH (EPA 16 total)	<0.1	NC	100[5]	-	50	0 (3)	-	0
TPH Aromatic C5-C7	<0.01	NC	28.1[1,6]	-	50	0 (1)	-	0
TPH Aromatic C7-C8	<0.01	NC	869^[1,7]	-	50	0 (1)	-	0
TPH Aromatic C8-C10	<0.1	NC	613^[1]	-	50	0 (1)	-	0
TPH Aromatic C10-C12	<0.1	NC	364^[1]	-	50	0 (1)	-	0
TPH Aromatic C12-C16	<0.1	NC	169^[1]	-	50	0 (1)	-	0
TPH Aromatic C16-C21	<0.1	NC	28,200[1]	-	50	0 (1)	-	0
TPH Aromatic C21-C35	<0.1	NC	28,000[1]	-	50	0 (1)	-	0

Determinand	Range of Concentrations	UCL	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV(WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
TPH Aliphatic C5-C6	<0.01	NC	304^[1]	-	50	0 (1)	-	0
TPH Aliphatic C6-C8	<0.01	NC	144^[1]	-	50	0 (1)	-	0
TPH Aliphatic C8-C10	<0.1	NC	78^[1]	-	50	0 (1)	-	0
TPH Aliphatic C10-C12	<0.1	NC	48^[1]	-	50	0 (1)	-	0
TPH Aliphatic C12-C16	<0.1	NC	24^[1]	-	50	0 (1)	-	0
TPH Aliphatic C16-C21	<0.1	NC	1,590,000[1]	-	50	0 (1)	-	0
TPH Aliphatic C21-C35	2.1	NC	1,590,000[1]	-	50	0 (1)	-	0
Sum of TPH C6-C40	2.1	NC	500[5]	-	50	0 (1)	-	0
Benzene	<0.01	NC	28.1[1]	-	-	0 (1)	-	-
Toluene	<0.01	NC	869^[1]	-	-	0 (1)	-	-
Ethyl Benzene	<0.01	NC	518^[1]	-		0 (1)	-	-
m&p Xylene	<0.01	NC	576^[1,P-]	-	-	0 (1)	-	-
o-xylene	<0.01	NC	478^[1]	-	-	0 (1)	-	-
Other VOC compounds	<0.01	-	-	-	-	- (1)	-	-
Soil Organic Matter	1.2	-	-	-	-	- (1)	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

* Wessex Water revised threshold for arsenic. Wessex Water Soil Survey Guidance

[FC] – Based on the value for Free cyanide as no total cyanide screening value exists

P- - Assessment of combined concentrations of both m and p isomers, based on the lower Tier 1 concentration for p xylene

^ In line with the Environment Agency approach in the published SGVs the GAC presented has been capped at the soil saturation limit

NC - Not calculated as values below the limit of detection

~ - Statistical outliers have been retained in the dataset as these values are not considered to represent a separate population

1. Internally derived EDF Energy SSV using CLEA v1.06 using all the same standard parameters that the Environment Agency or LQM used to derive standard SGVs for commercial and industrial end use with the exception the SOM has been set to 1%
2. Defra/EA (2002). R & D Publication SGV 10. Soil Guideline Values for Lead Contamination
3. BS3882:2007 Specification for topsoil and requirements for use
4. Former ICRCL 59/83 (N.B Paper withdrawn by Defra in 2004)
5. The Hazardous Waste (England and Wales) Regulations 2005. Inert Waste Threshold
6. Benzene Tier 1 Risk Assessment concentration for Aromatic TPH C5-C7 fractions
7. Toluene Tier 1 Risk Assessment for Aromatic TPH C7-C8 fractions
8. Statutory Instrument 1989 No 1263, 'Sludge Use in Agriculture Regulations' (1989), pH value >7
9. Tier 1 screening criteria is based on presence or absence of fibres
10. Chromium III values used for chromium SSV as 2009-2010 investigations on BDAE and BDAW have not identified any chromium VI above laboratory limit of detection (2 mg/kg)
11. BRE Special Digest SD1 Specification (3rd Edition, 2005)

Table 14C.4: Summary of Stage 1 Ecological Risk Assessment for Made Ground on the Built Development Area West

Determinant	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values
Total Arsenic	6.7 - 17.6	4	18[2a]/43[2c]/46[2d]	0[2a]/0[2c]/0[2d]	-	0
Total Cadmium	1.3 – 1.8	4	1.15[1]	**4**	0.1-1.78[b]	**1**
Total Chromium	33 – 53	4	21.1[1]	**4**	3.89-236[b]	0
Hexavalent Chromium	<2	2	-	-	-	-
Total Lead	36 – 100	4	167.9[1]	0	-	-
Total Mercury (inorganic)	<0.5	4	0.06[1]	**4**^	0.07-1.22[b]	0
Total Nickel	32 – 59	4	25.1[1]	**4**	2.13-88.9[b]	0
Total Copper	44 – 67	4	88.4[1]	0	4.8-75.2[b]	0
Total Zinc	285 – 687	4	90.1[1]	**4**	17.7-442[b]	**2**
Total Selenium	0.6 – 2.6	4	0.52[2a]/4.1[2b] /1.2[2c]/0.63[2d]	**4**[2a]/0[2b]/**1**[2c]/**3**[2d]	0.2-1.8[b1]	**1**
Boron (water soluble)	1.3 – 2.7	3	-	-	-	-
pH (pH units)	7.5 – 7.9	3	-	-	-	-
Total Sulphate (% as SO_4)	<0.05	2	-	-	-	-
Total Cyanide	<1 – 3	2	-	-	-	-
Sulphide	<2	2	-	-	-	-
Elemental Sulphur	<10	2	-	-	-	-
Asbestos	None detected	2	-	-	-	-
Total TPH C8-C35	<5	2	3,080[4]	0	-	-
Naphthalene	<0.1	3	17[3]	0	-	-
Acenaphthylene	<0.1	3	-	-	-	-
Acenaphthene	<0.1	3	-	-	-	-

Determinant	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values
Fluorene	<0.1	3	-	-	-	-
Phenanthrene	<0.1	3	31[3]	0	-	-
Anthracene	<0.1	3	1.6[3]	0	-	-
Fluoranthene	<0.1	3	260[3]	0	-	-
Pyrene	<0.1	3	-	-	-	-
Benzo(a)anthracene	<0.1	3	2.5[3]	0	-	-
Chrysene	<0.1	3	35[3]	0	-	-
Benzo(b)fluoranthene	<0.1	3	-	-	-	-
Benzo(k)fluoranthene	<0.1	3	38[3]	0	-	-
Benzo (a) Pyrene	<0.1	3	0.15[1]	0	-	-
Indeno(1,2,3-cd)pyrene	<0.1	3	1.9[3]	0	-	-
Dibenzo(a,h)anthracene	<0.1	3	-	-	-	-
Benzo(ghi)perylene	<0.1	3	33[3]	0	-	-
PAH (EPA 16 total)	<0.1	3	29[2b LM]/100[2d LM]	0	-	-
TPH Aromatic C5-C7	<0.01	1	-	-	-	-
TPH Aromatic C7-C8	<0.01	1	-	-	-	-
TPH Aromatic C8-C10	<0.1	1	-	-	-	-
TPH Aromatic C10-C12	<0.1	1	-	-	-	-
TPH Aromatic C12-C16	<0.1	1	-	-	-	-
TPH Aromatic C16-C21	<0.1	1	-	-	-	-
TPH Aromatic C21-C35	<0.1	1	-	-	-	-
TPH Aliphatic C5-C6	<0.01	1	-	-	-	-
TPH Aliphatic C6-C8	<0.01	1	-	-	-	-

Determinant	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values
TPH Aliphatic C8-C10	<0.1	1	-	-	-	-
TPH Aliphatic C10-C12	<0.1	1	-	-	-	-
TPH Aliphatic C12-C16	<0.1	1	-	-	-	-
TPH Aliphatic C16-C21	<0.1	1	-	-	-	-
TPH Aliphatic C21-C35	2.1	1	-	-	-	-
Sum of TPH C6-C40	2.1	1	3,080[4]	0	-	-
Benzene	<0.01	1	130[3]	0	-	-
Toluene	<0.01	1	0.3[1]	0	-	-
Ethyl Benzene	<0.01	1	110[3]	0	-	-
m&p Xylene	<0.01	1	17[3]	0	-	-
o-xylene	<0.01	1	17[3]	0	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

^ - LOD is greater than screening value

1. Proposed SSV. Environment Agency, Guidance on the Use of Soil Screening Values in Ecological Risk Assessment (Science Report SC070009/SR2b)
2. Ecological Soil Screening Levels, US EPA

2a SSL for Plants

2b SSL for Soil Invertebrates

2c SSL for Wildlife (Avian)

2d SSL for Wildlife (Mammalian)

LM Low Molecular weight

HM High Molecular Weight

3. Dutch RIVM Serious Risk Concentrations for Ecosystems - Ecotoxicological SRCeco Soil Values
4. Commercial TPH Value for Fine Soils. (Sum of C6 – C35 aliphatic and aromatic hydrocarbon guideline values). Canadian Wide Standard for Petroleum Hydrocarbons in Soil Canadian Council of Ministers of Environment (CCME) 2008

b. Range of Concentrations Recorded in rural soils in England . UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency b1 Reported range for selenium in normal soils in the UK (Adriano 2001). UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency

14C.2 Built Development Area East

14C.2.1 The Desk Based Assessment (Ref. 14.91) indicates that limited contamination sampling and monitoring has been conducted previously within the Built Development Area East (BDAE). A report prepared by Serco (2006) (Ref. 14.48) relates to a baseline contamination investigation for an area of land which was to be used for the temporary storage of spoil arising from the construction of a new ILW storage site for the HPA decommissioning process (i.e. the NDA temporary spoil placement area located in the north-western quadrant of the BDAE, see **Figure 14.4**). This investigation generally found low levels of soil contamination, although at two locations (H2 and BH4, see **Figure 14.7**, isolated suspected asbestos-containing materials were identified within the proposed spoil placement area. The ‘pre-closure’ report (Ref. 14.49) (i.e. a survey undertaken after the soils temporarily stored there had been removed) prepared by Serco for this area found concentrations of contaminants consistent with the baseline survey and no asbestos containing materials were identified.

14C.2.2 A number of potential sources of contamination were identified within the BDAE including a former sewage treatment works, a double-humped mound feature in the centre of the area containing surplus spoil from the construction of the existing Hinkley Point Power Station Complex, Made Ground deposits, former fabrication/construction facilities including former accommodation areas with associated boiler houses, fuel oil storage tanks and electrical substations. In addition the desk study identified the potential for radionuclide aerial deposition from the existing Hinkley Point Power Station Complex to have affected the area, with a limited potential for contaminants present in the soils and groundwater beneath the HPA and HPB to have migrated onto the BDAE.

14C.2.3 The Phase 2 Contamination Assessment (Non Radiological) of the Built Development Area East and Southern Construction Phase Area report (Ref. 14.93) presents the findings of the non-radiological investigation on the BDAE which was carried out between November 2009 and July 2010.

14C.2.4 In order to facilitate the investigation of the BDAE, the area was subdivided into six assessment areas based on current and historical land use and topography. These areas are presented on **Figure 14.4** and **Figure 14.6**. The investigations comprised the advancement of;

- 82 trial pits excavated up to between 0.5m and 5.6m bgl;
- 12 boreholes for gas monitoring purposes drilled to depths of up to 9.9m bgl (including three locations (GB21, GB3A, GB3B) which were advanced due to the required depth not being achieved at the original location), subsequently seven boreholes were installed for gas monitoring purposes;
- 18 boreholes for groundwater monitoring purposes (including CPH9 which was advanced for sampling purposes only) drilled to depths of up to 90.0m bgl;
- 20 windowless sampling holes advanced to up to 4.6m bgl; and
- eight hand pits excavated up to 1.0m bgl.

14C.2.5 The above listing includes additional exploratory hole locations advanced to delineate the presence of asbestos-containing materials (ACMs) and one hydrocarbon contaminated area. The locations of the exploratory holes are presented on **Figure 14.6**.

14C.2.6 Intrusive investigations identified the presence of variable depths of Made Ground across the BDAE, ranging from absent to a proven depth of 9.0m (GB4) within the mounds. Made Ground deposits have been found to typically comprise either reworked natural soils (weathered Blue Lias Formation deposits comprising mudstone and limestone), or demolition and construction materials. Natural superficial (drift) deposits have only been rarely encountered within the BDAE, having been identified in DBH2_23, GB6 and TE61. Apparent sediment deposits (believed to be associated with former infilled ponds) were also identified within TE13 and Tr2_5.

14C.2.7 Natural Blue Lias deposits (bedrock) were observed at depths ranging from 0.1m bgl (DBH2_24) and 9.0m bgl (GB4). These deposits comprise an interbedded sequence of mudstone and limestone units. The upper mudstone units were frequently noted to have been significantly weathered to a clay-like deposit. Further details of the ground conditions encountered are presented within the Phase 2 Contamination Assessment report (Ref. 14.93) and within section 14.5.

14C.2.8 Selected soil samples collected during the investigations were analysed for a range of determinands including metals and metalloids (arsenic, cadmium, chromium, hexavalent chromium, lead, mercury, copper, nickel, zinc, selenium and water soluble boron), pH, sulphate, total monohydric phenols, total cyanide, sulphide, elemental sulphur, total TPH C8-C35, speciated PAHs, speciated TPH, VOCs, Semi-Volatile Organic Compounds (SVOCs), Polychlorinated Biphenyls (PCBs) and asbestos. In addition, selected samples were also submitted for Waste Acceptance Criteria (WAC) and soil leachate analysis. Detailed forensic hydrocarbon analysis has also been undertaken on a number of samples from hydrocarbon contaminated soils.

14C.2.9 Given the probable time since the sewage works were decommissioned, (at least 10-20 years ago), the chances of any micro-organisms being present is considered to be very low and therefore testing for such contaminants was not considered necessary.

14C.2.10 Supporting information concerning details of the investigations including analytical certificates, details of methodologies and soil descriptions are provided within the Phase 2 Contamination Assessment report (Ref. 14.93).

14C.2.11 A summary of the results is presented in **Table 14C.5** to **Table 14C.8**. These results were used to conduct a Tier 1 risk assessment using human health, phytotoxic and built environment SSVs (see **Table 14C.5** and **Table 14C.7** for Made Ground and natural ground respectively). **Table 14C.6** and **Table 14C.8** provide a summary of the ecological risk assessment for the Made Ground and natural soil, respectively. A staged approach to ecological risk assessment has been adopted, whereby contaminant concentrations have initially been compared with Stage 1 ecological SSVs (Ref. 14.64) and then, where necessary, with the Stage 2 Rural England maximum background soil concentrations (Ref. 14.69 and Ref. 14.70) and subsequently with Stage 3 local background concentrations i.e. the range of concentrations recorded within soils on the BDAW (Ref. 14.84 and Ref. 14.86).

14C.2.12 Where appropriate the analytical results were subject to statistical tests, using the statistical approach recommended by CL:AIRE/CIEH 'Guidance on Comparing Soil Contamination Data with a Critical Concentration' (Ref. 14.101), resulting in the UCL of the true population mean for each contaminant being compared to the Critical Concentrations (Tier 1 SSVs). For the purpose of this statistical analysis the data was treated as belonging to two main 'populations' (in statistical terms), Made Ground and natural soils, and grouped by geographical area (i.e. the six assessment areas based on current and historical land use and topography, shown in **Figure 14.4** and **Figure 14.6**). The exception to this is Area 3 (double-humped mound) which contained a significant thickness of Made Ground and therefore was separated into three separate Made Ground populations for statistical analysis. The summary in **Table 14C.5** provides the range of all UCL values observed in Made Ground in the BDAE, i.e. Made Ground for Areas 1,2,4,5 and 6 and all three Made Ground populations for Area 3. The range of UCL values observed in the natural soils in the BDAE is presented in **Table 14C.7**.

Table 14C.5: Summary of Chemical Analysis Results for Made Ground Soils on the Built Development Area East and Tier 1 Risk Assessment

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Total Arsenic	<5–37	11.8-18.4	635[1]	-	50*	0 (153)	-	0
Total Cadmium	<0.5–3	1.0-1.7	230[1]	-	3	0 (153)	-	0
Total Chromium (III)	12-78	30.4-56.5	8,840[1]	-	600	0 (153)	-	0
Hexavalent Chromium	<2	1	35[1]	-	-	0 (153)	-	-
Total Lead	6-382	21.8-65.5	750[2]	-	500	0 (153)	-	0
Total Mercury	<0.5	0.25	3,640[1]	-	1	0 (153)	-	0
Total Copper	7-241	42.9-101.2	71,700[1]	200[8]	-	0 (153)	**1** (153)	-
Total Nickel	6-87	40.5-76.6	1,790[1]	110[8]	-	0 (153)	0 (153)	-
Total Zinc	22-922	92.5-246.1	665,000[1]	450[8]	-	0 (153)	**2** (153)	-
Total Selenium	<0.5-3.9	1.4-3.1	13,000[1]	-	3	0 (153)	-	**8**
Boron (water soluble)	<0.5-3.6	1.0-2.0	192,000[1]	3[4]	-	0 (153)	**2** (153)	-
pH (pH units)	6.9-11.4	NC	5.5 – 8.5[3]	5.5 – 8.5[3]	<5 or >8	**28** (152)	**28** (152)	**72**
Total Sulphate (%SO4)	<0.05-0.53	0.10-0.40	-	-	0.20/0.24[9]	- (152)	-	**15/14**
Total Cyanide	<1-5.4	0.5-2.1	16,000[FC,1]	-	25[FC]	0 (152)	-	0
Sulphide	<2-163	1-90.2	250[4]	-	250	0 (152)	-	0
Elemental Sulphur	<10-1526	5-33.8	5,000[4]	-	5000	0 (152)	-	0
Total Phenol	<1-3	0.5-1.2	3,200[P,1]	-	5	0 (152)	-	0
Asbestos	ND - Detected	-	Presence of fibres[10]	-	-	**20** (175)	-	-

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Total Petroleum Hydrocarbons (C8-C35)	<5-27011	2.5-108.4	500[5]	-	50	**1** (116)	-	**16**
PAH (EPA 16 total)	<0.1-226.7	0.1-35.8	100[5]	-	50	**1** (163)	-	**6**
Naphthalene	<0.1-1.6	0.1-2.0	76.4[1]	-	50	0 (163)	-	0
Acenaphthylene	<0.1-2.3	0.1-0.8	86.1^[1]	-	50	0 (163)	-	0
Acenaphthene	<0.1-2.5	0.1-1.7	57.0^[1]	-	50	0 (163)	-	0
Fluorene	<0.1-3.9	0.1-5.0	30.9^[1]	-	50	0 (163)	-	0
Phenanthrene	<0.1-28.3	0.1-4.6	21,900[1]	-	50	0 (163)	-	0
Anthracene	<0.1-7.5	0.1-4.1	525,000[1]	-	50	0 (163)	-	0
Fluoranthene	<0.1-43.4	0.1-5.7	22,600[1]	-	50	0 (163)	-	0
Pyrene	<0.1-30.8	0.1-4.9	54,200[1]	-	50	0 (163)	-	0
Benzo(a)anthracene	<0.1-17.3	0.1-3.5	89.5[1]	-	50	0 (163)	-	0
Chrysene	<0.1-18.2	0.1-3.8	137[1]	-	50	0 (163)	-	0
Benzo(b)fluoranthene	<0.1-16.6	0.1-3.2	100[1]	-	50	0 (163)	-	0
Benzo(k)fluoranthene	<0.1-12.9	0.1-2.9	141[1]	-	50	0 (163)	-	0
Benzo (a) Pyrene	<0.1-16.5	0.1-3.3	14.1[1]	-	50	**1** (163)	-	0
Indeno(1,2,3-cd)pyrene	<0.1-13.5	0.1-2.6	60[1]	-	50	0 (163)	-	0
Dibenzo(a,h)anthracene	<0.1-3.1	0.1-0.7	12.7[1]	-	50	0 (163)	-	0
Benzo(ghi)perylene	<0.1-11.8	0.1-2.3	654[1]	-	50	0 (163)	-	0
TPH Aromatic C5-C7	<0.01	0.01	28.1[1,6]	-	50	0 (58)	-	0

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
TPH Aromatic C7-C8	<0.01	0.01	869^[1,7]	-	50	0 (58)	-	0
TPH Aromatic C8-C10	<0.1-3.7	0.1-3.2	613^[1]	-	50	0 (58)	-	0
TPH Aromatic C10-C12	<0.1-128.3	0.1-169.6	364^[1]	-	50	0 (58)	-	**1**
TPH Aromatic C12-C16	<0.1-886.9	0.9-1151.0	169^[1]	-	50	**1** (58)	-	**4**
TPH Aromatic C16-C21	<0.1-1961.0	1.6-2489	28,200[1]	-	50	0 (58)	-	**4**
TPH Aromatic C21-C35	<0.1-6810.7	3.9-8507.0	28,200[1]	-	50	0 (58)	-	**10**
TPH Aliphatic C5-C6	<0.01	0.01	304^[1]	-	50	0 (58)	-	0
TPH Aliphatic C6-C8	<0.01-0.15	0.01-0.20	144^[1]	-	50	0 (58)	-	0
TPH Aliphatic C8-C10	<0.1-154.0	0.1-204.3	78^[1]	-	50	**1** (58)	-	**1**
TPH Aliphatic C10-C12	<0.1-605.6	0.1-796.0	48^[1]	-	50	**2** (58)	-	**2**
TPH Aliphatic C12-C16	<0.1-2766.6	0.4-3588.3	24^[1]	-	50	**4** (58)	-	**4**
TPH Aliphatic C16-C21	<0.1-4449.7	1.4-5724.8	1,590,000[1]	-	50	0 (58)	-	**4**
TPH Aliphatic C21-C35	<0.1-11131.4	2.6-14232.2	1,590,000[1]	-	50	0 (58)	-	**7**
Total TPH (Sum C6-C40)	<0.1-28898.0	9.6-36852.1	500[5]	-	50	**4** (58)	-	**14**
Benzene	<0.01	NC	28.1[1]	-	-	0 (46)	-	-
Toluene	<0.01	NC	869^[1]	-	-	0 (46)	-	-
Ethyl Benzene	<0.01	NC	518^[1]	-	-	0 (46)	-	-
m&p Xylene	<0.01	NC	576^[P-1]	-	-	0 (46)	-	-
o-xylene	<0.01	NC	478^[1]	-	-	0 (46)	-	-
Other VOCs	<0.01-0.27	NC	-	-	-	- (46)	-	-

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
All SVOC	<0.01-8.04	NC	-	-	-	- (36)	-	-
PCBs (7 congeners)	<0.01	NC	40 (total PCBs)	-	-	0 (16)	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

* Wessex Water revised threshold for arsenic. Wessex Water Soil Survey Guidance

FC - Based on the value for free cyanide as no total cyanide screening value exists

TP - Based on the Total Phenol concentration

P - Based on the Phenol concentration

P - Assessment of the combined concentrations of both m and p isomers, based on the lower Tier 1 concentration for p-xylene

^ - In line with the Environment Agency approach in the published SGVs, the GAC presented has been capped at the soil saturation limit

~ - Statistical outliers have been retained in the dataset as these values are not considered to represent a separate population

ND - None detected

NC - Not Calculated

1. Internally Derived EDFE SSV using CLEA model v1.06 using all the same standard input parameters that the Environment Agency or LQM used to derive standard SGVs for commercial and industrial end use with the exception that SOM has been set to 1%
2. Defra/EA (2002) R & D Publication SGV 10. Soil Guideline Values for Lead Contamination
3. BS3882:2007 Specification for Topsoil and requirements for use
4. Former ICRCL Guidance Note 59/83 (N.B. paper withdrawn by Defra in 2004)
5. The Hazardous Waste (England and Wales) Regulations 2005. Inert Waste Threshold
6. Benzene Tier 1 Risk Assessment concentration used for Aromatic TPH C5-C7 fractions
7. Toluene Tier 1 Risk Assessment concentration used for Aromatic TPH C7-C8 fractions
8. Statutory Instrument 1989 No. 1263, ’Sludge (Use in Agriculture) Regulations 1989’, pH value >7.0
9. BRE Special Digest SD1 Specification (3rd Edition, 2005)
10. Tier 1 Assessment for asbestos is based on presence or absence of fibres

Table 14C.6: Summary of Ecological Risk Assessment for Made Ground Soils on the Built Development Area East

Determinand	Range of Concentration	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values	Range of Local (BDAW) Stage 3 Background Values	Exceedence of Stage 3 Local Background Values
Total Arsenic	<5–37	153	18[2a]/43[2c]/46[2d]	**4**/0/0	1.37 – 143[b]	0	-	-
Total Cadmium	<0.5–3	153	1.15[1]	**29**	0.1 – 1.78[b]			**6**
Total Chromium (III)	12-78	153	21.1[1]	**133**	3.89 – 236[b]	0	-	-
Hexavalent Chromium	<2	153	-	-	-	-	-	-
Total Lead	6-382	153	167.9[1]	**3**	16.2 – 713[b]	0	-	-
Total Mercury	<0.5	153	0.06[1]^	**153**^	0.07 – 1.22[b]	0	-	-
Total Copper	7-241	153	88.4[1]	**3**	4.8 – 75.2[b]	**3**	24 – 179[a]	**1**
Total Nickel	6-87	153	25.1[1]	**143**	2.13 – 88.9[b]	0	-	-
Total Zinc	22-922	153	90.1[1]	**70**	17.7 – 442[b]	**2**	30 – 340[a]	**2**
Total Selenium	<0.5-3.9	153	0.52[2a]/4.1[2b]/ 1.2[2c]/0.63[2d]	**129**/0/**76**/**121**	0.2 – 1.8[b1]	**42**	<0.5 -3.1[a]	**7**
Boron (water soluble)	<0.5-3.6	153	-	-	-	-	-	-
pH (pH units)	6.9-11.4	152	-	-	-	-	5.9-8.5[a]	**28**
Total Sulphate (%SO4)	<0.05-0.53	152	-	-	-	-	-	-
Total Cyanide	<1-5.4	152	-	-	-	-	-	-
Sulphide	<2-163	152	-	-	-	-	-	-
Elemental Sulphur	<10-1526	152	-	-	-	-	-	-
Total Phenol	<1-3	152	-	-	-	-	-	-
Asbestos	ND - Detected	175	-	-	-	-	-	-
Total Petroleum Hydrocarbons (C8-C35)	<5-27011	116	3,080[4]	**1**	-	-	<5-72[a]	**1**

Determinand	Range of Concentration	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values	Range of Local (BDAW) Stage 3 Background Values	Exceedence of Stage 3 Local Background Values
PAH (EPA 16 total)	<0.1-226.7	163	29[2b LM]/100[2d LM]/ 18[2b HM]/1.1[2d HM]	**11/1/14/57**	0.0428 – 16.800[c]	**15**	<0.1a	**14**
Naphthalene	<0.1-1.6	163	17[3]	0	-	-	-	-
Acenaphthylene	<0.1-2.3	163	-	-	-	-	-	-
Acenaphthene	<0.1-2.5	163	-	-	-	-	-	-
Fluorene	<0.1-3.9	163	-	-	-	-	-	-
Phenanthrene	<0.1-28.3	163	31[3]	0	-	0	-	-
Anthracene	<0.1-7.5	163	1.6[3]	**6**	0.000135- 1.1[c]	**6**	<0.1[a]	**6**
Fluoranthene	<0.1-43.4	163	260[3]	0	-	-	-	-
Pyrene	<0.1-30.8	163	-	-	-	-	-	-
Benzo(a)anthracene	<0.1-17.3	163	2.5[3]	**11**	0.000135 - 1.1000[c]	**11**	<0.1[a]	**11**
Chrysene	<0.1-18.2	163	35[3]	0	-	-	-	-
Benzo(b)fluoranthene	<0.1-16.6	163	-	-	-	-	-	-
Benzo(k)fluoranthene	<0.1-12.9	163	38[3]	0	-	-	-	-
Benzo (a) Pyrene	<0.1-16.5	163	0.15[1]	**41**	0.000867 – 1.540[c]	**12**	<0.1[a]	**12**
Indeno(1,2,3-cd)pyrene	<0.1-13.5	163	1.9[3]	**11**	0.000105 – 1.250[c]	**11**	<0.1[a]	**11**
Dibenzo(a,h)anthracene	<0.1-3.1	163	-	-	-	-	-	-
Benzo(ghi)perylene	<0.1-11.8	163	33[3]	0	-	-	-	-
TPH Aromatic C5-C7	<0.01	58	-	-	-	-	-	-
TPH Aromatic C7-C8	<0.01	58	-	-	-	-	-	-

Determinand	Range of Concentration	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values	Range of Local (BDAW) Stage 3 Background Values	Exceedence of Stage 3 Local Background Values
TPH Aromatic C8-C10	<0.1-3.7	58	-	-	-	-	-	-
TPH Aromatic C10-C12	<0.1-128.3	58	-	-	-	-	-	-
TPH Aromatic C12-C16	<0.1-886.9	58	-	-	-	-	-	-
TPH Aromatic C16-C21	<0.1-1961.0	58	-	-	-	-	-	-
TPH Aromatic C21-C35	<0.1-6810.7	58	-	-	-	-	-	-
TPH Aliphatic C5-C6	<0.01	58	-	-	-	-	-	-
TPH Aliphatic C6-C8	<0.01-0.15	58	-	-	-	-	-	-
TPH Aliphatic C8-C10	<0.1-154.0	58	-	-	-	-	-	-
TPH Aliphatic C10-C12	<0.1-605.6	58	-	-	-	-	-	-
TPH Aliphatic C12-C16	<0.1-2766.6	58	-	-	-	-	-	-
TPH Aliphatic C16-C21	<0.1-4449.7	58	-	-	-	-	-	-
TPH Aliphatic C21-C35	<0.1-11131.4	58	-	-	-	-	-	-
Total TPH (Sum C6-C40)	<0.1-28898.0	58	3,080[4]	**4**	-	-	<0.1 – 4.4[a]	**4**
Benzene	<0.01	46	130[3]	0	-	-	-	-
Toluene	<0.01	46	0.3[1]	0	-	-	-	-
Ethyl Benzene	<0.01	46	110[3]	0	-	-	-	-
m&p Xylene	<0.01	46	17[3]	0	-	-	-	-
o-xylene	<0.01	46	17[3]	0	-	-	-	-
Other VOCs	<0.01-0.27	46	-	-	-	-	-	-
All SVOC	<0.01-8.04	36	-	-	-	-	-	-
PCBs (7 congeners)	<0.01	16	-	-	-	-	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

^ - LOD is greater than screening value

1. Proposed SSV. Environment Agency, Guidance on the Use of Soil Screening Values in Ecological Risk Assessment (Science Report SC070009/SR2b)
2. Ecological Soil Screening Levels, US EPA

2a SSL for Plants

2b SSL for Soil Invertebrates

2c SSL for Wildlife (Avian)

2d SSL for Wildlife (Mammalian)

LM Low Molecular weight

HM High Molecular Weight

3. Dutch RIVM Serious Risk Concentrations for Ecosystems - Ecotoxicological SRCeco Soil Values
4. Commercial TPH Value for Fine Soils. (Sum of C6 – C35 aliphatic and aromatic hydrocarbon guideline values). Canadian Wide Standard for Petroleum Hydrocarbons in Soil Canadian Council of Ministers of Environment (CCME) 2008

a Range of concentrations recorded in the natural soils within the Built Development Area West (data derived from the AMEC Phase 1 Desk Study and Preliminary Non-Radiological Site Investigation for the Built Development Area West and AMEC Phase 2 Supplementary Investigation of the Built Development Area West)

b. Range of Concentrations Recorded in rural soils in England. UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency

b1. Reported range for selenium in normal soils in the UK (Adriano 2001). UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency.

c. Range of Concentrations Recorded in rural soils in England. UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 9, Environmental Concentrations of PAHs in UK Soil and Herbage. Environment Agency.

Table 14C.7: Summary of Chemical Analysis Results for Natural Soils on the Built Development Area East and Tier 1 Risk Assessment

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
Total Arsenic	<5-18.7	9.1-16.2	635[1]	-	50*	0 (46)	-	0
Total Cadmium	<0.5-1.1	0.8-1.2	230[1]	-	3	0 (46)	-	0
Total Chromium (III)	21-58	37.6-55.1	8,840[1]	-	600	0 (46)	-	0
Hexavalent Chromium	<2	1	35[1]	-	-	0 (46)	-	-
Total Lead	<1-53	14.7-48.7	750[2]	-	500	0 (46)	-	0
Total Mercury	<0.5	0.25	3,640[1]	-	1	0 (46)	-	0
Total Copper	4-72	37.1-63.9	71,700[1]	200[8]	-	0 (46)	0 (46)	-
Total Nickel	24-78	39.9-55.2	1,790[1]	110[8]	-	0 (46)	0 (46)	-
Total Zinc	25-130	68.7-143.2	665,000[1]	450[8]	-	0 (46)	0 (46)	-
Total Selenium	<0.5-3.6	0.9-2.6	13,000[1]	-	3	0 (46)	-	**2**
Boron (water soluble)	<0.5-4.2	0.8-5.5	192,000[1]	3[4]	-	0 (46)	**1** (46	0
pH (pH units)	7.3-8.9	NC	5.5 – 8.5[3]	5.5 – 8.5[3]	<5 or >8	**3** (46)	**3** (46)	**34**
Total Sulphate (%SO4)	<0.05-0.37	0.025-0.41	-	-	0.20/0.24[9]	- (46)	-	**3/2**
Total Cyanide	<1-2	0.5-2.1	16,000[FC,1]	-	25[FC]	0 (46)	-	0
Sulphide	<2-17.4	1.0-15.9	250[4]	-	250	0 (46)	-	0
Elemental Sulphur	<10-122	5-36.3	5,000[4]	-	5000	0 (46)	-	0
Total Phenol	<1	0.5	3,200[P,1]	-	5	0 (46)	-	0
Asbestos	ND	-	Presence of fibres[10]	-	-	0 (18)	-	-
Total Petroleum Hydrocarbons (C8-C35)	<5-18	2.5-16.3	500[5]	-	50	0 (41)	-	0

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
PAH (EPA 16 total)	<0.1-5.0	0.1-2.0	100[5]	-	50	0 (46)	-	0
Naphthalene	<0.1-0.1	0.1	76.4[1]	-	50	0 (46)	-	0
Acenaphthylene	<0.1	0.1	86.1^[1]	-	50	0 (46)	-	0
Acenaphthene	<0.1-0.2	0.1	57.0^[1]	-	50	0 (46)	-	0
Fluorene	<0.1-0.4	0.1	30.9^[1]	-	50	0 (46)	-	0
Phenanthrene	<0.1-0.1	0.1	21,900[1]	-	50	0 (46)	-	0
Anthracene	<0.1-2.0	0.1-0.5	525,000[1]	-	50	0 (46)	-	0
Fluoranthene	<0.1-0.7	0.1-0.3	22,600[1]	-	50	0 (46)	-	0
Pyrene	<0.1-0.2	0.1	54,200[1]	-	50	0 (46)	-	0
Benzo(a)anthracene	<0.1-0.1	0.1	89.5[1]	-	50	0 (46)	-	0
Chrysene	<0.1-0.2	0.1	137[1]	-	50	0 (46)	-	0
Benzo(b)fluoranthene	<0.1-0.6	0.1-0.2	100[1]	-	50	0 (46)	-	0
Benzo(k)fluoranthene	<0.1-0.4	0.1-0.3	141[1]	-	50	0 (46)	-	0
Benzo (a) Pyrene	<0.1-1.3	0.1-0.5	14.1[1]	-	50	0 (46)	-	0
Indeno(1,2,3-cd)pyrene	<0.1-0.5	0.1-0.4	60[1]	-	50	0 (46)	-	0
Dibenzo(a,h)anthracene	<0.1-0.1	0.1	12.7[1]	-	50	0 (46)	-	0
Benzo(ghi)perylene	<0.1-1.0	0.1-0.9	654[1]	-	50	0 (46)	-	0
TPH Aromatic C5-C7	<0.01	NC	28.1[1,6]	-	50	0 (5)	-	0
TPH Aromatic C7-C8	<0.01	NC	869^[1,7]	-	50	0 (5)	-	0
TPH Aromatic C8-C10	<0.1	NC	613^[1]	-	50	0 (5)	-	0
TPH Aromatic C10-C12	<0.1	NC	364^[1]	-	50	0 (5)	-	0

Determinand	Range of Concentration	UCL Concentration Ranges	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)	Exceedence of Tier 1 Built Environment SSV
TPH Aromatic C12-C16	<0.1	NC	169^[1]	-	50	0 (5)	-	0
TPH Aromatic C16-C21	<0.1-0.2	NC	28,200[1]	-	50	0 (5)	-	0
TPH Aromatic C21-C35	<0.1-0.84	NC	28,200[1]	-	50	0 (5)	-	0
TPH Aliphatic C5-C6	<0.01	NC	304^[1]	-	50	0 (5)	-	0
TPH Aliphatic C6-C8	<0.01	NC	144^[1]	-	50	0 (5)	-	0
TPH Aliphatic C8-C10	<0.1-0.1	NC	78^[1]	-	50	0 (5)	-	0
TPH Aliphatic C10-C12	<0.1	NC	48^[1]	-	50	0 (5)	-	0
TPH Aliphatic C12-C16	<0.1-0.3	NC	24^[1]	-	50	0 (5)	-	0
TPH Aliphatic C16-C21	<0.1-0.3	NC	1,590,000[1]	-	50	0 (5)	-	0
TPH Aliphatic C21-C35	<0.1-1.06	NC	1,590,000[1]	-	50	0 (5)	-	0
Total TPH (Sum C6-C40)	0.6-1.9	NC	500[5]	-	50	0 (5)	-	0
Benzene	<0.01	NC	28.1[1]	-	-	0 (3)	-	-
Toluene	<0.01	NC	869^[1]	-	-	0 (3)	-	-
Ethyl Benzene	<0.01	NC	518^[1]	-	-	0 (3)	-	-
m&p Xylene	<0.01	NC	576^[P-1]	-	-	0 (3)	-	-
o-xylene	<0.01	NC	478^[1]	-	-	0 (3)	-	-
Other VOCs	<0.01	NC	-	-	-	0 (3)	-	-
All SVOC	<0.01	NC	-	-	-	0 (4)	-	-
PCBs (7 congeners)	<0.01	NC	40 (total PCBs)	-	-	0 (4)	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection
* Wessex Water revised threshold for arsenic. Wessex Water Soil Survey Guidance
FC Based on the value for free cyanide as no total cyanide screening value exists
TP Based on the Total Phenol concentration
P Based on the Phenol concentration
P Assessment of the combined concentrations of both m and p isomers, based on the lower Tier 1 concentration for p xylenes
^ In line with the Environment Agency approach in the published SGVs, the GAC presented has been capped at the soil saturation limit
~ Statistical outliers have been retained in the dataset as these values are not considered to represent a separate population
ND None detected
NC Not Calculated

1. Internally Derived EDF Energy SSV using CLEA model v1.06 using all the same standard input parameters that the Environment Agency or LQM used to derive standard SGVs for commercial and industrial end use with the exception that SOM has been set to 1%
2. Defra/EA (2002) R & D Publication SGV 10. Soil Guideline Values for Lead Contamination
3. BS3882:2007 Specification for Topsoil and requirements for use
4. Former ICRCL Guidance Note 59/83 (N.B. paper withdrawn by Defra in 2004)
5. The Hazardous Waste (England and Wales) Regulations 2005. Inert Waste Threshold
6. Benzene Tier 1 Risk Assessment concentration used for Aromatic TPH C5-C7 fractions
7. Toluene Tier 1 Risk Assessment concentration used for Aromatic TPH C7-C8 fractions
8. Statutory Instrument 1989 No. 1263, 'Sludge (Use in Agriculture) Regulations 1989', pH value >7.0
9. BRE Special Digest SD1 Specification (3rd Edition, 2005)
10. Tier 1 Assessment for asbestos is based on presence or absence of fibres

Table 14C.8: Summary of Ecological Risk Assessment for Natural Soils on the Built Development Area East

Determinand	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values	Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values
Total Arsenic	<5-18.7	46	18[2a]/43[2c]/46[2d]	**1**/0/0	1.37 - 143[b]	0	-	-
Total Cadmium	<0.5-1.1	46	1.15[1]	**2**	0.1 - 1.78 [b]	**1**	<0.5-3.0[a]	0
Total Chromium (III)	21-58	46	21.1[1]	**44**	3.89 - 236 [b]	0	-	-
Hexavalent Chromium	<2	46	-	-	-	-	-	-
Total Lead	<1-53	46	167.9[1]	0	-	-	-	-
Total Mercury	<0.5	46	0.06[1]^	**46**^	0.07 - 1.22 [b]	0	-	-
Total Copper	4-72	46	88.4[1]	0	-	-	-	-
Total Nickel	24-78	46	25.1[1]	**45**	2.13 - 88.9 [b]	0	-	-
Total Zinc	25-130	46	90.1[1]	**9**	17.7 - 442 [b]	0	-	-
Total Selenium	<0.5-3.6	46	0.52[2a]/4.1[2b]/ 1.2[2c]/0.63[2d]	**39**/0/**21**/**35**	0.2 - 1.8 [b1]	**6**	<0.5-.1[a]	**2**
Boron (water soluble)	<0.5-4.2	46	-	-	-	-	-	-
pH (pH units)	7.3-8.9	46	-	-	-	-	5.9-8.5[a]	**3**
Total Sulphate (%SO4)	<0.05-0.37	46	-	-	-	-	-	-
Total Cyanide	<1-2	46	-	-	-	-	-	-
Sulphide	<2-17.4	46	-	-	-	-	-	-
Elemental Sulphur	<10-122	46	-	-	-	-	-	-
Total Phenol	<1	46	-	-	-	-	-	-
Asbestos	ND	18	-	-	-	-	-	-
Total Petroleum Hydrocarbons (C8-C35)	<5-18	41	3,080[4]	0	-	-	-	-

Determinand	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values	Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values
PAH (EPA 16 total)	<0.1-5.0	46	29[2b LM]/100[2d LM]/ 18[2b HM]/1.1[2d HM]	0/0/0/**5**	0.0428 – 16.800[c]	0	-	-
Naphthalene	<0.1-0.1	46	17[3]	0	-	-	-	-
Acenaphthylene	<0.1	46	-	-	-	-	-	-
Acenaphthene	<0.1-0.2	46	-	-	-	-	-	-
Fluorene	<0.1-0.4	46	-	-	-	-	-	-
Phenanthrene	<0.1-0.1	46	31[3]	0	-	-	-	-
Anthracene	<0.1-2.0	46	1.6[3]	**1**	0.000135- 1.1[c]	**1**	<0.1[a]	**1**
Fluoranthene	<0.1-0.7	46	260[3]	0	-	-	-	-
Pyrene	<0.1-0.2	46	-	-	-	-	-	-
Benzo(a)anthracene	<0.1-0.1	46	2.5[3]	0	-	-	-	-
Chrysene	<0.1-0.2	46	35[3]	0	-	-	-	-
Benzo(b)fluoranthene	<0.1-0.6	46	-	-	-	-	-	-
Benzo(k)fluoranthene	<0.1-0.4	46	38[3]	0	-	-	-	-
Benzo (a) Pyrene	<0.1-1.3	46	0.15[1]	**4**	0.000867 – 1.540[c]	0	-	-
Indeno(1,2,3-cd)pyrene	<0.1-0.5	46	1.9[3]	0	-	-	-	-
Dibenzo(a,h)anthracene	<0.1-0.1	46	-	-	-	-	-	-
Benzo(ghi)perylene	<0.1-1.0	46	33[3]	0	-	-	-	-
TPH Aromatic C5-C7	<0.01	5	-	-	-	-	-	-
TPH Aromatic C7-C8	<0.01	5	-	-	-	-	-	-
TPH Aromatic C8-C10	<0.1	5	-	-	-	-	-	-

Determinand	Range of Concentrations	Number of Samples Analysed	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV	Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values	Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values
TPH Aromatic C10-C12	<0.1	5	-	-	-	-	-	-
TPH Aromatic C12-C16	<0.1	5	-	-	-	-	-	-
TPH Aromatic C16-C21	<0.1-0.2	5	-	-	-	-	-	-
TPH Aromatic C21-C35	<0.1-0.84	5	-	-	-	-	-	-
TPH Aliphatic C5-C6	<0.01	5	-	-	-	-	-	-
TPH Aliphatic C6-C8	<0.01	5	-	-	-	-	-	-
TPH Aliphatic C8-C10	<0.1-0.1	5	-	-	-	-	-	-
TPH Aliphatic C10-C12	<0.1	5	-	-	-	-	-	-
TPH Aliphatic C12-C16	<0.1-0.3	5	-	-	-	-	-	-
TPH Aliphatic C16-C21	<0.1-0.3	5	-	-	-	-	-	-
TPH Aliphatic C21-C35	<0.1-1.06	5	-	-	-	-	-	-
Total TPH (Sum C6-C40)	0.6-1.9	5	3,080[4]	0	-	-	-	-
Benzene	<0.01	3	130[3]	0	-	-	-	-
Toluene	<0.01	3	0.3[1]	0	-	-	-	-
Ethyl Benzene	<0.01	3	110[3]	0	-	-	-	-
m&p Xylene	<0.01	3	17[3]	0	-	-	-	-
o-xylene	<0.01	3	17[3]	0	-	-	-	-
Other VOCs	<0.01	3	-	-	-	-	-	-
All SVOC	<0.01	4	-	-	-	-	-	-
PCBs (7 congeners)	<0.01	4	-	-	-	-	-	-

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

^ - LOD is greater than screening value

1. Proposed SSV. Environment Agency, Guidance on the Use of Soil Screening Values in Ecological Risk Assessment (Science Report SC070009/SR2b)

2. Ecological Soil Screening Levels, US EPA

2a SSL for Plants

2b SSL for Soil Invertebrates

2c SSL for Wildlife (Avian)

2d SSL for Wildlife (Mammalian)

LM Low Molecular weight

HM High Molecular Weight

3. Dutch RIVM Serious Risk Concentrations for Ecosystems - Ecotoxicological SRCeco Soil Values

4. Commercial TPH Value for Fine Soils. (Sum of C6 – C35 aliphatic and aromatic hydrocarbon guideline values). Canadian Wide Standard for Petroleum Hydrocarbons in Soil Canadian Council of Ministers of Environment (CCME) 2008

a. Range of concentrations recorded in the natural soils within the Built Development Area West (data derived from the AMEC Phase 1 Desk Study and Preliminary Non-Radiological Site Investigation for the Built Development Area West and AMEC Phase 2 Supplementary Investigation of the Built Development Area West)

b. Range of Concentrations Recorded in rural soils in England. UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency

b1. Reported range for selenium in normal soils in the UK (Adriano 2001). UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency

c. Range of Concentrations Recorded in rural soils in England. UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 9, Environmental Concentrations of PAHs in UK Soil and Herbage. Environment Agency

a) Forensic Hydrocarbon Analysis

14C.2.13 A selection of soil, weathered rock and free-phase product samples taken from exploratory holes in the vicinity of TE418 and CBH2_54 in Area 4 of the BDAE (in which evidence of hydrocarbon contaminated soils was noted during exploratory works and during groundwater monitoring in CBH2_54) were submitted to Jones Environmental Ltd for tiered forensic hydrocarbon analysis (Tiers 1 to 3). **Table 14C.9** presents a summary of the soil samples submitted for forensic testing. For full details please refer to the Phase 2 contamination report (Ref. 14.93).

14C.2.14 Due to the specific targeted sampling undertaken, including sampling from depths at which no direct excavation of materials is anticipated during construction works (i.e. CBH2_55 ES1 23.1 to 23.5m bgl), the use of these samples to further characterise soils within Area 4 for human health risk purposes is not considered to be appropriate. Therefore, the results of forensic analysis are presented below but are not included or discussed within the Tier 1 soil risk assessment.

Table 14C.9: Summary of Samples Scheduled for Forensic Testing

Exploratory Hole	Depth	Reference	Field Description of Contamination
TE418D	0.6 – 0.75	ES1	Visible free product, comprising viscous black substance and hydrocarbon odour.
CBH2_55	23.1 – 23.5	ES1	Faint hydrocarbon odour in clay parting.
CH2_56	4.4 – 4.5	ES4	Hydrocarbon sheen in fissures in mudstone. During drilling the water on the gravels had a rainbow sheen with a strong kerosene odour.
CBH2_57	6.0 – 6.1	ES1	Slight sheen on flushing and slight hydrocarbon odour within clay when broken.

14C.2.15 The results of the Tier 1 forensic analysis recorded concentrations of total Extractable Petroleum Hydrocarbons (EPH) ranging from 191mg/kg (CBH2_55 ES1) to 735mg/kg (CBH2_57 ES1). The sample of free product (TE418D ES1) was reported, as anticipated, to have a very high EPH concentration (11,758mg/kg).

14C.2.16 The Tier 2 forensic analysis indicated that the likely source of contamination for each of the four samples was anthropogenic and likely to be sourced from heavy fuel oils or middle distillates, and that the hydrocarbon species present in the sampled soil was most likely to be from a crude oil or heavy fuel oil source rather than lube oil.

14C.2.17 Tier 3 forensic analysis confirmed correlations between samples CBH2_55 ES1 and CBH2_57 ES1 (derived from a similar middle distillate) and between samples CBH2_56 ES4 and TE418D ES1 (derived from a biodegraded heavy fuel oil of greater age than that in CBH2_55 and CBH2_57). The correlation between CBH2_56 and TE418D is expected, given that they were both advanced in order to delineate the extent, (both vertical and lateral), of shallow hydrocarbon contaminated soils identified within the Made Ground at sampling location TE418. Although samples from CBH2_55 and CBH2_57 are correlatable, the distance between the two (nearly 160m) means that it is unlikely that the same source zone is responsible for the hydrocarbons in these two locations, particularly given the variation in depth at which the sampled contamination was evident and the absence of identified hydrocarbon impact in nearby borehole DBH2_26 (located to the west of CBH2_57, close to the northern site boundary).

14C.2.18 During routine groundwater level monitoring of CBH2_54 (an uninstalled open hole at the time) free product was identified in the form of Light Non-Aqueous Phase Liquid (LNAPL) adhering to the groundwater level probe. A sample of free product was subsequently taken in May 2010 and the results of the TPH CWG analysis were interpreted by The Environmental Laboratory (ELAB) to be a weathered (degraded) diesel with some trace amounts of a heavier oil (>C28), which was considered likely to be lube oil. ELAB aged the product at approximately 3.5 years. In September 2010 the results of the ELAB analysis (including chromatogram traces from ELAB) were provided to Jones Environmental Ltd. for forensic interpretation and comparison with the four samples which are described above. The interpretation (Ref. 14.93) found that the sampled product was most likely to be a middle distillate of indeterminate age, with no sign of biodegradation but evidence of significant weathering or water washing. The data review also indicated that the oil was unlikely to be derived from a natural oil shale source.

14C.2.19 The results of forensic analysis on soil samples from CBH2_55, CBH2_56, CBH2_57 and TE418, and the interpretation of the gas chromatogram from the sample of free product from CBH2_54, indicate that the hydrocarbon contaminated soils and/or groundwater identified within all of these locations is of anthropogenic origin, and none of the observed hydrocarbons are of natural origin such as those often associated with locally occurring oil shales.

14C.2.20 The results of analysis together with field observations of the extent of visual and olfactory evidence of hydrocarbon contaminated soils in the vicinity of trial pit TE418 (TE418A-E and CBH2_56) shows that the contamination identified within shallow natural soil in CBH2_56 has migrated to that depth from a source zone in the region of TE418, which is likely to comprise leakage from a former above ground storage tank which was present in that location, as identified from aerial imagery as reported in the Desk Based Assessment (Ref. 14.91).

14C.2.21 Monitoring and sampling and analysis of groundwaters has been undertaken at the hydrocarbon affected boreholes CBH2_54, CBH2_55, CBH2_56 and CBH2_57. Details of this monitoring are provided in **Chapter 15** of this volume (Groundwater).

14C.2.22 In addition to the analysis of the samples identified above for forensic hydrocarbon testing, three samples of shallow natural soil (CBH2_56 ES3 3.0-3.15m bgl, CBH2_56 ES4 4.4-4.5m bgl and CBH2_57 ES1 6.0-6.1m bgl) were scheduled for analysis by Jones Environmental Ltd for speciated PAHs, TPH CWG and BTEX testing (Ref. 14.93). **Table 14C.10** presents a summary of the results of analysis on these samples.

Table 14C.10: Summary of Jones Environmental Hydrocarbon Analysis (Samples from CBH2_56 and CBH2_57 only)

Determinand	Range of Concentrations	Tier 1 Human Health SSV	Tier 1 Built Environment SSV (WRAS Threshold Value)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of WRAS Threshold Value (Number of Samples)
PAH (EPA 16 total)	<0.60 – 1.25	100[5]	50	0 (3)	0 (3)
Naphthalene	<0.04 – 0.10	76.4^[1]	50	0 (3)	0 (3)
Acenaphthylene	<0.03	86.1^[1]	50	0 (3)	0 (3)
Acenaphthene	<0.05 – 0.09	57.0^[1]	50	0 (3)	0 (3)
Fluorene	<0.04 – 0.10	30.9^[1]	50	0 (3)	0 (3)
Phenanthrene	<0.03 – 0.48	21,900[1]	50	0 (3)	0 (3)
Anthracene	<0.04	525,000[1]	50	0 (3)	0 (3)
Fluoranthene	<0.03 – 0.08	22,600[1]	50	0 (3)	0 (3)
Pyrene	<0.03 – 0.13	54,200[1]	50	0 (3)	0 (3)
Benzo(a)anthracene	<0.6 – 0.10	89.5[1]	50	0 (3)	0 (3)
Chrysene	<0.02 – 0.13	137[1]	50	0 (3)	0 (3)
Benzo(b)fluoranthene/ Benzo(k)fluoranthene	<0.07	100[1]/141[1]	50	0 (3)	0 (3)
Benzo (a) Pyrene	<0.04	14.1[1]	50	0 (3)	0 (3)
Indeno(1,2,3-cd)pyrene	<0.04	60[1]	50	0 (3)	0 (3)
Dibenzo(a,h) anthracene	<0.04	12.7[1]	50	0 (3)	0 (3)
Benzo(ghi)perylene	<0.04 – 0.04	654[1]	50	0 (3)	0 (3)
TPH Aromatic C5-C7	<0.1	28.1[1,3]	50	0 (3)	0 (3)
TPH Aromatic C7-C8	<0.1	869^[1,4]	50	0 (3)	0 (3)
TPH Aromatic C8-C10	<0.1	613^[1]	50	0 (3)	0 (3)
TPH Aromatic C10-C12	<0.2	364^[1]	50	0 (3)	0 (3)
TPH Aromatic C12-C16	<4	169^[1]	50	0 (3)	0 (3)
TPH Aromatic C16-C21	<7 - 18	28,200[1]	50	0 (3)	0 (3)
TPH Aromatic C21-C35	<7 – 70	28,200[1]	50	0 (3)	**1** (3)
TPH Aliphatic C5-C6	<0.1	304^[1]	50	0 (3)	0 (3)
TPH Aliphatic C6-C8	<0.1	144^[1]	50	0 (3)	0 (3)
TPH Aliphatic C8-C10	<0.1	78^[1]	50	0 (3)	0 (3)
TPH Aliphatic C10-C12	<0.2 – 36.0	48^[1]	50	0 (3)	0 (3)
TPH Aliphatic C12-	38 – 87	24^[1]	50	**3** (3)	**2** (3)

Determinand	Range of Concentrations	Tier 1 Human Health SSV	Tier 1 Built Environment SSV (WRAS Threshold Value)	Exceedence of Tier 1 Human Health SSV (Number of Samples)	Exceedence of WRAS Threshold Value (Number of Samples)
C16					
TPH Aliphatic C16-C21	41 – 80	1,590,000[1]	50	0 (3)	**2** (3)
TPH Aliphatic C21-C35	56 – 102	1,590,000[1]	50	0 (3)	**3** (3)
Total TPH (Sum C6 – C35)	164 - 308	500[2]	50	0 (3)	**3** (3)
Benzene	<5	28,100[1]	-	0 (3)	-
Toluene	<5	869,000^[1]	-	0 (3)	-
Ethyl Benzene	<5	518,000^[1]	-	0 (3)	-
m&p Xylene	<5	576,000^[1] (p-)	-	0 (3)	-
o-xylene	<5	478,000^[1]	-	0 (3)	-
PAH (EPA 16 total)	<0.60 – 1.25	100[2]	50	0 (3)	0 (3)
Naphthalene	<0.04 – 0.10	76.4^[1]	50	0 (3)	0 (3)

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

* Wessex Water revised threshold for arsenic. Wessex Water Soil Survey Guidance

P - Assessment of the combined concentrations of both m and p isomers, based on the lower Tier 1 concentration for p xylene.

^ - In line with the Environment Agency approach in the published SGVs, the GAC presented has been capped at the soil saturation limit.

1. Internally Derived EDF Energy SSV using CLEA model v1.06 using all the same standard input parameters that the Environment Agency used to derive standard SGVs for commercial and industrial end use with the exception that SOM has been set to 1 %.
2. The Hazardous Waste (England and Wales) Regulations 2005. Inert Waste Threshold
3. Benzene Tier 1 Risk Assessment concentration used for Aromatic TPH C5-C7
4. Toluene Tier 1 Risk Assessment concentration used for Aromatic TPH C7-C8

b) Waste Acceptance Criteria

14C.2.23 As part of the investigation Waste Acceptance Criteria (WAC) analysis has been scheduled on 23 samples from across the BDAE to provide an initial assessment of the waste acceptance classification which materials may fall into should they require disposal off-site. All samples analysed were of Made Ground material with the exception of two samples of natural soil materials (weathered Blue Lias mudstone in TE12 ES2 and apparent pond sediment in TE13 ES4).

14C.2.24 Certificated full WAC test data and tables are provided within the Phase 2 Contamination Assessment report (Ref. 14.93). **Table 14C.11** below provides a summary of the WAC results across the BDAE (presenting 10:1 leachate results only, and excluding the 2:1 and 8:1 leachability test results which contribute to the 10:1 value) and highlights any exceedences of the WAC screening values.

Table 14C.11: Summary of Waste Acceptance Criteria Analysis and Comparison with Waste Acceptance Criteria

Determinand	Range of Concentrations (mg/kg Unless Stated)	Inert Waste Landfill (Number of Exceedences in Bold)	Stable Non-reactive Hazardous Waste in Non-hazardous Landfill (Number of Exceedences in Bold)	Hazardous Waste Landfill (Number of Exceedences in Bold)
Solid Waste Analysis				
TOC (%)	0.4-7.3	3 **(2)**	5 **(2)**	6 **(1)**
Loss on Ignition (%)	2.9-9.4	--	--	10
BTEX (mg/kg)	<0.01	6	--	--
Sum of PCBs (mg/kg)	<0.01-0.04	1	--	--
Mineral Oil (mg/kg)	1-27011	500 **(2)**	--	--
Total PAH (mg/kg)	<0.1-41.1	100	--	--
pH (Units)	7.3-10.6	--	--	--
Acid Neutralisation Capacity (mol/kg)	<0.1	--	To be evaluated	To be evaluated
Eluate Analysis		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10l/kg (mg/kg)		
Arsenic	<0.1	0.5	2	25
Barium	<0.1-0.3	20	100	300
Cadmium	<0.01	0.04	1	5
Chromium	<0.1	0.5	10	70
Copper	<0.1	2	50	100
Mercury	<0.001	0.01	0.2	2
Molybdenum	<0.1-9.9	0.5 **(8)**	10	30
Nickel	<0.1	0.4	10	40
Lead	<0.1	0.5	10	50
Antimony	<0.01-0.06	0.06	0.7	5
Selenium	<0.01-0.01	0.1	0.5	7
Zinc	<0.1	4	50	200
Chloride	5-82	800	15000	25000
Fluoride	<1	10	150	500
Sulphate	2-3335	1000 **(3)**	20000	50000
TDS	143-2508	4000	60000	100000
Phenol Index	<0.5	1	-	-
DOC	26-158	500	800	1000

Determinand	Range of Concentrations (mg/kg Unless Stated)	Inert Waste Landfill (Number of Exceedences in Bold)	Stable Non-reactive Hazardous Waste in Non-hazardous Landfill (Number of Exceedences in Bold)	Hazardous Waste Landfill (Number of Exceedences in Bold)
Leachate Test Information				
pH (units)	7.4-8.4	-	-	-
Electrical Conductivity	198-2480	-	-	-

If no value is presented in brackets then no samples exceeded the screening criteria for that contaminant.

c) Soil Leachability Analysis

14C.2.25 Soil leachability testing has been carried out on fifteen samples comprising two samples of natural soils, eight samples of Made Ground containing construction and demolition materials (including two samples from hydrocarbon impacted trial pit TE418 which were analysed for PAHs and TPHs only) and five samples of Made Ground comprising reworked natural soils. The soil leachability results have been used to conduct a Tier 1 controlled waters risk assessment in accordance with the methodology presented in the Phase 2 Contamination Assessment report (Ref. 14.93).

14C.2.26 A summary of the results is presented in **Table 14C.12** and further details are presented in the Phase 2 Contamination Assessment report (Ref. 14.93).

Table 14C.12: Summary of Leachate Analysis Results for the Built Development Area East and Tier 1 Risk Assessment

Determinand	Range of Concentrations (µg/l Unless Stated) (Number of Samples)	Drinking Water Standard (Exceedences in Bold)	Environmental Quality Standard Saltwater (Exceedences in Bold)	Environmental Quality Standard Freshwater (Exceedences in Bold)
Total Arsenic	<1-7 (13)	10^{T}	$25^{\text{4 A GC}}$	$50^{\text{4 A/G15}}$
Total Cadmium	<1 (13)	5^{T}	$0.2^{\text{4 A}}/1.5^{\text{4}}_{\text{MAC * LOD}}$	$0.25^{\text{4 A(C5)/}}1.5^{\text{4}}_{\text{MAC * LOD}}$
Total Chromium	<1-6 (13)	50^{T}	-	$4.7^{\text{A 4/}}32^{\text{P G15 4}}$ **(2)**
Hexavalent Chromium	<20 (13)	-	$0.6^{\text{4 A GC}}/32^{\text{P GC}}$	$3.4^{\text{4 A G15}}$
Total Lead	<1-28 (13)	25^{T} **(1)**	$7.2^{\text{4 A}}$ **(2)**	$7.2^{\text{4 A}}$ **(2)**
Total Mercury	<0.1 (13)	1^{T}	$0.05^{\text{4 A/}}0.07_{\text{MAC *LOD}}$	$0.05^{\text{4 A/}}0.07^{\text{4 MAC}}_{\text{*LOD}}$
Total Copper	<5-15 (13)	2000^{T}	$5^{\text{4 A GC}}$ **(4)**	$28^{\text{4 A G15\#}}$
Total Nickel	<1-3 (13)	20^{T}	$20^{\text{4 A}}$	$20^{\text{4 A}}$
Total Zinc	<5-64 (13)	5000^{5T}	-	$125^{\text{4 AT\#G15}}$
Total Selenium	<5 (13)	10^{T}	$1^{\text{4 A}}/5^{\text{4 P GC}}_{\text{FCN}}$ **(1)**	-

Determinand	Range of Concentrations (µg/l Unless Stated) (Number of Samples)	Drinking Water Standard (Exceedences in Bold)	Environmental Quality Standard Saltwater (Exceedences in Bold)	Environmental Quality Standard Freshwater (Exceedences in Bold)
Boron (water soluble)	<5-352 (13)	1000 [1T]	-	2000 [2 AT]
pH (pH units)	7.4-8.3 (13)	6.5-9.5 [1]	-	6 [4 (P5)H] 9 [4 (P95)H]
Sulphate (mg/l)	<5-23 (13)	250 [1]	-	400 [A (3)]
Total Cyanide	<5-8 (13)	50 [1]	-	1 [4 A]/5 [4 P G15 FCN] **(1)**
Sulphide (mg/l)	<0.1 (13)	-	-	-
Elemental Sulphur (mg/l)	<0.1 (11)	-	-	-
Total Phenol	<0.5 (13)	-	1.2 [4 A]	-
Thiocyanate (mg/l)	<0.1 (3)	-	-	-
Total Petroleum Hydrocarbons (C_8-C_{35})	<10 (13)	10 [5]	-	50 [6]
PAH (EPA 16 total)	<0.01 (15)	0.1 [1^^]	-	-
Naphthalene	<0.01 (15)	-	-	2.4 [4 A]
Acenaphthylene	<0.01 (15)	-	0.1 [A]/0.4 [MAC]	-
Acenaphthene	<0.01 (15)	-	0.1 [4 A]/1 [4 MAC]	-
Fluorene	<0.01 (15)	-	-	-
Phenanthrene	<0.01 (15)	-	-	-
Anthracene	<0.01 (15)	-	-	0.1 [A]/0.4 [MAC]
Fluoranthene	<0.01 (15)	-	Σ0.03 [4 A]	0.1 [4 A]/1 [4 MAC]
Pyrene	<0.01 (15)	-		-
Benzo(a)anthracene	<0.01 (15)	-	0.05 [4 A]/0.1 [4 MAC]	-
Chrysene	<0.01 (15)	-	Σ0.002 [4 A * LOD]	-
Benzo(b)fluoranthene	<0.01 (15)	0.1 [1^^^]		Σ0.03 [4 A]
Benzo(k)fluoranthene	<0.01 (15)	0.1 [1^^^]	-	
Benzo (a) Pyrene	<0.01 (15)	0.01		0.05 [4 A]/0.1 [4 MAC]
Indeno(1,2,3-cd)pyrene	<0.01 (15)	0.1 [1^^^]	-	Σ0.002 [4 A * LOD]
Dibenzo(a,h)anthracene	<0.01 (15)	0.1 [1^^^]	-	
Benzo(ghi)perylene	<0.01 (15)	-	-	-
Aromatic TPH			-	
>C_5-C_7	<10 (2)	-	-	-
>C_7-C_8	<10 (2)	-	-	-
>C_8-C_{10}	<10 (2)	-	-	-
>C_{10}-C_{12}	<10 (2)	-	-	-

Determinand	Range of Concentrations (µg/l Unless Stated) (Number of Samples)	Drinking Water Standard (Exceedences in Bold)	Environmental Quality Standard Saltwater (Exceedences in Bold)	Environmental Quality Standard Freshwater (Exceedences in Bold)
$>C_{12}$-C_{16}	<10 (2)	-	-	-
$>C_{16}$-C_{21}	12-22 (2)	-	-	-
$>C_{21}$-C_{35}	16-24 (2)	-	-	-
Aliphatic TPH			-	
$>C_{5}$-C_{6}	<10 (2)	-	-	-
$>C_{6}$-C_{8}	<10 (2)	-	-	-
$>C_{8}$-C_{10}	<10-98 (2)	-	-	-
$>C_{10}$-C_{12}	<10-11 (2)	-	-	-
$>C_{12}$-C_{16}	27-40 (2)	-	-	-
$>C_{16}$-C_{21}	76-133 (2)	-	-	-
$>C_{21}$-C_{35}	236-574 (2)	-	-	-
TPH (C_5 - C_{35})	390-879 (2)	10 [5] (2)	-	50 [6] **(2)**
PCB 28	<0.01 (3)	-	-	-
PCB 52	<0.01	-	-	-
PCB 101	<0.01	-	-	-
PCB 118	<0.01	-	-	-
PCB 138	<0.01	-	$1^{4\ A}/5^{4\ P\ GC}_{FCN}$ **(1)**	-
PCB 153	<0.01	-	-	-
PCB 180	<0.01	-	-	-

If no value is presented in brackets, no samples exceeded the screening criteria

#	Corrected based on the reported average hardness value (399mg/l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009
-	No current threshold value available
DPA	River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010 Part 7 Groundwater Threshold Values for Groundwater Drinking Water Protected Areas
D	Dissolved
T	Total
A	Annual Average
P	95-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 5% of the time or more)
P90	90-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 10% of the time or more)
P5	5-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is less than the standard for 5% of the time or more)
MAC	Maximum Allowable Concentration

C5	Cadmium EQS based on class 5 hardness (>200mg/l $CaCO_3$), corrected based on the reported average hardness value (399mg/l $CaCO_3$) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l $CaCO_3$) recorded during monitoring in 2009
GC	Threshold value based on 'good standard' for transitional and coastal waters to meet objective of WFD for Bridgewater Bay to achieve good ecological status by 2027 (no chemical criteria target thresholds specified)
G15	Threshold value based on 'good standard' to meet objective of WFD for Stogursey Brook to achieve good status by 2015
FCN	Threshold value for free cyanide (as HCN)
I	Imperative Value
T7	Type 7 surface water
As	Threshold value assumed to be total concentration as not defined in the directive and based on percentage of current DWS values
H	Threshold value for high standard based on current WFD Status
* LOD	Exceedences of the annual average EQS have occurred due to the limit of detection (LOD) not being low enough. This is a consequence of the current methodologies of analysis for these parameters. However, these ‘exceedences’ are not considered to be environmentally significant
^	Guideline Value – Non statutory/proposed EQS, but EQS never adopted in UK
^^	The parametric value applies to the sum of the concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(1,2,3-cd)pyrene detected and quantified in the monitoring process
^^^	The individual concentrations are based on the 0.1µg/l quoted for the sum of the four PAH compounds. By virtue of the total Tier 1 concentration being reported as 0.1µg/l the Tier 1 concentration for each individual compound has been applied at this value
1.	The Water Supply (Water Quality) Regulations 2000
2.	National Environmental Quality Standards (EQS) – For List II substances. Source DoE Circular 7/89. (Saltwater EQS = Saltwater concentration, Freshwater EQS = Freshwater Protection of other aquatic life - cyprinid fish)
3.	Environment Agency Non-Statutory (Operational) Environmental Quality Standards. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis
4.	The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010
5.	The Water Supply (Water Quality) Regulations 1989. N.B. These Regulations were superseded by the 2000 regulations therefore there is currently no UK DWS for zinc and/or Total Petroleum Hydrocarbons
6.	The Surface Waters (Abstraction) for Drinking Water (Classification) Regulations 1996. DW1 treatment (i.e. simple physical treatment and disinfection) limit
7.	The Surface Waters (Dangerous Substances) (Classification) Regulations 1989
8.	2006/44/EC Fish Directive - Cyprinid Fish Guideline
9.	The Private Water Supply regulations 1992 N.B. These regulations were superseded by 2009 regulations therefore there is no current UK DWS for these determinands
10.	The Surface Waters (Dangerous Substances) (Classification) Regulations 1998

d) Southern Construction Phase Area

14C.2.27 Intrusive investigations within the Southern Construction Phase Area (SCPA) were undertaken in June 2010 (Ref. 14.93). The works comprised nine window sampling holes advanced up to 5m bgl and six hand dug pits, advanced up to 1.2m bgl. Eight boreholes were also advanced to a maximum depth of 15m bgl (with the exception of CBH2_49 which was advanced to 60.8m bgl) for gas and/or groundwater monitoring or geotechnical purposes. Made Ground was encountered at one location only (WS75) extending to 0.79m bgl and at the other locations ground conditions generally comprised of topsoil over natural superficial deposits or weathered mudstone. The exploratory holes were positioned to provide coverage of the SCPA in general and to target possible infilled former ponds. Sampling locations are presented within the Phase 2 Contamination Assessment Report (Ref. 14.93).

14C.2.28 Selected soil samples collected during the investigation were analysed for a range of determinands including metals and metalloids (arsenic, cadmium, chromium, hexavalent chromium, lead, mercury, copper, nickel, zinc, selenium, water soluble boron), pH, sulphate, total monohydric phenols, total cyanide, sulphide, elemental sulphur, total TPH C8-C35, speciated PAHs, speciated TPH and asbestos.

14C.2.29 Supporting information concerning details of the investigations including analytical certificates, details of methodologies and soil descriptions are provided within the Phase 2 Contamination Assessment report (Ref. 14.93).

14C.2.30 The results have been divided into samples of Made Ground (one sample only) and natural soils (seventeen samples) and a summary of the results is presented in **Table 14C.13**. These results were used to conduct a Tier 1 risk assessment using human health, phytotoxic and built environment SSVs and **Table 14C.14** provides a summary of the ecological risk assessment. As a conservative approach contaminant concentrations have been compared to human health SSVs for residential without plant uptake land use, in consideration of the proposed use of part of the SCPA as an accommodation campus for workers at the HPC site. A staged approach to ecological risk assessment has been adopted, whereby contaminant concentrations have initially been compared with Stage 1 ecological SSVs (Ref. 14.64) and then, where necessary, with the Stage 2 rural England background soil concentrations (Ref. 14.69 and Ref. 14.70) and subsequently with Stage 3 local background concentrations, i.e. the range of concentrations recorded within soils on the BDAW (Ref. 14.84 and Ref. 14.86).

14C.2.31 The analytical results for natural soils were subject to further statistical tests, using the statistical approach recommended by CL:AIRE/CIEH ‘Guidance on Comparing Soil Contamination Data with a Critical Concentration) (Ref. 14.71). The resultant UCL for each contaminant was compared to the Critical Concentrations (Tier 1 SSVs) and these are also presented in **Table 14C.13**.

Table 14C.13: Summary of Chemical Analysis Results for Locations on the Southern Construction Phase Area and Tier 1 Risk Assessment

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration in Natural Soils	UCL Natural Soils	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)		Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)		Exceedence of Tier 1 Built Environment SSV	
							MG	N	MG	N	MG	N
Total Arsenic	15.6	<5 – 18.9	14.0	35[1]	-	50*	0 (1)	0 (17)	-	-	0	0
Total Cadmium	1.0	<0.5 – 5.2	2.4~	17.7[1]	-	3	0 (1)	0 (17)	-	-	0	**1**
Total Chromium (III)	32	10 – 51	35.6	627[1]	-	600	0 (1)	0 (17)	-	-	0	0
Hexavalent Chromium	<2	<2	1	4.25[1]	-	-	0 (1)	0 (17)	-	-	-	-
Total Lead	44	4 – 58	31.1	450[2]	-	500	0 (1)	0 (17)	-	-	0	0
Mercury (inorganic)	<0.5	<0.5	0.25	238[1]	-	1	0 (1)	0 (17)	-	-	0	0
Total Copper	56	10 – 132	72.0~	6,200[1]	200[8]	-	0 (1)	0 (17)	0 (1)	0 (17)	-	-
Total Nickel	36	12 – 109	66.7~	127[1]	110[8]	-	0 (1)	0 (17)	0 (1)	0 (17)	-	-
Total Zinc	149	15 – 312	174.3~	40,400[1]	450[8]	-	0 (1)	0 (17)	0 (1)	0 (17)	-	-
Total Selenium	0.8	<0.5 – 3.0	1.5~	595[1]	-	3	0 (1)	0 (17)	-	-	0	0
Boron (water soluble)	2.2	<0.5 – 31.6	10.5~	10,300[1]	3[4]	-	0 (1)	0 (17)	0 (1)	**1** (17)	-	-
pH (pH units)	8.2	7.1 – 8.9	NC	5.5 – 8.5[3]	5.5 – 8.5[3]	<5 or >8	0 (1)	**4** (17)	0 (1)	**4** (17)	**1**	**11**
Total Sulphate (%SO4)	0.32	<0.05 – 0.97	0.54~	-	-	0.20/0.249	- (1)	- (17)	-	-	**1 /1**	**6 / 5**
Total Cyanide	1.1	<1	0.5	762[FC,1]	-	25FC	0 (1)	0 (17)	-	-	0	0
Sulphide	<2	<2	1	250[4]	-	250	0 (1)	0 (17)	-	-	0	0
Elemental Sulphur	<10	<10	5	5,000[4]	-	5000	0 (1)	0 (17)	-	-	0	0
Total Phenol	<1	<1	0.5	310[P,1]	-	5	0 (1)	0 (17)	-	-	0	0
Asbestos	ND	-	-	Presence of fibres[10]	-	-	0 (1)	- (0)	-	-	-	-

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration in Natural Soils	UCL Natural Soils	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)		Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)		Exceedence of Tier 1 Built Environment SSV	
Total Petroleum Hydrocarbons (C8-C35)	-	<5 – 24	10.7~	500[5]	-	50	- (0)	0 (15)	-	-	-	0
PAH (EPA 16 total)	<0.1	<0.1 – 0.6	0.34~	100[5]	-	50	0 (1)	0 (17)	-	-	0	0
Naphthalene	<0.1	<0.1	0.1	1.64[1]	-	50	0 (1)	0 (17)	-	-	0	0
Acenaphthylene	<0.1	<0.1	0.1	86.1^[1]	-	50	0 (1)	0 (17)	-	-	0	0
Acenaphthene	<0.1	<0.1	0.1	57.0^[1]	-	50	0 (1)	0 (17)	-	-	0	0
Fluorene	<0.1	<0.1	0.1	30.9^[1]	-	50	0 (1)	0 (17)	-	-	0	0
Phenanthrene	<0.1	<0.1 – 0.1	0.1~	36.0^[1]	-	50	0 (1)	0 (17)	-	-	0	0
Anthracene	<0.1	<0.1	0.1	1.17^[1]	-	50	0 (1)	0 (17)	-	-	0	0
Fluoranthene	<0.1	<0.1 – 0.5	0.3~	972[1]	-	50	0 (1)	0 (17)	-	-	0	0
Pyrene	<0.1	<0.1	0.1	2,330[1]	-	50	0 (1)	0 (17)	-	-	0	0
Benzo(a)anthracene	<0.1	<0.1	0.1	3.71[1]	-	50	0 (1)	0 (17)	-	-	0	0
Chrysene	<0.1	<0.1	0.1	8.84[1]	-	50	0 (1)	0 (17)	-	-	0	0
Benzo(b)fluoranthene	<0.1	<0.1	0.1	6.99[1]	-	50	0 (1)	0 (17)	-	-	0	0
Benzo(k)fluoranthene	<0.1	<0.1	0.1	10.1[1]	-	50	0 (1)	0 (17)	-	-	0	0
Benzo (a) Pyrene	<0.1	<0.1 – 0.1	0.1~	1.00[1]	-	50	0 (1)	0 (17)	-	-	0	0
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	0.1	4.17[1]	-	50	0 (1)	0 (17)	-	-	0	0
Dibenzo(a,h)anthracene	<0.1	<0.1 – 0.1	0.1~	0.865[1]	-	50	0 (1)	0 (17)	-	-	0	0
Benzo(ghi)perylene	<0.1	<0.1	0.1	46.8[1]	-	50	0 (1)	0 (17)	-	-	0	0
TPH Aromatic C5-C7	<0.01	<0.01	NC	0.266[1,6]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aromatic C7-C8	<0.01	<0.01	NC	607[1,7]	-	50	0 (1)	0 (2)	-	-	0	0

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration in Natural Soils	UCL Natural Soils	Tier 1 Human Health SSV	Tier 1 Phytotoxic SSV	Tier 1 Built Environment SSV (WRAS Threshold Value Unless Stated)	Exceedence of Tier 1 Human Health SSV (Number of Samples)		Exceedence of Tier 1 Phytotoxic SSV (Number of Samples)		Exceedence of Tier 1 Built Environment SSV	
TPH Aromatic C8-C10	<0.1	<0.1	NC	33.2[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aromatic C10-C12	<0.1	<0.1	NC	177[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aromatic C12-C16	<0.1	<0.1	NC	169^[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aromatic C16-C21	<0.1	<0.1	NC	1,290[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aromatic C21-C35	0.5	0.3	NC	1,330[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C5-C6	<0.01	<0.01	NC	29.8[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C6-C8	<0.01	<0.01	NC	72.7[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C8-C10	<0.1	<0.1	NC	18.8[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C10-C12	0.1	<0.1	NC	47.5^[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C12-C16	0.2	<0.1	NC	23.7^[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C16-C21	0.2	<0.1	NC	8.48^[1]	-	50	0 (1)	0 (2)	-	-	0	0
TPH Aliphatic C21-C35	<0.1	<0.1 – 0.2	NC	8.48^[1]	-	50	0 (1)	0 (2)	-	-	0	0
Total TPH (Sum C6-C40)	1.0	0.3 – 0.5	NC	500[5]	-	50	0 (1)	0 (2)	-	-	0	0

All units mg/kg unless otherwise stated

< - Value below laboratory limit of detection

* Wessex Water revised threshold for arsenic. Wessex Water Soil Survey Guidance

FC Based on the value for free cyanide as no total cyanide screening value exists

P Based on the Phenol concentration

^ In line with the Environment Agency approach in the published SGVs, the GAC presented has been capped at the soil saturation limit.

~ Statistical outliers have been retained in the dataset as these values are not considered to represent a separate population.

ND None detected

NC Not Calculated

1. Internally Derived EDFE SSV using CLEA model v1.06 using all the same standard input parameters that the Environment Agency or LQM used to derive standard SGVs residential without consumption of homegrown vegetables end use with the exception that SOM has been set to 1 %.
2. Defra / EA (2002) R & D Publication SGV 10. Soil Guideline Values for Lead Contamination
3. BS3882:2007 Specification for Topsoil and requirements for use.
4. Former ICRCL Guidance Note 59 / 83 (N.B. paper withdrawn by Defra in 2004)
5. The Hazardous Waste (England and Wales) Regulations 2005. Inert Waste Threshold
6. Benzene Tier 1 Risk Assessment concentration used for Aromatic TPH C5-C7 fractions
7. Toluene Tier 1 Risk Assessment concentration used for Aromatic TPH C7-C8 fractions
8. Statutory Instrument 1989 No. 1263, 'Sludge (Use in Agriculture) Regulations 1989', pH value >7.0
9. BRE Special Digest SD1 Specification (3rd Edition, 2005)
10. Tier 1 Assessment for asbestos is based on presence or absence of fibres

Table 14C.14: Summary of Ecological Risk Assessment for Locations in the Southern Construction Phase Area

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration Natural Ground	Number of Natural Ground Samples	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV		Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values		Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values	
					MG	N		MG	N		MG	N
Total Arsenic	15.6	<5 – 18.9	17	18[2a] / 43[2c] / 46[2d]	0[2b] / 0[2c] / 0[2d]	**1**[2b] / 0[2c] / 0[2d]	1.37 – 143[b]	-	0	-	-	-
Total Cadmium	1.0	<0.5 – 5.2	17	1.15[1]	0	**6**	0.1 – 1.78 [b]	-	**2**	<0.5 – 3.0[a]	-	**1**
Total Chromium (III)	32	10 – 51	17	21.1[1]	**1**	**15**	3.89 – 236 [b]	0	0	-	-	-
Hexavalent Chromium	<2	<2	17	-	-	-	-	-	-	-	-	-
Total Lead	44	4 – 58	17	167.9[1]	0	0	-	-	-	-	-	-
Total Mercury	<0.5	<0.5	17	0.06[1]^	**1**^	**17** ^	0.07 – 1.22 [b]	0	0	-	-	-
Total Copper	56	10 – 132	17	88.4[1]	0	**1**	4.8 – 75.2 [b]	-	**1**	24-179 [a]	-	0
Total Nickel	36	12 – 109	17	25.1[1]	0	**15**	2.13 – 88.9 [b]	-	**1**	25-90 [a]	-	**1**
Total Zinc	149	15 – 312	17	90.1[1]	**1**	**7**	17.7 – 442 [b]	0	0	-	-	-
Total Selenium	0.8	<0.5 – 3.0	17	0.52[2a]/4.1[2b]/ 1.2[2c]/0.63[2d]	**1**[2a]/0[2b] /0[2c]/**1**[2d]	**14**[2a]/ 0[2b]/ **6**[2c]/ **13**[2d]	0.2 – 1.8 [b1]	0	**2**	<0.5 -3.1[a]	-	0
Boron (water soluble)	2.2	<0.5 – 31.6	17	-	-	-	-	-	-	-	-	-
pH (pH units)	8.2	7.1 – 8.9	17	-	-	-	-	-	-	-	-	-
Total Sulphate (%SO4)	0.32	<0.05 – 0.97	17	-	-	-	-	-	-	-	-	-
Total Cyanide	1.1	<1	17	-	-	-	-	-	-	-	-	-
Sulphide	<2	<2	17	-	-	-	-	-	-	-	-	-

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration Natural Ground	Number of Natural Ground Samples	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV		Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values		Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values	
Elemental Sulphur	<10	<10	17	-	-	-	-	-	-	-	-	-
Total Phenol	<1	<1	17	-	-	-	-	-	-	-	-	-
Asbestos	ND	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (C8-C35)	-	<5 – 24	15	3,080[4]	-	0	-	-	-	-	-	-
PAH (EPA 16 total)	<0.1	<0.1 – 0.6	17	29[2b LM]/ 100[2d LM]/ 18[2b HM] /1.1[2d HM]	0[2b LM]/ 0[2d LM] / 0[2b HM] / 0[2d HM]	0[2b LM]/ 0[2d LM] / 0[2b HM] / 0[2d HM]	-	-	-	-	-	-
Naphthalene	<0.1	<0.1	17	17[3]	0	0	-	-	-	-	-	-
Acenaphthylene	<0.1	<0.1	17	-	-	-	-	-	-	-	-	-
Acenaphthene	<0.1	<0.1	17	-	-	-	-	-	-	-	-	-
Fluorene	<0.1	<0.1	17	-	-	-	-	-	-	-	-	-
Phenanthrene	<0.1	<0.1 – 0.1	17	31[3]	0	0	-	-	-	-	-	-
Anthracene	<0.1	<0.1	17	1.6[3]	0	0	-	-	-	-	-	-
Fluoranthene	<0.1	<0.1 – 0.5	17	260[3]	0	0	-	-	-	-	-	-
Pyrene	<0.1	<0.1	17	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	<0.1	<0.1	17	2.5[3]	0	0	-	-	-	-	-	-
Chrysene	<0.1	<0.1	17	35[3]	0	0	-	-	-	-	-	-
Benzo(b)fluoranthene	<0.1	<0.1	17	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	<0.1	<0.1	17	38[3]	0	0	-	-	-	-	-	-
Benzo (a) Pyrene	<0.1	<0.1 – 0.1	17	0.15[1]	0	0	-	-	-	-	-	-

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration Natural Ground	Number of Natural Ground Samples	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV		Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values		Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values	
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	17	1.9[3]	0	0	-	-	-	-	-	-
Dibenzo(a,h)anthracene	<0.1	<0.1 – 0.1	17	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	<0.1	<0.1	17	33[3]	0	0	-	-	-	-	-	-
TPH Aromatic C5-C7	<0.01	<0.01	2	-	-	-	-	-	-	-	-	-
TPH Aromatic C7-C8	<0.01	<0.01	2	-	-	-	-	-	-	-	-	-
TPH Aromatic C8-C10	<0.1	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aromatic C10-C12	<0.1	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aromatic C12-C16	<0.1	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aromatic C16-C21	<0.1	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aromatic C21-C35	0.5	0.3	2	-	-	-	-	-	-	-	-	-
TPH Aliphatic C5-C6	<0.01	<0.01	2	-	-	-	-	-	-	-	-	-
TPH Aliphatic C6-C8	<0.01	<0.01	2	-	-	-	-	-	-	-	-	-
TPH Aliphatic C8-C10	<0.1	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aliphatic C10-C12	0.1	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aliphatic C12-C16	0.2	<0.1	2	-	-	-	-	-	-	-	-	-

Determinand	Concentration in Made Ground (One Sample)	Range of Concentration Natural Ground	Number of Natural Ground Samples	Ecological Stage 1 SSV	Exceedence of Stage 1 SSV		Range of Stage 2 Rural England Background Values	Exceedence of Stage 2 Rural England Background Values		Range of Stage 3 Local (BDAW) Background Values	Exceedence of Stage 3 Local Background Values	
TPH Aliphatic C16-C21	0.2	<0.1	2	-	-	-	-	-	-	-	-	-
TPH Aliphatic C21-C35	<0.1	<0.1 – 0.2	2	-	-	-	-	-	-	-	-	-
Total TPH (Sum C6-C40)	1.0	0.3 – 0.5	2	3,080[4]	0	0	-	-	-	-	-	-

All units mg/kg unless otherwise stated

< Value below laboratory limit of detection

^ LOD is greater than screening value

1. Proposed SSV. Environment Agency, Guidance on the Use of Soil Screening Values in Ecological Risk Assessment (Science Report SC070009/SR2b)
2. Ecological Soil Screening Levels, US EPA.

2a SSL for Plants

2b SSL for Soil Invertebrates

2c SSL for Wildlife (Avian)

2d SSL for Wildlife (Mammalian)

LM Low Molecular weight

HM High Molecular Weight

3. Dutch RIVM Serious Risk Concentrations for Ecosystems - Ecotoxicological SRCeco Soil Values
4. Commercial TPH Value for Fine Soils. (Sum of C6 – C35 aliphatic and aromatic hydrocarbon guideline values). Canadian Wide Standard for Petroleum Hydrocarbons in Soil Canadian Council of Ministers of Environment (CCME) 2008.

a. Range of concentrations recorded in the natural soils within the Built Development Area West (data derived from the AMEC Phase 1 Desk Study and Preliminary Non-Radiological Site Investigation for the Built Development Area West and AMEC Phase 2 Supplementary Investigation of the Built Development Area West).

b. Range of Concentrations Recorded in rural soils in England . UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency.

b1. Reported range for selenium in normal soils in the UK (Adriano 2001). UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 7, Environmental Concentrations of Heavy Metals in UK Soils. Environment Agency.

c. Range of Concentrations Recorded in rural soils in England . UK Soil and Herbage Pollutant Survey (UKSHS) Report No. 9, Environmental Concentrations of PAHs in UK Soil and Herbage. Environment Agency.

14C.2.32 The concentrations recorded in the soil samples from both Made Ground and natural soils were below the human health Tier 1 assessment criteria for residential without plant uptake land use. Levels of pH were in slight exceedence of the BS3882:2007 Topsoil Specification (Ref. 14.57) limit value (8.5 pH units) in four natural soil samples (up to 8.9 pH units), however, these slightly alkaline pH levels are not considered to pose a risk to human health. No asbestos containing materials were found in any of the exploratory holes on the SCPA.

14C.2.33 Contaminant concentrations in soil samples from both the Made Ground and natural soils were below the phytotoxic SSVs, with the exception of one sample of natural soil (WS713 ES4) which exceeded the water soluble boron phytotoxicity SSV (31.6mg/kg compared to 3mg/kg). This sample was taken from a horizon of peat extending to depths ranging from 1.71m bgl to 3.59m bgl and as such the elevated boron concentration is considered to be of natural origin. This isolated exceedence is not considered to pose a significant phytotoxic risk.

14C.2.34 In general, the concentrations of the determinands which may pose a risk to concrete structures and water supply pipe materials have been recorded below the Tier 1 criteria with the exception of sulphate and pH levels. The one Made Ground sample (WS75 ES1) and six of the seventeen natural soil samples exceed the WRAS (Ref. 14.60) sulphate limit (0.2%) and all but one natural soil sample also exceed the BRE SD1 (Ref. 14.62) sulphate value (0.24%). The elevated sulphate concentrations noted in the natural soils are considered to be of natural origin, as no evidence of anthropogenic contamination of the natural soils was noted, and the SCPA has no history of potentially contaminative use with respect to sulphate. Eleven of the natural soil samples and the Made Ground sample also exceeded the WRAS Tier 1 upper threshold for pH. The presence of naturally elevated pH and sulphate levels may pose a low risk to potable water supply pipes and buried concrete structures.

14C.2.35 One sample of natural soil (WS714 ES4), taken from natural alluvial strata, was found to exceed the WRAS threshold for cadmium. The cadmium concentration (5.2mg/kg) in this sample is noticeably higher than in other natural soil samples on the SCPA. However, this concentration is considered to be naturally occurring, as an elevated cadmium concentration was also identified in natural soil on the BDAW.

14C.2.36 Elevated concentrations of chromium, mercury, zinc and selenium have been recorded in the Made Ground sample when compared to the conservative ecological SSVs, however concentrations are within the English background concentration ranges. Concentrations of arsenic, chromium, cadmium, mercury, copper, nickel, zinc and selenium in natural soils were also found to exceed the ecological SSVs. Comparison with the rural England and local background concentration ranges indicates marginally elevated cadmium and nickel in one sample (TE714 ES4). However, these concentrations are considered to be naturally occurring and given concentrations of contaminants on the SCPA are generally consistent with background concentrations, the risk posed to ecological systems from contaminants within the soils on the SCPA is considered to be negligible.

14C.2.37 Overall the intrusive investigations of soils within the SCPA have identified the risk of significant non-radiological contamination being present to be very low.

APPENDIX 14D: SUMMARY OF RADIOLOGICAL INVESTIGATIONS FOR THE HPC DEVELOPMENT SITE

CONTENTS

TABLES

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APPENDIX 14D: SUMMARY OF RADIOLOGICAL INVESTIGATIONS FOR THE HPC DEVELOPMENT SITE

14D.1 Baseline Non-Intrusive Radiological Surveys

14D.1.1 Baseline non-intrusive radiological surveys have been undertaken across the different areas of land within the HPC Development Site. Measurements were taken using a Mini 6-80/MC7 a low-background Geiger-Muller detector designed for environmental gamma dose rate measurement using the methods outlined in the Environment Agency Guidance TGNM5 – Monitoring (Ref. 14.50). Integration period of 600 seconds was used for each measurement. Measurements were used to determine the excess radiation dose that would be received by a person who was occupying the site from the presence of any gamma emitting radionuclides in the ground. The measurements permitted the evaluation of the external radiation hazard to humans on the HPC Development Site in its current state.

14D.1.2 To complement the gamma dose rate measurements a walkover survey using a Thermo G2 probe and an Electra ratemeter, which is a sodium iodide scintillation detector designed for the detection of gamma radiation. This was set up to detect gamma photons of energy 60keV to approximately 1.5MeV (this is the full range of operating parameters for the equipment). This instrument is capable of detecting low levels of activity in the shallow ground to a maximum depth of ~0.4m below ground level (bgl). Below this depth and dependent on the ground surface type, gamma activity will be detected if sources emitting greater levels of activity or at higher energy are present. Radiological survey locations were randomly selected to afford good coverage of the different areas of land within the HPC site, a number of targeted survey points were also selected to cover areas of interest on the BDAE.

14D.1.3 The field readings were compared to background concentrations taken at a cemetery site near Bridgwater using both the G2/Electra and the Mini 6-80/MC71. Measurements were taken over undisturbed ground within the cemetery where no grave digging had occurred. The readings were taken at spot locations, with counts for both being recorded for either 60 or 600 seconds respectively.

14D.2 Built Development Area West

14D.2.1 A baseline intrusive survey was carried out in 2008 which involved a non-intrusive radiological survey, including a radiological walkover survey and environmental gamma dose rate measurements (see above), together with an intrusive investigation involving the collection, and radiochemical analysis, of 20 near surface soil samples (surface scrapes <0.2m bgl). The samples were analysed for the following determinands: gross alpha (calibrated with americium-241); gross beta (calibrated with potassium-40); high-resolution gamma spectrometry and water-extractable tritium. Analytical reports, details of methodology etc. are included within the Baseline Radiological Survey report (Ref. 14.85).

14D.2.2 The information obtained during the baseline intrusive survey was augmented by a Phase 2 Supplementary Investigation of Potential Radiological Contamination (Ref. 14.87). Soil samples were collected from the trial trenches excavated in 2008. (See **Figure 14.9)**.

14D.2.3 A total of 30 soil samples taken from depths of greater than 0.2m bgl were selected for radiochemical analysis for the following determinands: gross alpha (calibrated with americium-241); gross beta (calibrated with potassium-40); high-resolution gamma spectrometry, total tritium and carbon-14. The samples analysed were selected to assess the contamination status of the deeper soils within the BDAW. Analytical reports, details of methodology etc. are included within the Phase 2 Supplementary Investigation of Potential Radiological Contamination for the Built Development Area West (Ref. 14.87).

14D.2.4 A summary of the results, including data from both the initial survey surface samples and the deeper Phase 2 investigations, is presented in **Table 14D.1**. The Table includes ranges of results, adopted screening and background values and an indication of where results have exceeded any of the adopted screening values, in line with the data assessment approach described above. For details on the approach to data assessment and adopted background and screening values see the Phase 2 report (Ref. 14.87).

Table 14D.1: Summary of Radiochemical Soil Analysis Results for Built Development Area West

Determinand	Measured Activity Concentration Range [a] /Bq g^{-1}	Adopted Background Values [b,c] /Bq g^{-1}	Adopted Screening Value [d, e] / Bq g^{-1}	Exceedance of Adopted Screening Value (Total Number of Samples) [e, f]
C-14	< 0.0020 - 0.0040	0.010 - 0.012 (0.011)	N/A	N/A
Ac-228	0.0168 - 0.1066	N/A	0.19	0 (50)
Ag-110m	< 0.00042 - < 0.0023	N/A	N/A	N/A
Be-7	< 0.0028 - < 0.024	N/A	N/A	N/A
Bi-212	0.023 - 0.087	N/A	N/A	N/A
Bi-214	0.0224 - 0.082	N/A	N/A	N/A
Ce-144	< 0.0019 - < 0.0064	< 0.0020 - < 0.0038 (< 0.0029)	N/A	N/A
Co-57	< 0.00031 - < 0.00085	N/A	N/A	N/A
Co-58	< 0.00019 - < 0.0027	N/A	N/A	N/A
Co-60	< 0.00037 - < 0.0097	< 0.00023 - < 0.00041 (< 0.00032)	N/A	N/A
Cs-134	< 0.00041 - < 0.0020	< 0.00034 - < 0.00064 (< 0.00049)	N/A	N/A
Cs-137	0.00263 - 0.0106	0.0052 - 0.0068 (0.0060)	N/A	N/A
Eu-152	< 0.00091 - < 0.016	N/A	N/A	N/A
Eu-154	< 0.00056 - < 0.0023	< 0.00071 - < 0.0013	N/A	N/A

Determinand	Measured Activity Concentration Range [a] /Bq g^{-1}	Adopted Background Values [b,c] /Bq g^{-1}	Adopted Screening Value [d, e] / Bq g^{-1}	Exceedance of Adopted Screening Value (Total Number of Samples) [e, f]
		(< 0.0010)		
Eu-155	< 0.0023 - < 0.0089	< 0.00094 - < 0.0018 (< 0.0014)	N/A	N/A
I-131	< 0.00026 - < 0.0028	N/A	N/A	N/A
K-40	0.264 - 2.17	0 - 3.2	N/A	N/A
Mn-54	< 0.00035 - < 0.0026	N/A	N/A	N/A
Nb-95	0 - < 0.0018	< 0.0010 - < 0.0072 (< 0.0041)	N/A	N/A
Np-237	< 0.0029 - < 0.015	N/A	N/A	N/A
Pa-233	< 0.00042 - < 0.0057	N/A	N/A	N/A
Pa-234m	< 0.058 - 0.142	N/A	0.12	1 (50)[g]
Pb-210	0.017- 0.073	0.041	0.19	0 (50)
Pb-212	0.0156 - 0.0852	N/A	0.19	0 (50)
Pb-214	0.0200 - 0.0834	N/A	0.19	0 (50)
Ra-226	0.021 - 0.140	0.037	0.093	2 (50)[g]
Ru-106	< 0.0028 - < 0.032	< 0.0025 - < 0.0049 (< 0.0037)	N/A	N/A
Sb-125	< 0.00063 - < 0.0087	< 0.00069 - < 0.0012 (< 0.0009)	N/A	N/A
Th-234	0.026 - 0.12	N/A	0.43	0 (50)
Tl-208	0.0064 - 0.0291	N/A	N/C	N/A
U-235	0.00099 - 0.0054	N/A	3.7	0 (50)
Zn-65	< 0.00095 - < 0.0065	N/A	N/A	N/A
Zr-95	< 0.00033 - < 0.0042	< 0.00090 - < 0.0035 (< 0.0022)	N/A	N/A
Gross alpha (calibrated with Am-241)	0.282 - 0.84	N/A	N/A	N/A
Gross beta (calibrated with K-40)	0.306 - 1.47	N/A	N/A	N/A
Tritium	0.038 - 0.152	N/A	N/A	N/A

[a] Where positive values, i.e. detected values, have been reported, these have been used in preference to "less than" (<) values for presenting the ranges of activity concentration

[b] The sources of the adopted background values are referenced in **Table 14D.2**

[c] The average background value is provided in parentheses

[d] The adopted screening values are derived from the values for the specified elements listed in the Environmental Permitting (England and Wales) Regulations 2010. The screening values are calculated by dividing the elemental limit by the number of isotopes of the radionuclides in the natural radioactive decay series (uranium-238, thorium-232 and uranium-235)

[e] N/A indicates not applicable

[f] Only positive values are used for assessment of numbers of results that exceed screening values. "Less than" values that exceed the screening values are not included

[g] Although the adopted screening value was exceeded, the specified elemental limits described in the Environmental Permitting (England and Wales) Regulations 2010 were not

Table 14D.2: Adopted Radiological Background Values

Determinand	Background Value/Bq g^{-1}
C-14*	0.010 - 0.012 (0.011)
Co-60*	< 0.00023 - < 0.00041 (< 0.00032)
Zr-95*	< 0.00090 - < 0.0035 (< 0.0022)
Nb-95*	< 0.0010 - < 0.0072 (< 0.0041)
Ru-106*	< 0.0025 - < 0.0049 (< 0.0037)
Sb-125*	< 0.00069 - < 0.0012 (< 0.0009)
Cs-134*	< 0.00034 - < 0.00064 (< 0.00049)
Cs-137*	0.0052 - 0.0068 (0.0060)
Ce-144*	< 0.0020 - < 0.0038 (< 0.0029)
Eu-154*	< 0.00071 - < 0.0013 (< 0.0010)
Eu-155*	< 0.00094 - < 0.0018 (< 0.0014)
Am-241*	< 0.00097 - < 0.0026 (< 0.0018)
K-40[#]	0 - 3.2
Pb-210[#]	0.041
Ra-226[+]	0.037

Values in parentheses are mean values

*Data from RIFE reports 13 (Ref. 14.80) and 14 (Ref. 14.81).

Data from DoE/HMIP/RR/93/063 (1993) (Ref. 14.82).

+ Data from UNSCEAR (2000) (Ref. 14.83).

a) Built Development Area East and Southern Construction Phase Area

14D.2.5 A series of assessments relating to the radiological conditions on the BDAE and SCPA were undertaken.

14D.2.6 A non-intrusive radiological survey (Ref. 14.85), including a radiological walkover survey and environmental gamma dose rate measurements (see Section 14D.1 above), was undertaken on the BDAE and SCPA in October 2009 prior to the commencement of intrusive works. The survey locations are presented in **Figure 14.10** and **Figure 14.12.**

14D.2.7 In general, the walkover survey recorded measurements that were low, being at or below expected background values for the area. The environmental gamma dose rates measured were also generally consistent with background levels. The radiological survey did, however, identify an area of elevated radiation readings close to the eastern boundary of the BDAE land adjacent to HPA. These findings were consistent with a previous walkover survey carried out on the BDAE land by Serco Assurance in 2008 (Ref. 14.49). The annual dose in excess of background based on commercial occupancy of the most elevated survey location would be 0.071mSv a^{-1} based on external radiation only. This constitutes 7.1% of the annual dose limit for members of the public (1mSv a^{-1}) (Ref. 14.105), and is 23.8% of the dose constraint adopted by the Environment Agency (0.3mSv a^{-1}) in their contaminated land guidance (Ref. 14.106).

14D.2.8 Following the non-intrusive radiological survey, the Phase 2 intrusive works on the BDAE and SCPA commenced. From the intrusive investigations a total of 128 soil samples from the BDAE and six soil samples from the SCPA, were collected and submitted for radiochemical analysis for the following determinands: gross alpha (calibrated with americium-241); gross beta (calibrated with potassium-40); high-resolution gamma spectrometry; total tritium; and carbon-14. **Figure 14.11** and **Figure 14.12** provide the sampling locations.

14D.2.9 Supplementary information such as analytical reports and details of methodology are included within the Phase 2 Contamination Assessment (Radiological) of the BDAE and SCPA report (Ref. 14.94). A summary of the results for the BDAE are provided in **Table 14D.3** and for the SCPA in **Table 14D.4**. The tables provide a comparison of the results with the screening and adopted background values, where available. In addition, the gross alpha and gross beta results were compared with those obtained for the BDAW for consistency between the two datasets.

Table 14D.3: Summary of Radiochemical Soil Analysis Results for the Built Development Area East

Determinand	Activity Concentration Range [a] /Bq g^{-1}	Adopted Background Values [b,c] /Bq g^{-1}	Adopted Screening Value [d,e] / Bq g^{-1}	Exceedence of Adopted Screening Value [e,f] (Sample Number)
C-14	0.0030 - 0.0170	0.010 - 0.012 (0.011)	N/A	N/A
Ac-228	0.0069 - 0.0546	N/A	0.19	0 (120)
Ag-110m	< 0.00043 - < 0.0018	N/A	N/A	N/A
Am-241	0.0025 - 0.0140	N/A	N/A	N/A
Be-7	< 0.0022 - < 0.026	N/A	N/A	N/A
Bi-212	0.0113 - 0.061	N/A	N/A	N/A
Bi-214	0.0178 - 0.094	N/A	N/A	N/A
Ce-144	< 0.0024 - < 0.0073	< 0.0020 - < 0.0038 (< 0.0029)	N/A	N/A
Co-57	< 0.00026 - < 0.0011	N/A	N/A	N/A
Co-58	< 0.00024 - < 0.0038	N/A	N/A	N/A
Co-60	< 0.00019 - < 0.0065	< 0.00023 - < 0.00041 (< 0.00032)	N/A	N/A
Cs-134	< 0.00023 - < 0.0019	< 0.00034 - < 0.00064 (< 0.00049)	N/A	N/A
Cs-137	0.00088 - 0.0108	0.0052 - 0.0068 (0.0060)	N/A	N/A
Eu-152	< 0.00080 - < 0.020	N/A	N/A	N/A
Eu-154	< 0.00049 - < 0.0023	< 0.00071 - < 0.0013 (< 0.0010)	N/A	N/A
Eu-155	< 0.0016 - < 0.0069	< 0.00094 - < 0.0018 (< 0.0014)	N/A	N/A
I-131	< 0.00037 - < 0.0035	N/A	N/A	N/A
K-40	0.046 - 1.124	0 - 3.2	N/A	N/A
Mn-54	< 0.00028 - < 0.0037	N/A	N/A	N/A
Nb-95	< 0.00033 - < 0.0025	< 0.0010 - < 0.0072 (< 0.0041)	N/A	N/A
Np-237	< 0.0019 - < 0.0092	N/A	N/A	N/A
Pa-233	< 0.00065 - < 0.0060	N/A	N/A	N/A
Pa-234m	0.101 - < 0.41	N/A	0.12	0 (120)
Pb-210	0.013 - 0.063	0.041	0.19	0 (120)
Pb-212	0.0025 - 0.0534	N/A	0.19	0 (120)
Pb-214	0.0113 - 0.0837	N/A	0.19	0 (120)
Ra-226	0.0161 - 0.090	0.037	0.093	0 (120)
Ru-106	< 0.0020 - < 0.037	< 0.0025 - < 0.0049 (< 0.0037)	N/A	N/A

Determinand	Activity Concentration Range [a] /Bq g^{-1}	Adopted Background Values [b,c] /Bq g^{-1}	Adopted Screening Value [d,e] / Bq g^{-1}	Exceedence of Adopted Screening Value [e,f] (Sample Number)
Sb-125	< 0.00088 - < 0.0089	< 0.00069 - < 0.0012 (< 0.0009)	N/A	N/A
Th-234	0.015 - 0.091	N/A	0.43	0 (120)
Tl-208	0.00196 - 0.0170	N/A	N/C	N/A
U-235	0.00078 - 0.00437	N/A	3.7	0 (120)
Zn-65	< 0.0012 - < 0.0050	N/A	N/A	N/A
Zr-95	< 0.00052 - < 0.0047	< 0.00090 - < 0.0035 (< 0.0022)	N/A	N/A
Gross alpha (calibrated with Am-241)	0.141 - 0.91	0.282 - 0.84	N/A	N/A
Gross beta (calibrated with K-40)	0.077 - 1.22	0.306 - 1.47	N/A	N/A
Total tritium	< 0.011 - < 0.055	N/A	N/A	N/A

[a] Where positive values, i.e. detected values, have been reported, these have been used in preference to "less than" (<) values for presenting the ranges of activity concentration

[b] The sources of the adopted background values are referenced in **Table 14D.2**

[c] The average background value is provided in parentheses

[d] The adopted screening values are derived from the values for the specified elements listed in the Environmental Permitting (England and Wales) Regulations 2010. The screening values are calculated by dividing the elemental limit by the number of isotopes of the radionuclides in the natural radioactive decay series (uranium-238, thorium-232 and uranium-235)

[e] N/A indicates not applicable

[f] Only positive values are used for assessment of numbers of results that exceed screening values. "Less than" values that exceed the screening values are not included

Table 14D.4: Summary of Radiochemical Soil Analysis Results for the Southern Construction Phase Area

Determinand	Activity Concentration Range [a] /Bq g^{-1}	Adopted Background Values [b,c] /Bq g^{-1}	Adopted Screening Value [d,e] / Bq g^{-1}	Exceedance of Adopted Screening Value [e,f] (Sample Number)
C-14	< 0.0036 - < 0.012	0.010 - 0.012 (0.011)	N/A	N/A
Ac-228	0.0365 - 0.0508	N/A	0.19	0 (6)
Ag-110m	< 0.00066 - < 0.0014	N/A	N/A	N/A
Am-241	< 0.00087 - < 0.0036	N/A	N/A	N/A
Be-7	< 0.0014 - < 0.0092	N/A	N/A	N/A
Bi-212	0.038 - 0.062	N/A	N/A	N/A
Bi-214	0.0422 - 0.055	N/A	N/A	N/A
Ce-144	< 0.0030 - < 0.0063	< 0.0020 - < 0.0038 (< 0.0029)	N/A	N/A
Co-57	< 0.00045 - < 0.00085	N/A	N/A	N/A
Co-58	< 0.00027 - < 0.0029	N/A	N/A	N/A
Co-60	< 0.00035 - < 0.0030	< 0.00023 - < 0.00041 (< 0.00032)	N/A	N/A
Cs-134	< 0.00058 - < 0.0011	< 0.00034 - < 0.00064 (< 0.00049)	N/A	N/A
Cs-137	0.00313 - 0.00484	0.0052 - 0.0068 (0.0060)	N/A	N/A
Eu-152	< 0.0012 - < 0.0025	N/A	N/A	N/A
Eu-154	< 0.00066 - < 0.0014	< 0.00071 - < 0.0013 (< 0.0010)	N/A	N/A
Eu-155	< 0.0032 - < 0.0049	< 0.00094 - < 0.0018 (< 0.0014)	N/A	N/A
I-131	< 0.00063 - < 0.0020	N/A	N/A	N/A
K-40	0.600 – 1.089	0 - 3.2	N/A	N/A
Mn-54	< 0.00057 - < 0.0018	N/A	N/A	N/A
Nb-95	< 0.00048 - < 0.0013	< 0.0010 - < 0.0072 (< 0.0041)	N/A	N/A
Np-237	< 0.0034 - < 0.0081	N/A	N/A	N/A
Pa-233	< 0.00083 - < 0.0034	N/A	N/A	N/A
Pa-234m	< 0.069 - < 0.13	N/A	0.12	0 (6)
Pb-210	0.029 - 0.061	0.041	0.19	0 (6)
Pb-212	0.0319 - 0.0513	N/A	0.19	0 (6)
Pb-214	0.0390 - 0.0547	N/A	0.19	0 (6)
Ra-226	0.055 - 0.067	0.037	0.093	0 (6)
Ru-106	< 0.0042 - < 0.011	< 0.0025 - < 0.0049	N/A	N/A

Determinand	Activity Concentration Range [a] /Bq g^{-1}	Adopted Background Values [b,c] /Bq g^{-1}	Adopted Screening Value [d,e] / Bq g^{-1}	Exceedance of Adopted Screening Value [e,f] (Sample Number)
		(< 0.0037)		
Sb-125	< 0.0011 - < 0.0052	< 0.00069 - < 0.0012 (< 0.0009)	N/A	N/A
Th-234	0.033 - 0.070	N/A	0.43	0 (6)
Tl-208	0.0113 - 0.0168	N/A	N/C	N/A
U-235	0.0027 - 0.00323	N/A	3.7	0 (6)
Zn-65	< 0.0015 - < 0.0031	N/A	N/A	N/A
Zr-95	< 0.00046 - < 0.0016	< 0.00090 - < 0.0035 (< 0.0022)	N/A	N/A
Gross alpha (calibrated with Am-241)	0.518 - 0.72	0.282 - 0.84	N/A	N/A
Gross beta (calibrated with K-40)	0.758 - 1.25	0.306 - 1.47	N/A	N/A
Total tritium	< 0.019 - < 0.022	N/A	N/A	N/A

[a] Where positive values, i.e. detected values, have been reported, these have been used in preference to “less than” (<) values for presenting the ranges of activity concentration

[b] The sources of the adopted background values are referenced in (**Table 14D.2**)

[c] The average background value is provided in parentheses

[d] The adopted screening values are derived from the values for the specified elements listed in the Environmental Permitting (England and Wales) Regulations 2010. The screening values are calculated by dividing the elemental limit by the number of isotopes of the radionuclides in the natural radioactive decay series (uranium-238, thorium-232 and uranium-235)

[e] N/A indicates not applicable

[f] Only positive values are used for assessment of numbers of results that exceed screening values. “Less than” values that exceed the screening values are not included

14D.2.10 During the Phase 2 intrusive survey works, two locations were identified along the western boundary of the BDAE (TE312 and GB2, see **Figure 14.11**) that provided elevated radiation readings during routine health physics monitoring which was undertaken throughout the on-site works (i.e. the Phase 2 intrusive investigations). As a result of this, a further six samples were collected from the two locations and submitted for radiochemical testing for a range of determinands that would enable the identification and quantification of a wide range of both naturally occurring and anthropogenic radionuclides: gross alpha (calibrated with americium-241); gross beta (calibrated with potassium-40); high-resolution gamma spectrometry; total tritium; carbon-14; plutonium isotopes; strontium-90; nickel-63 and iron-55. A comparison of the results for these samples with those reported for the other samples collected from the BDAE is presented in **Table 14D.5**. All analytical data are included within the Phase 2 Contamination Assessment (Radiological) of the BDAE and SCPA report (Ref. 14.94).

Table 14D.5: Comparison of Results from Sample Locations GB2, TE312, TE312A and TE312B with other Samples Collected from the Built Development Area East

Determinand	Activity Concentration Range for BDAE Soil Samples[a,b] /Bq g^{-1}	TE312 RAD1 0.1m			TE312 RAD1D[c] 0.1m			GB2 RAD 1 1.8m			GB2 RAD 1D[c] 1.8m			TE312A_ES1-0.0-0.2[d]			TE312A_ES2-0.4-0.5[d]			TE312B_ES1-0.0-0.2[d]			TE312B_ES2-0.7-0.9[d]		
C-14	0.0030 - 0.0170	0.0038	±	0.0032	0.0055	±	0.0035	0.0047	±	0.0039	0.0038	±	0.0036		<	0.0029		<	0.0029		<	0.0058	0.0042	±	0.0040
Ac-228	0.0069 - 0.0546	0.033	±	0.018	0.031	±	0.026	0.0197	±	0.0091	0.021	±	0.013	0.0319	±	0.0039	0.065	±	0.028	0.0357	±	0.0049	0.066	±	0.020
Ag-110m	< 0.00043 - < 0.0018		<	0.0013		<	0.0022		<	0.0012		<	0.0015		<	0.00079		<	0.0063		<	0.00069		<	0.0043
Am-241	0.0025 - 0.0140		<	0.0061		<	0.0087		<	0.0061		<	0.0052		<	0.0032		<	0.0056		<	0.0024		<	0.0048
Be-7	< 0.0022 - < 0.026		<	0.011		<	0.016		<	0.0065		<	0.0055		<	0.0064		<	0.011		<	0.011		<	0.048
Bi-212	0.0113 - 0.061	0.036	±	0.019	0.040	±	0.020		<	0.025	0.023	±	0.014	0.036	±	0.012	0.086	±	0.053	0.045	±	0.011		<	0.086
Bi-214	0.0178 - 0.094	1.716	±	0.090	1.84	±	0.11	1.33	±	0.11	1.377	±	0.098	0.083	±	0.011	0.901	±	0.087	0.041	±	0.011	0.092	±	0.043
Ce-144	< 0.0024 - < 0.0073		<	0.011		<	0.015		<	0.012		<	0.0086		<	0.0050		<	0.023		<	0.0058		<	0.011
Co-57	< 0.00026 - < 0.0011		<	0.0021		<	0.0037		<	0.0011		<	0.0013		<	0.00064		<	0.0019		<	0.00059		<	0.0024
Co-58	< 0.00024 - < 0.0038		<	0.0016		<	0.0022		<	0.0014		<	0.00087		<	0.00051		<	0.0052		<	0.0012		<	0.0020
Co-60	< 0.00019 - < 0.0065		<	0.0018		<	0.0013		<	0.00037		<	0.0034		<	0.00064		<	0.0073		<	0.0018		<	0.018
Cs-134	< 0.00023 - < 0.0019		<	0.0024		<	0.0023		<	0.0019		<	0.0013		<	0.0013		<	0.0047		<	0.00085		<	0.0055
Cs-137	0.00088 - 0.0108		<	0.0028		<	0.0025		<	0.0019		<	0.0017	0.00214	±	0.00088		<	0.0070	0.00370	±	0.00085		<	0.0030
Eu-152	< 0.0080 - < 0.020		<	0.0076		<	0.0023		<	0.0042		<	0.0041		<	0.0039		<	0.0074		<	0.00091		<	0.0042
Eu-154	< 0.00049 - < 0.0023		<	0.0042		<	0.0048		<	0.0029		<	0.0032		<	0.0011		<	0.0063		<	0.0012		<	0.0030
Eu-155	< 0.0016 - < 0.0069		<	0.012		<	0.015		<	0.014		<	0.0068		<	0.0047		<	0.017		<	0.0031		<	0.015
I-131	< 0.00037 - < 0.0035		<	0.0026		<	0.0057		<	0.0033		<	0.0011		<	0.00055		<	0.0062		<	0.0013		<	0.0063
K-40	0.046 - 1.124	0.169	±	0.027	0.210	±	0.026	0.158	±	0.021	0.228	±	0.032	0.495	±	0.033	0.50	±	0.12	0.597	±	0.038	0.80	±	0.11
Mn-54	< 0.00028 - < 0.0037		<	0.0014		<	0.0017		<	0.00091		<	0.0012		<	0.0011		<	0.0076		<	0.0018		<	0.0070
Nb-95	< 0.00033 - < 0.0025		<	0.0018		<	0.0040		<	0.0030		<	0.0021		<	0.0013		<	0.0082		<	0.00059		<	0.0034
Np-237	< 0.0019 - < 0.0092		<	0.027		<	0.027		<	0.021		<	0.019		<	0.0042		<	0.023		<	0.0057		<	0.012
Pa-233	< 0.00065 - < 0.0060		<	0.0024		<	0.0078		<	0.0018		<	0.0048		<	0.0014		<	0.0059		<	0.0040		<	0.012
Pa-234m	0.101 - < 0.41	1.27	±	0.20	1.81	±	0.21	1.82	±	0.51	1.36	±	0.45		<	0.16		<	0.70		<	0.14		<	0.48
Pb-210	0.013 - 0.063	0.97	±	0.11	1.04	±	0.11	0.719	±	0.097	0.83	±	0.12	0.055	±	0.019	0.609	±	0.082	0.033	±	0.016		<	0.11
Pb-212	0.0025 - 0.0534	0.0246	±	0.0035	0.0229	±	0.0037	0.0183	±	0.0030	0.0214	±	0.0030	0.0313	±	0.0026	0.0321	±	0.0065	0.0318	±	0.0023	0.0381	±	0.0056
Pb-214	0.0113 - 0.0837	1.86	±	0.13	1.96	±	0.13	1.38	±	0.12	1.46	±	0.12	0.0835	±	0.0053	0.891	±	0.042	0.0419	±	0.0035	0.0423	±	0.0095
Ra-226	0.0161 - 0.090	1.76	±	0.13	1.88	±	0.15	1.31	±	0.13	1.37	±	0.13	0.081	±	0.016	0.724	±	0.062	0.044	±	0.011		<	0.13
Ru-106	< 0.0020 - < 0.037		<	0.018		<	0.022		<	0.039		<	0.0074		<	0.0084		<	0.094		<	0.0075		<	0.018
Sb-125	< 0.00088 - < 0.0089		<	0.0071		<	0.022		<	0.0074		<	0.0088		<	0.0032		<	0.030		<	0.0042		<	0.0065
Th-234	0.015 - 0.091	1.68	±	0.24	1.63	±	0.25	1.20	±	0.20	1.19	±	0.20	0.067	±	0.023	0.72	±	0.12	0.061	±	0.024		<	0.074
Tl-208	0.00196 - 0.0170	0.0083	±	0.0017	0.0069	±	0.0018	0.0070	±	0.0015	0.0058	±	0.0013	0.0102	±	0.0033	0.0092	±	0.0048	0.0110	±	0.0017	0.0119	±	0.0069
U-235	0.00078 - 0.00437	0.0839	±	0.0075	0.0902	±	0.0078	0.0636	±	0.0064	0.0657	±	0.0067	0.00393	±	0.00077	0.0358	±	0.0044	0.00211	±	0.00051		<	0.0072
Zn-65	< 0.0012 - < 0.0050		<	0.0034		<	0.0035		<	0.0048		<	0.0041		<	0.0023		<	0.0076		<	0.0019		<	0.013
Zr-95	< 0.00052 - < 0.0047		<	0.0032		<	0.0053		<	0.0034		<	0.0020		<	0.00099		<	0.015		<	0.0027		<	0.0095

Determinand	Activity Concentration Range for BDAE Soil Samples[a,b] /Bq g^{-1}	TE312 RAD1 0.1m			TE312 RAD1D[c] 0.1m			GB2 RAD 1 1.8m			GB2 RAD 1D[c] 1.8m			TE312A_ES1-0.0-0.2[d]			TE312A_ES2-0.4-0.5[d]			TE312B_ES1-0.0-0.2[d]			TE312B_ES2-0.7-0.9[d]		
Gross alpha (calibrated with Am-241)	0.141 - 0.91	11.0	±	1.1	13.3	±	1.3	3.01	±	0.33	2.33	±	0.26	0.82	±	0.13	3.87	±	0.39	0.547	±	0.097	0.382	±	0.080
Gross beta (calibrated with K-40)	0.077 - 1.22	5.73	±	0.41	6.28	±	0.45	0.961	±	0.080	0.948	±	0.076	0.780	±	0.072	2.94	±	0.24	0.710	±	0.067	0.888	±	0.080
Total tritium	< 0.011 - < 0.055	0.036	±	0.020		<	0.014		<	0.018		<	0.024		<	0.020		<	0.021		<	0.022		<	0.013
Fe-55	N/A		<	0.046		<	0.066		<	0.057		<	0.070		NM			NM			NM			NM	
Ni-63	N/A		<	0.022		<	0.015		<	0.0082		<	0.011		NM			NM			NM			NM	
Pu-241	N/A		<	0.079		<	0.062		<	0.055		<	0.056		NM			NM			NM			NM	
Pu-238	N/A		<	0.00099		<	0.00086		<	0.00079		<	0.00076		NM			NM			NM			NM	
Pu-239+240	N/A		<	0.00054		<	0.00013		<	0.00046		<	0.00028		NM			NM			NM			NM	
Pu-242	N/A		<	0.00090		<	0.00033		<	0.00034		<	0.00035		NM			NM			NM			NM	
Sr-90	N/A		<	0.0089		<	0.014		<	0.015		<	0.021		NM			NM			NM			NM	

[a] Range is based on the results for 120 samples collected and analysed as presented in **Table 14D.3**
[b] N/A indicates not applicable
[c] D indicates a duplicate sample
[d] NM indicates not measured

14D.2.11 The results for the samples collected from GB2, TE312, TE312A and TE312B provide no evidence of contamination by anthropogenic radionuclides. However, the levels of naturally occurring radionuclides from the uranium-238 and uranium-235 decay series from selected locations (GB2, TE312 and TE312A) were elevated when compared with the range of results observed for the rest of the BDAE. The levels of uranium-238 series radionuclides observed at these locations fell within the range of 1 - 2Bq g^{-1}. This compares with an upper level for these radionuclides in samples collected from the rest of the site of approximately 0.09Bq g^{-1}. The gross alpha and gross beta levels were also elevated compared with the rest of the site due to the elevated levels of these naturally occurring radionuclides.

14D.2.12 The levels of uranium-238 and uranium-235 natural series radionuclides in the samples from these locations are such that the levels of lead, polonium, protactinium, radium and thorium exceed their respective EPR 2010 (Ref. 14.19) elemental limits. However, the levels of all of these elements are below the Radioactive Substances (Phosphatic Substances, Rare Earths etc.) Exemption Order (Ref. 14.79) limit of 14.8Bq g-1 and hence should be exempt from radioactive substances regulation.

14D.2.13 In summary, the radiochemical analysis results for the soil samples from the BDAE and SCPA show that there is no evidence of significant contamination with anthropogenic radionuclides and that the levels of radionuclides present are generally consistent with background levels:

- The only anthropogenic radionuclides detected were caesium-137 and americium-241. The levels of caesium-137 detected were consistent with background due to global atmospheric fallout. Americium-241 was detected in two samples at low levels. Overall, levels of anthropogenic radionuclides detected were significantly below The Radioactive Substances (Substances of Low Activity) Exemption Order (Ref. 14.78) limit of 0.4Bq g^{-1}.
- The levels of anthropogenic radionuclides detected were significantly below The Radioactive Substances (Substances of Low Activity) Exemption Order (Ref. 14.78) limit of 0.4Bq g^{-1}.
- Carbon-14, which can be present both naturally and from anthropogenic sources, was detected in a number of the samples at levels consistent with adopted background values. The levels detected were significantly below The Radioactive Substances (Substances of Low Activity) Exemption Order (Ref. 14.78) limit of 0.4Bq g-1.
- Tritium which can be present both naturally and from anthropogenic sources, was detected in one sample at a level close to the limit of detection and significantly below The Radioactive Substances (Substances of Low Activity) Exemption Order (Ref. 14.78) limit of 0.4Bq g^{-1}.
- With the exception of samples collected from locations in Area 6 (TE312, TE312A and GB2), gross alpha and gross beta results were consistent with values reported for the BDAW.
- With the exception of samples collected from three locations in Area 6 (TE312, TE312A and GB2), the levels of naturally occurring radionuclides present would not result in the levels of specified radioelements exceeding EPR2010 (Ref. 14.19) limits.

The only locations where elevated levels of radionuclides were observed along the western boundary of the BDAE (TE312, TE312A and GB2). The samples from these locations contained elevated levels of natural uranium and associated daughter products. Although the levels of some of the EPR2010-specified elements present in these samples exceed their associated limits, they are below the Radioactive Substances (Phosphatic Substances, Rare Earths etc.) Exemption Order (Ref. 14.79) limit of 14.8Bq g-1 and hence would be exempt from radioactive substances regulation. The elevated natural uranium is likely to be associated with granite chippings observed at these locations.

APPENDIX 14E: SUMMARY OF GAS MONITORING RESULTS FOR THE HPC DEVELOPMENT SITE

CONTENTS

TABLES

NOT PROTECTIVELY MARKED

APPENDIX 14E: SUMMARY OF GAS MONITORING RESULTS FOR THE HPC DEVELOPMENT SITE

14E.1 Built Development Area West

14E.1.1 A programme of ground gas monitoring has been undertaken within the Built Development Area West. Six gas monitoring visits were undertaken between January 2009 and April 2009 at ten piezometer locations (installed as part of the on-shore investigation undertaken by Structural Soils Ltd in 2008). The monitoring locations are presented in **Figure 14.13**. Gas monitoring was undertaken in accordance with requirements set out in guidance document Construction Industry Research and Information Association (CIRIA) 665 ‘Assessing risks posed by hazardous ground gases to buildings’ (2007) (Ref. 14.76).

14E.1.2 During one visit, six gas samples were taken from selected locations and submitted for laboratory analysis to determine concentrations of methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide, nitrogen, hydrocarbons (n-alkanes) C1 to C8 and volatile organic compounds. The laboratory analysis was carried out to confirm field data and provide confidence that the field monitoring technique was robust. A summary of the gas monitoring results is presented in **Table 14E.1**.

14E.1.3 Details of the methodology, assessment, full monitoring data and analytical certificates are presented in the Final Ground Gas Risk Assessment report for Built Development Area West (Ref. 14.88).

Table 14E.1: Summary of Data from Six Gas Monitoring Visits for Boreholes within the Built Development Area West

Piezometer ID	Response Zone (m bgl) & Geological Strata	Atmospheric Pressure (mb)	Differential Pressure (Pa)	CH_4 % vol.	CO_2 % vol.	O_2 % vol.	CO (ppm)	H_2S (ppm)	Flow (l/hr)	VOCs (ppm)	Static Water Level (m bgl)	Total Depth (m)
DBH04	12.0-19.0 PG	991 to 1014	-2 to 2	<0.1	<0.1 to 3.0	2.0 to 21.3	<1 to 3	<1	-8 to 0.9	<0.1	18.945 to dry	19.11
DBH09	6.0-16.0 BLF/PG	994 to 1016	0 to 1	<0.1	<0.1 to 0.1	20.7 to 21.4	<1	<1	-0.1 to 5.2	<0.1	1.084 to 4.642	15.83
CBH11	30.0-40.0 BLF	979 to 1015	0	<0.1	<0.1 to 0.1	21.0 to 21.2	<1	<1	0 to 0.1	<0.1	6.44 to 6.882	38.38
CBH16	41.5-48.5 MMGBA	990 to 1016	0	<0.1	<0.1 to 0.1	20.5 to 21.1	<1 to 2	<1	-0.1 to 0.3	<0.1	8.39 to 11.552	48.18
CBH21	3.5-15.0 BLF	979 to 1015	-6 to 4	<0.1	<0.1 to 1.3	4.9 to 21.1	<1	<1	-3.1 to 1.7	<0.1	5.043 to 7.448	14.97
CBH24	3.5-18.5 BLF	980 to 1015	-9 to 13	<0.1	0.1 to 1.6	2.9 to 21.0	<1 to 2	<1	-5.1 to 4.6	<0.1	3.855 to 6.816	18.52
CBH25	4.0-17.0 BLF	979 to 1015	-1 to 1	<0.1	<0.1 to 0.6	18.5 to 20.7	<1	<1	-1.5 to 1.2	<0.1	0.825 to 3.723	16.95
CBH27	6.5-12.5 BLF	979 to 1015	-1 to 1	<0.1	<0.1 to 0.1	20.6 to 21.2	<1 to 1	<1	-1.1 to 0.1	<0.1	1.637 to 4.475	12.48
CBH29	41.0-55.0 MMGBA	995 to 1015	-2 to 3	<0.1	<0.1 to 0.1	20.7 to 21.4	<1 to 1	<1	-0.2 to 1.4	<0.1	15.637 to 16.495	54.15
CBH35	7.5-11.5 MMG	980 to 1015	0 to 12	<0.1	<0.1 to 0.7	18.9 to 21.2	<1	<1	0 to 3.8	<0.1	6.592 to 7.587	11.57
LOD (equipment)	-	-	-	0.1 (GA2000)	0.1 (GA2000)	0.1 (GA2000)	1 (GA2000)	1 (GA2000)	-	0.1 (Mini-Rae)	-	-

LOD = Limit of Detection.

Unless stated all values are the stable concentrations.

MMGBA = Mercia Mudstone Group Blue Anchor, BLF = Blue Lias Formation, PG = Penarth Group, MG = Made Ground, SF = Superficial (A) = Alluvium

Where measurements have been taken to the top of a standpipe or casing, the static water level has been calculated to meters below ground level (level minus standpipe/casing height).

< Less than LOD, variable per compound.

14E.2 Built Development Area East and Southern Construction Phase Area

14E.2.1 A programme of ground gas monitoring was undertaken within the BDAE and SCPA in accordance with the requirements presented in guidance document CIRIA C665 (Ref. 14.76). Eight monitoring visits were undertaken between June 2010 and September 2010. The monitoring programme was extended to eight monitoring visits to ensure that all piezometers had been monitored on at least six occasions, in accordance with the CIRIA C665 guidance. Monitoring was undertaken at 11 piezometers in the BDAE, seven piezometers in the SCPA and two piezometers in the BDAW (the two BDAW boreholes were selected for routine monitoring during the BDAE and SCPA monitoring programme as elevated flow rates and calculated borehole nitrogen concentrations were identified during drilling). The monitoring locations are presented on **Figure 14.14**, **Figure 14.15** and **Figure 14.13** respectively. A summary of the gas monitoring results is presented in **Table 14E.2**.

14E.2.2 During the fourth monitoring visit, eight gas samples were taken from selected piezometers and submitted for laboratory analysis to determine concentrations of methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide, nitrogen and volatile organic compounds. The laboratory analysis was carried out to confirm field data and provide confidence that the field monitoring technique was robust.

14E.2.3 Details of the methodology, assessment, full monitoring data and analytical certificates are presented in the Ground Gas Risk Assessment report for the Built Development Area East and Southern Construction Phase Area (Ref. 14.95).

Table 14E.2: Summary of Data from Eight Gas Monitoring Visits for Boreholes within the Built Development Area East, West and Southern Construction Phase Area

Piezometer ID	Area	Response Zone m bgl & Geological Strata	Atmospheric Pressure (mb)	Differential Pressure (Pa)	CH_4 % vol.	CO_2 % vol.	O_2 % vol.	Balance % vol.	CO ppm	H_2S ppm	Flow Min – Max l/hr	VOC ppm	Static Water Level (m bgl)	Measured Total Depth (m)	Installed Depth (m)
GB1	BDAE	1.4 - 8.0 BLF	1001 to 1018	-2.0 to 6.0	<0.1 to 0.1	<0.1 to 0.2	19.3 to 21.1	78.9 to 80.4	<1	<1	-1.5 to 3.1	<0.1	2.126 to 2.457	7.43 to 7.48	8.0
GB2A	BDAE	0.5 - 2.2 MG	993 to 1014	0.0 to 3.0	<0.1 to 0.1	0.9 to 2.6	17.4 to 20.2	78.3 to 80.8	<1	<1	-2.2 to 0.3	<0.1	1.777 to 2.154	2.34 to 2.42	2.2
GB3B	BDAE	1.0 - 7.0 MG	992 to 1017	2.0 to 27.0	<0.1 to 0.1	1.0 to 2.7	16.7 to 19.1	79.6 to 80.7	<1-2	<1	0.0 to 8.7	<0.1 to 0.3 (PK)	6.731 to 6.921	6.92 to 6.93	7.0
GB4	BDAE	1.0 - 8.0 MG	993 to 1018	3.0 to 13.0	<0.1 to 0.1	0.2 to 1.7	12.2 to 19.9	79.8 to 81.0	<1	<1	0.0 to 6.9	<0.1 to 15.1 (PK)	No water	7.69 to 7.97	8.0
GB6	BDAE	1.0 - 2.1 BLF	992 to 1019	4.0 to 11.0	<0.1 to 0.1	0.1 to 1.6	18.9 to 20.3	79.1 to 80.2	<1	<1	0.0 to 5.7	<0.1 to 18.7 (PK)	1.257 to 1.488	1.88 to 1.91	2.1
GB7	BDAE	1.0 - 4.0 MG	997 to 1019	0.0 to 2.0	<0.1	0.1 to 0.8	17.4 to 19.7	80.0 to 80.5	<1 to 1	<1	-1.7 to 1.5	<0.1 to 5.3 (PK)	3.044 to 3.172	3.73 to 3.74	4.0
GB8	BDAE	0.5 - 1.2 MG	998 to 1019	1.0 to 6.0	<0.1 to 0.1	<0.1 to 0.2	19.5 to 19.9	80.0 to 80.2	<1 to 1	<1-1	-4.7 to 2.4	<0.1 to 0.8 (PK)	0.946 to 1.176	1.19 to 1.20	1.2
DBH2_7	BDAE	25.5 - 34.7 BLF	993 to 1019	0.0 to 2.0	<0.1	<0.1 to 0.1	19.8 to 20.3	79.6 to 80.1	<1 to 1	<1	0.0 to 0.5	<0.1 to 25.4 (PK)	5.673 to 6.661	33.13	34.7
DBH2_20	BDAE	4.5 - 14.5 BLF	1000 to 1018	0.0 to 1.0	<0.1 to 0.1	<0.1 to 3.4	16.4 to 20.9	79.1 to 80.4	<1 to 3	<1	0.0 to 2.1	<0.1	5.852 to 7.221	13.94 to 14.31	14.5
DBH2_22	BDAE	3.5 - 13.0 BLF	1002 to 1017	0.0 to 4.0	<0.1	<0.1 to 0.1	19.3 to 20.8	79.2 to 80.7	<1	<1	0.0 to 1.3	<0.1	2.577 to 3.271	15.20	13.0
DBH2_23	BDAE	2.0 - 14.5 BLF	993 to 1018	-1.0 to 1.0	<0.1	<0.1 to 1.2	18.2 to 20.9	79.0 to 89.9	<1	<1	-1.1 to 0.4	<0.1 to 3.6 (PK)	6.141 to 6.724	14.00	14.5
DBH2_13	SCPA	3.5 - 13.5 BLF	1003 to 1017	0.0 to 1.0	<0.1	<0.1 to 0.1	19.1 to 21.1	78.9 to 80.8	<1	<1	0.0 to 3.4	<0.1 to 44.4 (PK)	0.348 to 0.610	12.76 to 12.80	13.5
DBH2_14	SCPA	3.5 - 13.5 BLF	999 to 1017	0.0 to 8.0	<0.1	<0.1	19.5 to 20.9	79.1 to 80.4	<1	<1	-1.0 to 1.2	<0.1	1.750 to 2.542	12.88 to 13.01	13.5

Piezometer ID	Area	Response Zone m bgl & Geological Strata	Atmospheric Pressure (mb)	Differential Pressure (Pa)	CH_4 % vol.	CO_2 % vol.	O_2 % vol.	Balance % vol.	CO ppm	H_2S ppm	Flow Min – Max l/hr	VOC ppm	Static Water Level (m bgl)	Measured Total Depth (m)	Installed Depth (m)
DBH2_16	SCPA	1.0 - 11.5 BLF	1003 to 1017	0.0 to 1.0	<0.1	<0.1 to 0.1	19.6 to 21.0	79.8 to 80.3	<1	<1	0.0 to 0.5	<0.1	4.279 to 5.851	10.84 to 10.87	11.5
WS73	SCPA	0.5 - 0.7 BLF	999 to 1017	0.0 to 0.1	<0.1	0.3 to 1.2	19.2 to 19.8	79.4 to 80.1	<1	<1	0.0 to 0.5	<0.1 to 14.9	No water	0.67	0.70
WS79	SCPA	0.5 - 3.6 SF (A)	1000 to 1017	0.0 to 1.0	<0.1	0.2 to 0.5	19.4 to 20.6	78.9 to 80.2	<1	<1	0.0 to 4.8	<0.1	0.682 to 1.171	3.57	3.6
WS711	SCPA	0.5 - 1.5 SF/BLF	998 to 1017	0.0 to 3.0	<0.1	0.2 to 0.8	19.1 to 20.2	79.3 to 80.3	<1	<1	0.0 to 3.4	<0.1 to 1.9 (PK)	No water	1.47	1.5
WS714	SCPA	0.5 - 1.8 SF/BLF	999 to 1017	0.0 to 1.0	<0.1	0.3 to 0.6	19.2 to 20.2	79.2 to 80.2	<1-5	<1	0.0 to 1.1	<0.1	1.602 to 1.746 & no water	1.88 to 1.96	1.8
DBH04	BDAW	12.0 - 19.0 PG	999 to 1016	-12.0 to 0.0	<0.1 to 0.2	<0.1 to 0.7	11.5 to 21.0	78.8 to 87.7	<1	<1	-4.7 to 0.1	<0.1	19.041 to 19.087	19.11 to 19.19	19.0
CBH2_33	BDAW	25.5 - 40.0 MMGBA	999 to 1016	-1.0 to 0.1	<0.1	<0.1	19.2 to 21.1	78.9 to 80.6	<1	<1	-5.0 to 0.8	<0.1	19.020 to 20.056	40.00	40.0
Instrument	-	-	GA2000	GF60	GA2000							Mini-Rae	-	-	-
Instrument LOD	-	-	-	0.1	0.1	0.1	0.1	-	1	1	-	0.1	-	-	-

LOD = Limit of Detection, PK = Peak gas concentrations – unless stated all values are the stable concentrations

MMGBA = Mercia Mudstone Group Blue Anchor, BLF = Blue Lias Formation, PG = Penarth Group, MG = Made Ground, SF = Superficial (A) = Alluvium

Where measurements have been taken to the top of a standpipe or casing, the static water level has been calculated to meters below ground level (level minus standpipe/casing height)

< Less than LOD, variable per compound

APPENDIX 14F: DEFRA RESPONSE TO ANIMAL BURIAL PITS

From: [redacted]
Sent: Thursday, January 22, 2009 9:40 AM
To: [redacted]
Subject: EDF - Burial sites

[redacted]

There are no burial pits in the area as stated in the email below:

From: [redacted]
Sent: Monday, January 19, 2009 3:54 PM
To: [redacted]
Cc: [redacted]
Subject: FW: Burial pits

Good Afternoon With reference to your email sent to this office on 15 January 2009 I can confirm from our information that there are no FMD burial sites in the area surrounding Hinkley Point. Regards

[redacted]

GIS
Animal Health
Quantock House
Paul Street
Taunton TA1 3NX
Tel: 01823 337922 ext 8448
Email: [redacted]

APPENDIX 14G CONCEPTUAL MODEL TABLES

Table 14G.1: Conceptual Site Models

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
Actual and potential contaminants associated with the previous and current land uses on the BDAE, BDAW and SCPA and in the surrounding area The list of off-site contaminants is intended to be indicative, not exhaustive Actual **on-site soil** sources and associated contaminants identified are: **BDAE** Undeveloped land/Infilled Ponds (Area 1/TE13) • Boron > phytotoxic SSV • Sulphate in excess of WRAS and BRE threshold • pH (Made Ground) > WRAS Former Accommodation camp/ Contractors compound (Area 2) • Se and pH in excess of WRAS • Sulphate in excess of WRAS and BRE threshold • Hydrocarbons >WRAS • PAHs > ecotoxicological Stage 1	• Indoor soil vapour and ground gas inhalation from ingress of ground gases and vapours via service entry points and cracks/joints (1) • Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Inhalation of soils vapours or soil particles/wind blown particulates, dermal contact/ingestion of soil particles and direct exposure (4) • Leaching/migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4)	**Humans** • Users of and visitors to the BDAE, BDAW and SCPA • Off-site Human Receptors (walkers, residents, adjacent land users)	**Current Land Use. Baseline (Before Enabling/Remedial Works)** **Linkage unlikely. Low risk.** • On the basis of the site investigation, concentrations of non radiochemical and radiochemical contaminants on the study site are not generally significantly elevated (there have been no exceedences of Tier 1 human health risk assessment criteria, with the exception of some elevated pH readings, however these are most likely to be attributable to mortar and plaster in construction and demolition materials and as they are all <pH 11.5 and >pH 5 are unlikely to pose a risk to human health even though they exceed the conservative Tier 1 criteria). An exception to this is the presence of an isolated zone of hydrocarbon contamination in the vicinity of TE418 and CBH2_56 (exceeds conservative Tier 1 SSV for aliphatic C12-C16 TPH) within Area 4 on the BDAE which poses a potentially significant risk to human receptors, although the ground conditions encountered during site investigations showed this contamination to be present beneath a confining layer of hard standing at 0.6m bgl, therefore the potential for exposure to human receptors at surface is limited. Also slightly elevated concentration of benzo(a)pyrene was noted in TE63 in Area 6 but the overall UCL for Area 6 was below the SSV. A sample from CBH2_57 also exceeded the conservative Tier 1 SSV for aliphatic C12-C16 TPH, however this is a very conservative SSV based on solubility saturation and the actual human health based risk value is much higher. The concentration of aliphatic C12-C16 TPH in CBH2_57 is therefore not considered to be a risk. The presence of asbestos containing materials (ACMs) within Made Ground in Area 2, Area 3, Area 4, Area 5 and Area 6 has been confirmed, however these materials have not been witnessed exposed at surface, and due to the presence of surface vegetation and hard standing across the affected areas the potential for airborne fibre release is currently considered negligible. Also, to date no concentrations of free fibre >0.01% w/w within the soil matrix have been detected even in locations where fragments of ACM have been detected with the exception of one location (TE55/WS55A) in Area 6.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
SSVs, Stage 2 and 3 background values • Se > ecological Stage 1 SSVs and Stage 2 and 3 background values • Asbestos Former Spoil Disposal Areas (Area 3) • Asbestos • Boron > phytotoxic SSV • Se > ecotoxicological Tier 1 SSVs Stage 2 and 3 background values. • pH in excess of WRAS • Se in excess of WRAS • Hydrocarbons >WRAS • PAH >WRAS, ecological Stage 1 SSVs and Stage 2 and 3 background values. • Sulphate in excess of WRAS and BRE threshold Former Fabrication Areas (Area 4 and Area 5) • Asbestos • Cu, Se, Zn exceeding ecological Tier 1 SSVs and Stage 2 and 3 background values.	• Migration of contaminants via agricultural drainage Ditches/Bristol Channel (6) • Air/wind transport (on and off-site) (8) • Indoor soil vapour and ground gas inhalation from ingress of ground gases and vapours via service entry points and cracks/joints (1) • Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Inhalation of soils vapours or soil particles/wind blown particulates, dermal contact/ingestion of soil particles and direct exposure (4) • Leaching/migration via permeable ground (5) • Transfer of contaminants via	• Construction workers • Users and visitors to the site • Off-site Human Receptors (walkers, residents, adjacent land users etc).	• • No exceedances of human health Tier 1 criteria have been noted on BDAW and SCPA. **Construction Phase (Post Enabling/Remedial Works)** **Linkage to soil contaminants possible. Low risk**. • On the basis of the intrusive investigations to date, no concentrations of non radiochemical and/or radiochemical contaminants in excess of Tier 1 human health criteria have been identified to date with the exception of some limited areas of the site, where the presence of asbestos containing materials within Made Ground soils in Area 2, Area 3, Area 4, Area 5 and Area 6 poses a potential risk during ground works to construction/ground workers and to members of the public/power station workers downwind of the working area and a localised zone of significantly elevated hydrocarbon contamination within Area 4. However, all known hotspots of ACM and the hotspot of significant hydrocarbon contamination around TE418 will have been removed during the enabling/remedial works. • Any additional contamination identified during the earthworks/construction will need to be assessed to determine the potential risks posed, and subsequently removed and/or remediated as required. • Soil material proposed for re-use will be further analysed and assessed during earthworks to determine if ‘suitable for use’ from an environmental point of view as part of the Materials Management Plan and Soil Management Plan. • Risk of mobilising contamination/pollution incidents is always

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
• Zn, Cu > phytotoxic SSV • pH in excess of WRAS • Sulphate in excess of WRAS and BRE threshold • Hydrocarbons > ecological Stage 1 SSVs (TE418 area), Human health SSVs (TE418 area), WRAS • PAHs > ecotoxicological Stage 1 SSVs, background values and WRAS Former NDA Spoil Disposal Area (Area 5) • Asbestos • Cu, Zn, > ecological Stage 1 SSVs and Stage 2 and 3 background values • Zn, Cu > phytotoxic SSV • pH in excess of WRAS • Hydrocarbons >WRAS	surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via agricultural drainage ditches/Bristol Channel (6) • Air/wind transport (on and off site) (8)		increased during major earthworks/construction, however good environmental construction practice/Environmental/Pollution Prevention Management Plans will detail procedures to minimise these risks. • Construction/ground workers are more likely to come into contact with existing contamination due to their proximity and close work with soils/groundwater. Risks can be minimised through use of PPE and good hygiene standards. • Ground gas risk identified on the site is negligible (CIRIA C665 Characteristic Situation 1), which does not require the provision of gas protective measures into the design of the development. The deposits within the double-humped mound feature were noted to generate slightly elevated concentrations of hazardous ground gases and as such poses a potential risk. However the double-humped mound feature will be removed as part of the enabling works and any putrescible materials removed; any associated ground gas risk will thereby be mitigated. Isolated occurrences of elevated VOCs have been identified within shallow monitoring installations and occasional elevated concentrations of nitrogen, methane, hydrogen sulphide, carbon monoxide and carbon dioxide (in addition to depleted oxygen) were identified during health and safety monitoring during deep drilling of natural strata. Contractors should have due consideration for, and assess the health and safety risks of, potential ground gas concentrations and potential mitigation measures (e.g. gas and vapour monitoring), in particular, during any confined space working or during works which are carried out in deep excavations.
Former Sewage Works (Area 6) • Slightly elevated levels naturally occurring radioactivity associated with granite ballast • pH in excess of WRAS • Sulphate in excess of WRAS	• Indoor soil vapour and ground gas inhalation from ingress of ground gases and vapours via service entry points and cracks/joints (1) • Migration via man made pathways such as	• End users • Construction workers during any future construction work on during the operational phase • Users and visitors to the	**Operational Phase (Commercial Land Use in BDAW/BDAE only. SCPA will be agricultural/habitat restoration areas)** **Linkage unlikely to exist post development. Very low risk.** • Majority of BDAW and BDAE will be covered by buildings and hardstanding, so only limited potential pathways available to any residual or new contamination that may occur. • Soils which will have been reused on-site will be 'suitable for use'

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
and BRE threshold • Boron in excess of phytotoxicity SSV. • Benzo(a)pyrene and total PAH (TE63 ES2) > human health SSVs • Benzo(a)pyrene, anthracene, benzo(a)anthracene, indeno(123-cd)pyrene, total PAHs > ecological SSVs and Stage 2 and 3 background values (TE63 ES2)Asbestos • Hydrocarbons > WRAS for TE63 **BDAW** • Heavy Metals – As, Cd, Cr, Ni, Se, Zn etc (in natural ground > Stage 1 ecological SSVs but generally below Stage 2 SSVs (i.e. rural England background) • Water soluble boron (Made Ground in TRE01 only) > phytotoxicity criteria • Zn > Tier 1 Phytotoxicity criteria (TRE01 and TRE21 Made Ground) • As > WRAS but < WWSSG • Occasional elevated Cd in natural ground > WRAS.	drains and underground services (includes permeation into and distribution via water service pipes) (2) • Inhalation of soils vapours or soil particles/wind blown particulates, dermal contact/ingestion of soil particles and direct exposure (4) • Leaching/migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via agricultural drainage ditches/Bristol Channel (6) • Air/wind transport (on and off-site) (8)	site Off-site Human Receptors (walkers, residents adjacent land users)	from an environmental point of view. • Any contaminated soils (within acceptability standards) that will have been reused on site will have been carefully managed by the suitable placement of these materials beneath buildings and areas of hardstanding, and if placed in areas of soft landscaping, agricultural restoration or habitat creation these should not be placed within the upper 1 m of the soil profile. • Post-development, there will be many more potential contaminant sources. The risk of future contamination occurring (e.g. through spills and leaks etc) will be minimised through good Environmental Management Practises and Procedures, monitoring and physical infrastructure (e.g. bunded tanks/containment areas, sealed drainage etc).

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
• Elevated SO4 > WRAS and BRE screening criteria (WS85 and WS86) **SCPA** • Heavy Metals - Cd, Ni (in natural ground sample WS714 ES4) > ecological SSVs and Stage 2 and 3 background values • Water soluble boron (alluvial peat in WS713 only) > phytotoxicity criteria • Slightly elevated pH > WRAS criteria • Elevated SO4 > WRAS and BRE screening criteria • Elevated VOCs (DBH2_13 only) by field PID testing (not validated by laboratory testing) • Other potential sources on BDAW and SCPA.	• Indoor soil vapour and ground gas inhalation from ingress of ground gas and vapours via service entry points and crack/joints (1) • Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Leaching/Migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7)	<u>Built Environment</u> • Hinkley Point Nuclear New Build Site Induction Centre • Car Parks • Old Barns	<u>**Current Land Use. Baseline (Before Enabling/Remedial Works)**</u> **Linkage Unlikely. Low Risk.** • Slightly elevated soil concentrations of pH, sulphate, and petroleum hydrocarbons in excess of WRAS and BRE guidance noted in several locations in Made Ground and some natural soils on BDAE, BDAW and SCPA. A localised zone of significant soil hydrocarbon contamination has been identified in the vicinity of TE418 in Area 4. Soil contamination levels currently across the site generally do not pose a significant risk to existing built environment. • Extent of current built environment on the site is limited.
<u>Arable Crop Management</u> • Nitrates • Pesticides • Herbicides • Heavy metals • Metals and Metalloids	• Indoor soil vapour and ground gas inhalation from ingress of ground gas and vapours via service entry points and crack/joints (1) • Migration via man made pathways such as drains and underground services (includes	<u>Built Environment</u> • New buildings (BDAE, BDAW) • Contractors Accommodation Buildings (SCPA area) • Contractors offices. • New services (pipelines e.g. sewers, water,	<u>**Construction Phase (Post Enabling/Remedial Works)**</u> **Linkage Unlikely. Very low to low risk.** • Hotspot of significant hydrocarbon in vicinity of TE418 in Area 4 will have been removed. • Any additional contamination identified during the earthworks/construction will need to be assessed to determine the potential risks posed, and subsequently removed and/or remediated as required. • Soil material proposed for re-use will be further analysed and

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
<u>Agricultural vehicle maintenance and use</u> • Hydrocarbons • PAHs <u>Sewage Sludge Application</u> • Heavy Metals • Metals and Metalloids <u>Derelict Farm Buildings</u> • Hydrocarbons • PAHs • Pesticides • Herbicides • Asbestos <u>Infilled Ponds</u> • Heavy Metals • Hydrocarbons • PAHs • Ground Gases • Asbestos **Potential Off-Site Sources**	permeation into and distribution via water service pipes) (2) • Leaching/Migration via permeable ground (5) • Transfer of contaminants via surface run off (6) • Transfer of contaminants via groundwater (7) • Indoor soil vapour and ground gas inhalation from ingress of ground gas and vapours via service entry points and crack/joints (1) • Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Leaching/Migration via permeable ground (5) • Transfer of contaminants via	electric etc) <u>Built Environment</u> • New buildings located on BDAE/BDAW • New services (e.g. sewers, water, electric etc.)	assessed during earthworks to determine if 'suitable for use' from an environmental point of view as part of the Materials Management Plan and Soil Management Plan. • Risk of mobilising contamination/pollution incidents is always increased during major earthworks/construction, however good environmental construction practice/Environmental/Pollution Prevention Management Plans will detail procedures to minimise these risks. • New built environment will be suitably designed and constructed with appropriate specification of materials (e.g. sulphate resistant concrete, Pe/Al/Pe water pipes etc.) to design out any potential risks from residual contamination. • Ground gas risk identified on the site is negligible (CIRIA C665 Characteristic Situation 1), which does not require the provision of gas protective measures into the design of the development **<u>Operational Phase (Commercial Land Use in BDAW/BDAE only. SCPA will be agricultural/habitat restoration areas</u>**) **Linkage unlikely to exist post development. Very low risk.** • The built environment on the BDAE and BDAW post-development will be extensive. However, new built environment will be suitably designed and constructed with appropriate specification of materials (e.g. sulphate resistant concrete, Pe/Al/Pe water pipes etc.) to design out any potential risks from residual or new contamination. • Soils which will have been reused on-site will have been determined as 'suitable for use' from an environmental and geotechnical point of view. • Post development, there will be many more potential contaminant sources. However, the risk of future contamination occurring (e.g. through spills and leaks etc) will be minimised through good Environmental Management Practises and Procedures, monitoring and physical infrastructure (e.g. bunded tanks/containment areas, sealed drainage etc).

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
Hinkley Point Power Station Complex • Hydrocarbons • PAHs • Solvents • PCB • Asbestos • Radioactive materials Lime Kilns • Hydrocarbons • PAHs • Heavy Metals Alluvial deposits (salt marshland at Wick Moor and North Moor) • Ground gases Actual and potential contaminants associated with the previous and current land uses on the BDAE, BDAW and SCPA and in the surrounding area. The list of off-site contaminants is intended to be indicative, not exhaustive.	surface run-off (6) • Transfer of contaminants via groundwater (7) • Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Leaching/migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Migration of contaminants via agricultural drainage ditches/Bristol Channel (6) • Air/wind transport (on-site and off site) (8)	Controlled Waters • Groundwaters on-site and off-site (e.g. Secondary A Aquifer) • Agricultural drainage ditches/streams on-site and off-site • Bristol Channel off-site (N.B. The site and the surrounding area are within a Nitrate Vulnerable Zone).	**Current Land Use/Baseline (Before Enabling/Remedial Works)** **Potential soil linkage identified. Low to moderate risk.** • The results of leachability testing of soils from the site in general are not indicative of the presence of significant contamination within soils with the potential to impact Controlled Waters via leaching. However, a zone of significant hydrocarbon contamination has been identified in the vicinity of TE418 within Area 4 of the BDAE, which was found to contain significant concentrations of TPH (including observations of free phase oil) which may pose a significant leachable risk to Controlled Waters. • Controlled waters on-site are generally low sensitivity. Groundwater is Secondary A Aquifer, no abstractions within 1km of BDAE and BDAW and not within a SPZ. Off-site controlled waters are of (streams and Bristol Channel) low to moderate sensitivity.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
Actual **on-site soil** sources and associated contaminants identified are: **BDAE** Undeveloped land/Infilled Ponds (Area 1/TE13) • Boron > phytotoxic SSV • Sulphate in excess of WRAS and BRE threshold • pH (Made Ground) > WRAS Former Accommodation camp/ Contractors compound (Area 2) • Se and pH in excess of WRAS • Sulphate in excess of WRAS and BRE threshold • Hydrocarbons >WRAS • PAHs > ecological Stage 1 SSVs, Stage 2 and 3 background values • Se > ecological Stage 1 SSVs and Stage 2 and 3 background values • Asbestos	• Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Leaching/migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Migration of contaminants via agricultural drainage ditches/Bristol Channel (6) • Air/wind transport (on and off-site) (8)	Controlled Waters • Groundwaters on and off-site (e.g. Secondary A Aquifer) • Agricultural drainage ditches/streams on and off-site • Bristol Channel off-site (N.B. The site and the surrounding area are within a Nitrate Vulnerable Zone).	**Construction Phase (Post Enabling/Remedial Works)** **Linkage unlikely. Low risk.** • Zone of significant hydrocarbon contamination in vicinity of TE418 in Area 4 of the BDAE will have been removed. • Controlled waters on-site are of low sensitivity. Groundwater is Secondary A Aquifer, no abstractions within 1km of BDAE/BDAW and not within a SPZ. Off-site controlled waters (streams and Bristol Channel) are of low to moderate sensitivity. • Any additional contamination identified during the earthworks /construction will be assessed to determine the potential risks posed, and subsequently removed and/or remediated as required. • Soil material proposed for re-use will be further analysed and assessed during earthworks to determine if 'suitable for use' from an environmental point of view as part of the Materials Management Plan and Soil Management Plan. • Any contaminated soils (within acceptability standards) that will have been reused on-site will have been carefully managed by the suitable placement of these materials beneath buildings and areas of hardstanding, and if placed in areas of soft landscaping, agricultural restoration or habitat creation these should not be placed within the upper 1.0m of the soil profile. • Risk of mobilising contamination/pollution incidents is always increased during major earthworks/construction, however good environmental construction practice/Environmental/Pollution Prevention Management Plans will detail procedures to minimise these risks.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
<u>Former Spoil Disposal Areas (Area 3)</u> • Asbestos • Boron > phytotoxic SSV • Se > ecological Stage 1 SSVs and Stage 2 and 3 background values • pH in excess of WRAS • Se in excess of WRAS • Hydrocarbons >WRAS • PAH >WRAS, ecological Stage 1 SSVs and Stage 2 and 3 background values • Sulphate in excess of WRAS and BRE threshold <u>Former Fabrication Areas (Area 4 and Area 5)</u> • Asbestos • Cu, Se, Zn exceeding ecological Stage 1 SSVs and Stage 2 and 3 background values • Zn, Cu > phytotoxic SSV • pH in excess of WRAS • Sulphate in excess of WRAS and BRE threshold • Hydrocarbons > ecological Stage 1 SSVs (TE418 area), Human health SSVs (TE418	• Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Leaching/migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Migration of contaminants via Agricultural Drainage Ditches/Bristol Channel (6) • Air/wind transport (on-site and off-site) (8)	<u>Controlled Waters</u> • Groundwaters on-site and off-site (e.g. Secondary A Aquifer) • Agricultural drainage ditches/streams on-site and off-site • Bristol Channel off-site (N.B. The site and the surrounding area are within a Nitrate Vulnerable Zone).	**<u>Operational Phase (Commercial Land Use in BDAW/BDAE only. SCPA will be agricultural/habitat restoration areas)</u>** **Linkage unlikely to exist post-development. Very low risk.** • Controlled waters on-site are low sensitivity. Groundwater is Secondary A Aquifer, no abstractions within 1km of BDAE/BDAW and not within a SPZ. Off-site controlled waters (streams and Bristol Channel) low to moderate sensitivity. • Post-development, majority of the main development area will be covered by buildings and hardstanding which will limit infiltration on leaching into these areas, however, post-development there will be many more potential contaminant sources. • Soils which will have been reused on-site will have been deemed as 'suitable for use' from an environmental and geotechnical point of view. • The risk of future contamination occurring (e.g. through spills and leaks etc.) will be minimised through good Environmental Management Practises and Procedures, monitoring and physical infrastructure (e.g. bunded tanks/containment areas, sealed drainage etc.).

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
area), WRAS • PAHs > ecological Stage 1 SSVs, Stage 2 and 3 background values and WRAS <u>Former NDA Spoil Disposal Area (Area 5)</u> • Asbestos • Cu, Zn, > ecological Stage 1 SSVs and Stage 2 and 3 background values • Zn, Cu > phytotoxic SSV • pH in excess of WRAS • Hydrocarbons >WRAS <u>Former Sewage Works (Area 6)</u> • Slightly elevated levels naturally occurring radioactivity associated with granite ballast • pH in excess of WRAS • Sulphate in excess of WRAS and BRE threshold • Boron in excess of phytotoxicity SSV • Benzo(a)pyrene and total PAH (TE63 ES2) > human health SSVs • Benzo(a)pyrene, anthracene, benzo(a)anthracene, indeno(123-cd)pyrene, total	• Phytotoxic risk to vegetation via plant uptake (3) • Inhalation of soils vapours or soil particles/wind blown particulates, dermal contact/ingestion of soil particles and direct exposure (4) • Leaching/Migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via Agricultural Drainage Ditches/Bristol Channel (6) • Air/wind transport (on-site and off-site) (8) • Predation and bioaccumulation (9)	<u>Non-Designated Ecological Systems</u> • Flora and fauna on-site • Flora and fauna off-site	**<u>Current Land Use. Baseline (Before Enabling/Remedial Works)</u>** **Potential soil linkage identified/Generally negligible risk with low to moderate risk in hotspots.** • In general the concentrations of potentially ecotoxic and phytotoxic contaminants in the soils on the BDAE, BDAW and SCPA are very low and consistent with rural England background concentrations and are not therefore considered to pose a significant ecological risk. A slightly higher, but still low risk is posed to ecological systems in some areas of the site due to the presence of slightly elevated concentrations of some potentially ecotoxic and phytotoxic heavy metals, PAHs, TPH and elevated pH mainly in some areas of the Made Ground on the BDAE but also to a lesser extent with isolated pockets of Made Ground on the BDAW and SCPA, and also in some natural soils. The localised zone of significantly hydrocarbon impacted Made Ground within Area 4 (TE418 vicinity) poses a moderate ecological risk, although this area is currently covered over and therefore less accessible to plants and animals. • Detailed ecological surveys on the have not reported any evidence of ecological impact that may be attributable to existing soil contamination.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
PAHs > ecological SSVs and Stage 2 and 3 background values (TE63 ES2) • Asbestos • Hydrocarbons > WRAS for TE63 **BDAW** • Heavy Metals – As, Cd, Cr, Ni, Se, Zn etc (in natural ground > Stage 1 ecological SSVs but generally below Stage 2 SSVs (i.e. rural England background) • Water soluble boron (Made Ground in TRE01 only) > phytotoxicity criteria • Zn > Tier 1 Phytotoxicity criteria (TRE01 and TRE21 Made Ground) • As > WRAS but < WWSSG • Occasional elevated Cd in natural ground > WRAS. • Elevated SO4 > WRAS and BRE screening criteria (WS85 and WS86) **SCPA** • Heavy Metals - Cd, Ni (in natural ground sample WS714 ES4) > ecological SSVs and Stage 2 and 3 background values • Water soluble boron (alluvial	• Phytotoxic risk to vegetation via plant uptake (3) • Inhalation of soils vapours or soil particles/wind blown particulates, dermal contact/ingestion of soil particles and direct exposure (4) • Leaching/ migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via agricultural drainage ditches/Bristol Channel (6) • Air / wind transport (on-site and off-site) (8) • Predation and bioaccumulation (9)	<u>Non Designated Ecological Systems</u> • Flora and fauna on-site (limited remaining flora and fauna during construction phase) • Flora and fauna offsite	<u>**Construction Phase (Post Enabling /Remedial Works)**</u> **Linkage unlikely. Very low to low risk.** • Zone of significant hydrocarbon contamination in vicinity of TE418 in Area 4 of the BDAE will have been removed. • Also, by the time any earthworks/construction works takes place, any sensitive plants and animals will have been removed/translocated (where necessary) as part of environmental mitigation works. • Any additional contamination identified during the earthworks /construction will be assessed to determine the potential risks posed, and subsequently removed and/or remediated as required. • Soil material proposed for re-use will be further analysed and assessed during earthworks to determine if 'suitable for use' from an environmental point of view as part of the Materials Management Plan and Soil Management Plan. Soils with significant exceedence of Stage 1 ecological or phytological SSVs and background concentrations can be mitigated by careful management in the selection and placement in less sensitive areas and not within the top 1m in areas of soft landscaping or agricultural restoration or ecological mitigation areas. • Any contaminated soils (within acceptability standards) that will have been reused on-site will have been carefully managed by the suitable placement of these materials beneath buildings and areas of hardstanding, and if placed in areas of soft landscaping, agricultural restoration or habitat creation these should not be placed within the upper 1.0m of the soil profile • Risk of mobilising contamination/pollution incidents is always increased during major earthworks/construction, however good environmental construction practice/Environmental/Pollution Prevention Management Plans will detail procedures to minimise these risks.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
peat in WS713 only) > phytotoxicity criteria • Slightly elevated pH > WRAS criteria • Elevated SO4 > WRAS and BRE screening criteria • Elevated VOCs (DBH2_13 only) by field PID testing (not validated by laboratory testing) Other potential sources on BDAW and SCPA. <u>Arable Crop Management</u> • Nitrates • Pesticides • Herbicides • Heavy metals • Metals and Metalloids <u>Agricultural vehicle maintenance and use</u> • Hydrocarbons • PAHs <u>Sewage Sludge Application</u> • Heavy Metals • Metals and Metalloids	• Phytotoxic risk to vegetation via plant uptake (3) • Inhalation of soils vapours or soil particles/wind blown particulates, dermal contact/ingestion of soil particles and direct exposure (4) • Leaching/migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via agricultural drainage ditches/Bristol Channel (6) • Air/wind transport (on-site and off-site) (8) • Predation and bioaccumulation (9)	<u>Non Designated Ecological Systems</u> • Flora and fauna on-site (limited during operational phase on BDAW and BDAE) • Flora and fauna on-site (particularly in agricultural and ecological restoration areas on SCPA) • Flora and fauna off-site	**<u>Operational Phase (Commercial Land Use in BDAW / BDAE only. SCPA will be agricultural / habitat restoration areas)</u>** **Linkage unlikely to exist post development. Very low risk** • There will be very limited non designated ecological receptors post-development on the BDAW and BDAE area as the majority of the site will comprise buildings and hardstanding. However the SCPA will have significant non designated ecological receptors as significant parts of this area will be restored to agricultural land use and ecological habitat. • Post-development, the majority of the main development area will be covered by buildings and hardstanding, thus preventing exposure pathways of direct contact and ingestion. Also post-development, the majority of developed area will be hardstanding and buildings thus potential for presence of plants and animals in these areas will be low. • Soils which will have been reused on-site will have been 'suitable for use' from an environmental and geotechnical point of view. Soils with significant exceedence of Stage 1 ecological or phytological SSVs and background concentrations will have been controlled by careful management in the selection and placement in ecologically less sensitive areas (e.g. beneath buildings and hardstanding) and not within the top 1m in areas of soft landscaping or agricultural restoration or ecological mitigation areas. • Post-development, there will be many more potential contaminant sources. However, the risk of future contamination occurring (e.g. through spills and leaks etc.) will be minimised through good Environmental Management Practises and Procedures, monitoring and physical infrastructure (e.g. bunded tanks/containment areas, sealed drainage etc.).

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
Derelict Farm Buildings • Hydrocarbons • PAHs • Pesticides • Herbicides • Asbestos Infilled Ponds • Heavy Metals • Hydrocarbons • PAHs • Ground Gases • Asbestos **Potential Off-site Sources** Hinkley Point Power Station Complex • Hydrocarbons • PAHs • Solvents • PCB • Asbestos • Radioactive materials	• Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Phytotoxic risk to vegetation via plant uptake (3) • Leaching / Migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (8) • Migration of contaminants via Agricultural Drainage Ditches/Bristol Channel (6) • Air/wind transport (on and off-site) (8) • Predation and bioaccumulation (9)	Ecological Designations and Sensitive Land Uses • On-site County Wildlife Site • Off-site SSSI sites • Off-site NNR sites • Off-site SPA sites • On-site/off-site Nitrate Vulnerable Zone • Off-site RAMSAR site • Off-site SAC	**Current Land Use. Baseline (Before Enabling/Remedial Works)** **Potential soil linkage identified. Generally negligible risk with low to moderate risk in hotspots.** • There are no statutory designated ecological sites on the BDAE/BDAW or SCPA, however there are a number of ecological designations and sensitive land uses in off site adjacent areas, and the BDAE is listed as a (non-statutory) County Wildlife Site. • In general the concentrations of potentially ecotoxic and phytotoxic contaminants in the soils on the BDAE, BDAW and SCPA are very low and consistent with rural England background concentrations and are not therefore considered to pose a significant ecological risk. A slightly higher, but still low risk is posed to ecological systems in some areas of the site due to the presence of slightly elevated concentrations of some potentially ecotoxic and phytotoxic heavy metals, PAHs, TPH and elevated pH mainly in some areas of the Made Ground on the BDAE but also to a lesser extent with isolated pockets of Made Ground on the BDAW and SCPA, and also in some natural soils. The localised zone of significantly hydrocarbon impacted Made Ground within Area 4 (TE418 vicinity) poses a moderate ecological risk, although this area is currently covered over and therefore less accessible to plants and animals. • Detailed ecological surveys on the have not reported any evidence of ecological impact that may be attributable to existing soil contamination.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
Lime Kilns • Hydrocarbons • PAHs • Heavy Metals Alluvial deposits (salt marshland at Wick Moor and North Moor) Ground gases	• Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Phytotoxic risk to vegetation via plant uptake (3) • Leaching/Migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via Agricultural Drainage Ditches / Bristol Channel (6) • Air/wind transport (on-site and off-site) (8) • Predation and bioaccumulation (9)	Ecological Designations and Sensitive Land Uses • Off-site SSSI sites • Off-site NNR sites • Off-site SPA sites • On-site / off-site Nitrate Vulnerable Zone • Off-site RAMSAR site • Off-site SAC	**Construction Phase (Post Enabling /Remedial Works)** **Linkage unlikely. Very low to low risk.** • Zone of significant hydrocarbon contamination in vicinity of TE418 in Area 4 of the BDAE will have been removed. • Also, by the time any earthworks/construction works takes place, any sensitive plants and animals will have been removed/translocated (where necessary) as part of environmental mitigation works. • Any additional contamination identified during the earthworks/construction will be assessed to determine the potential risks posed, and subsequently removed and/or remediated as required. • Soil material proposed for re-use will be further analysed and assessed during earthworks to determine if 'suitable for use' from an environmental point of view as part of the Materials Management Plan and Soil Management Plan. Risk from soils with significant exceedance of Stage 1 ecological or phytological SSVs and background concentrations can be controlled by careful management in the selection and placement in less sensitive areas and not within the top 1m in areas of soft landscaping or agricultural restoration or ecological mitigation areas • Any contaminated soils (within acceptability standards) that will have been reused on site will have been carefully managed by the suitable placement of these materials beneath buildings and areas of hardstanding, and if placed in areas of soft landscaping, agricultural restoration or habitat creation these should not be placed within the upper 1.0 m of the soil profile • Risk of mobilising contamination/pollution incidents is always increased during major earthworks/construction, however good environmental construction practice/Environmental/Pollution Prevention Management Plans will detail procedures to minimise these risks.

Potential Source(s)	Potential Pathways/ Exposure Mechanisms	Potential Receptors	Relevant Pollutant Linkage Present?/Initial Risk Level Comments and Risk Control Measures
	• Migration via man made pathways such as drains and underground services (includes permeation into and distribution via water service pipes) (2) • Phytotoxic risk to vegetation via plant uptake (3) • Leaching/Migration via permeable ground (5) • Transfer of contaminants via surface run-off (6) • Transfer of contaminants via groundwater (7) • Inhalation of vapours from groundwater (4) • Migration of contaminants via agricultural drainage ditches / Bristol Channel (6) • Air/wind transport (on-site and off-site) (8) • Predation and bioaccumulation (9)	Ecological Designations and Sensitive Land Uses • Off-site SSSI sites • Off-site NNR sites • Off-site SPA sites • On-site/off-site Nitrate Vulnerable Zone • Off-site RAMSAR site • Off-site SAC	**Operational Phase (Commercial Land Use in BDAW / BDAE only. SCPA will be agricultural / habitat restoration areas)** **Linkage unlikely to exist post-development. Very low risk** • There will be no designated ecological receptors post-development on the BDAW and BDAE area as the majority of the site will comprise buildings and hardstanding. • Post-development, the majority of the main development area will be covered by buildings and hardstanding, thus preventing exposure pathways of direct contact and ingestion. • Soils which will have been reused on site will have been 'suitable for use' from an environmental and geotechnical point of view. Soils with significant exceedance of Stage 1 ecotoxicological or phytotoxicolgical SSVs and background concentrations will have been controlled by careful management in the selection and placement in ecologically less sensitive areas (e.g. beneath buildings and hardstanding) and not within the top 1m in areas of soft landscaping or agricultural restoration or ecological mitigation areas • Post-development, there will be many more potential contaminant sources. However, the risk of future contamination occurring (e.g. through spills and leaks etc) will be minimised through good Environmental Management Practises and Procedures, monitoring and physical infrastructure (e.g. bunded tanks/containment areas, sealed drainage etc).

APPENDIX 15A: PUMPING TEST ANALYSES

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Pumping Tests from PW-1 at Hinkley C

1. Summary

The July-August 2010 pumping test conducted on PW-1 at the Hinkley Point C site has been re-analysed. Table 1.1 summarises the analysis methods applied and the results.

This short technical note summarises the analysis conducted.

Table 1.1 Summary of analyses and results.

Method and data	Transmissivity (m2/s)	Storage coefficient [-]
Cooper-Jacob, early time. All Piezometers	1.9×10^{-3} to 8.0×10^{-4}	2×10^{-2} to 6×10^{-5}
Distance –drawdown, 12, 24, 48 and 96 hours	1.0×10^{-3} to 7.1×10^{-4}	9×10^{-4} to 2×10^{-7}
Theis recovery	1.3×10^{-3} to 1.8×10^{-3}	n/a

Note these values are based on manual rather than automated analysis.
Values of storage below 10^{-6} are not taken to be realistic.

Only the constant rate data was analysed. The following points and conclusions are drawn:

1. The constant rate test and data obtained are of medium quality. The pumping rate did vary significantly through the test, reducing from 3.07 to 2.11 l/s;
2. There is a very large drawdown in the pumped well by the end of the test, with apparently less than 0.5 m of water remaining in the pumped well. It is surprising that it was possible to maintain a 2 l/s of yield to the end of the test;
3. The system displays some degree of anisotropy. Distance-drawdown analysis shows horizontal anisotropy with T_{E-W} :T_{N-S} ratio of ~1.3:1. This is less than the 2:1 found when analysing the July 2010 pumping test of PW-2;
4. Cooper-Jacob analysis again indicates the presence of a barrier or transition to lower permeability in the aquifer. The deviation from straight line behaviour occurs at around 5,000 seconds, earlier than the 40,000 seconds observed in the PW2 test. It is interpreted that the barrier is closer to PW1 than PW2;
5. The recovery analysis shows unconfined behaviour due to dewatering of the aquifer around the pumped well. Storage values from the recovery are unfortunately unreliable.

2. Constant Rate Test

The constant rate test lasted 4 days exactly, from 08:00 30th July to 08:00 3rd August 2010. The desired pumping rate was 3.0 l/s with records taken manually using totalising and electromagnetic flow meters. The recorded abstraction declined over the test, from 3.03 l/s to 2.1 l/s. The decline in rate is seen as a decrease in gradient at late times in Cooper-Jacob plots, beyond ~ 2 days (170,000 seconds).

Water levels in the pumping well decline to 21m below datum, effectively the bottom of the hole and account for the decline in yield. The water level at the start of the test (3.8-4.0 m BD) coincides with the top of the siltstone sequence of the Blue Lias beds.

2.1 Cooper Jacob Analysis

Results of Cooper-Jacob analysis of early times, from approximately 600 to 6000 seconds (10-100 minutes) are given in Table 2.1.

Table 2.1 Transmissivity and Storage values for early time based on manual fit.

Observation Well	T (m2/s)	T (m2/d)	S [-]
PZ01	9.6E-04	83	1.4E-04
PZ02	8.6E-04	74	2.4E-04
PZ03	8.0E-04	69	6.7E-04
PZ04	8.0E-04	69	7.0E-05
PZ05	9.5E-04	82	6.0E-05
PZ06	8.2E-04	71	1.2E-04
PZ07	9.1E-04	79	5.0E-04
PZ08	1.1E-03	99	1.2E-03
PZ09	8.0E-04	69	1.8E-02
PZ10	9.2E-04	79	3.5E-03
PZ12	1.9E-03	163	1.2E-03
Maximum	**1.9E-03**	**163**	**1.8E-02**
Minimum	**8.0E-04**	**69**	**6.0E-05**
Average	**9.8E-04**	**85**	**2.3E-03**

2.2 Distance drawdown analysis

Distance drawdown analysis has been completed at 4 times during the constant rate test:

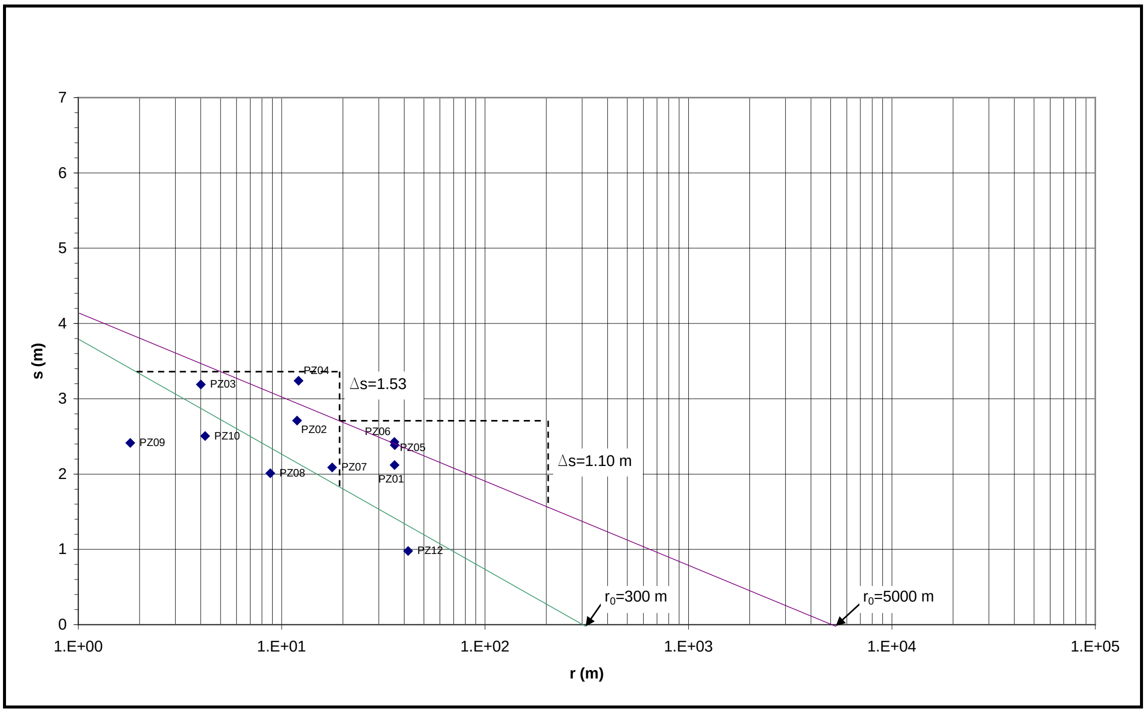
- 43,200 seconds, 12 hours;
- 86,400 seconds, 24 hours;
- 172,800 seconds, 48 hours; and,
- 345,600 seconds, 96 hours.

Figures 2.1 to 2.4 present the distance-drawdown analysis. The analysis has considered two groups of boreholes:

- A north-south orientated group consisting of: PZ08, PZ10 and PZ12; and
- An east-west orientated group consisting of: PZ01, PZ02, PZ03, and PZ05.

The other piezometers PZ04, PZ06, PZ07 and PZ09 tend to lie slightly or further off the main trend lines.

Figure 2-1 Distance-Drawdown plot 12 hours into test (t=43,200 seconds).



Note greater drawdown in E-W compared to N-S group indicating anisotropy.

Figure 2-2 Distance-Drawdown plot 24 hours into test (t=86,400 sec).

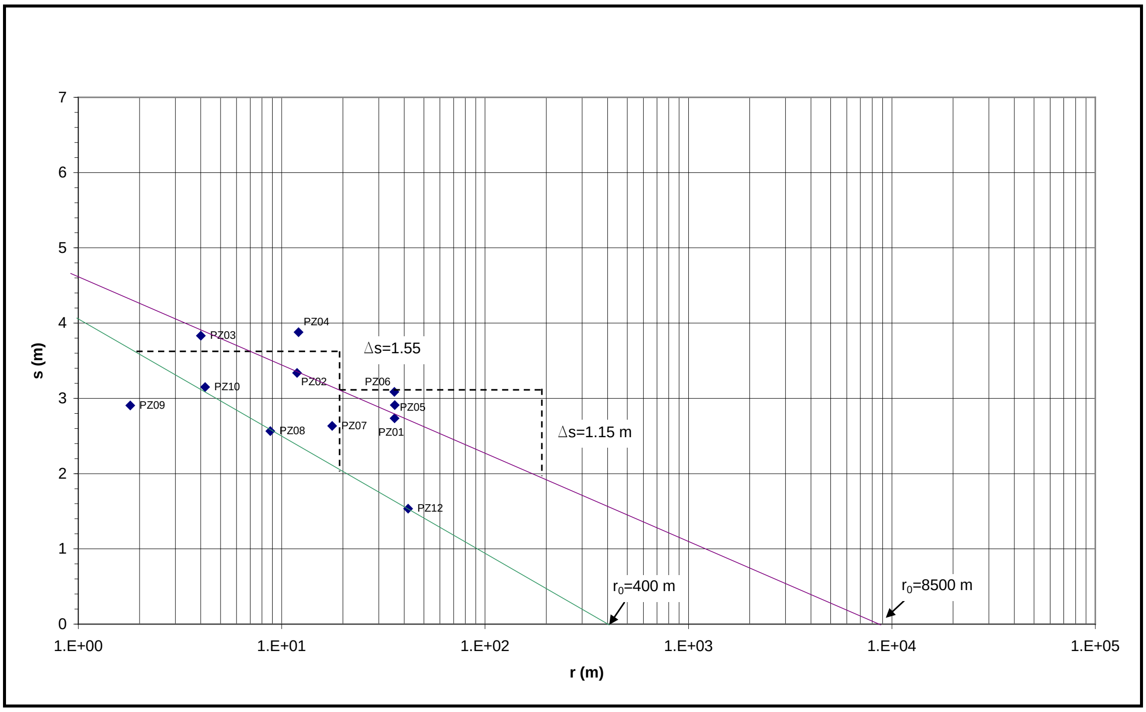


Figure 2-3 Distance-Drawdown plot 48 hours into test (t=172,800 sec).

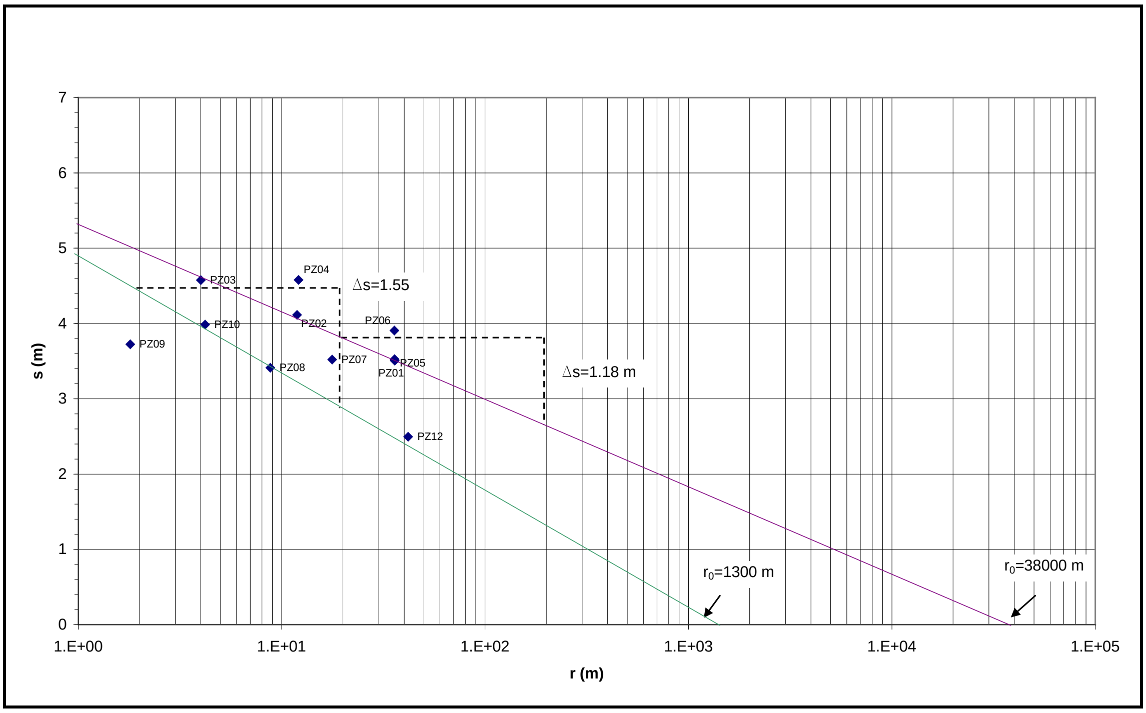
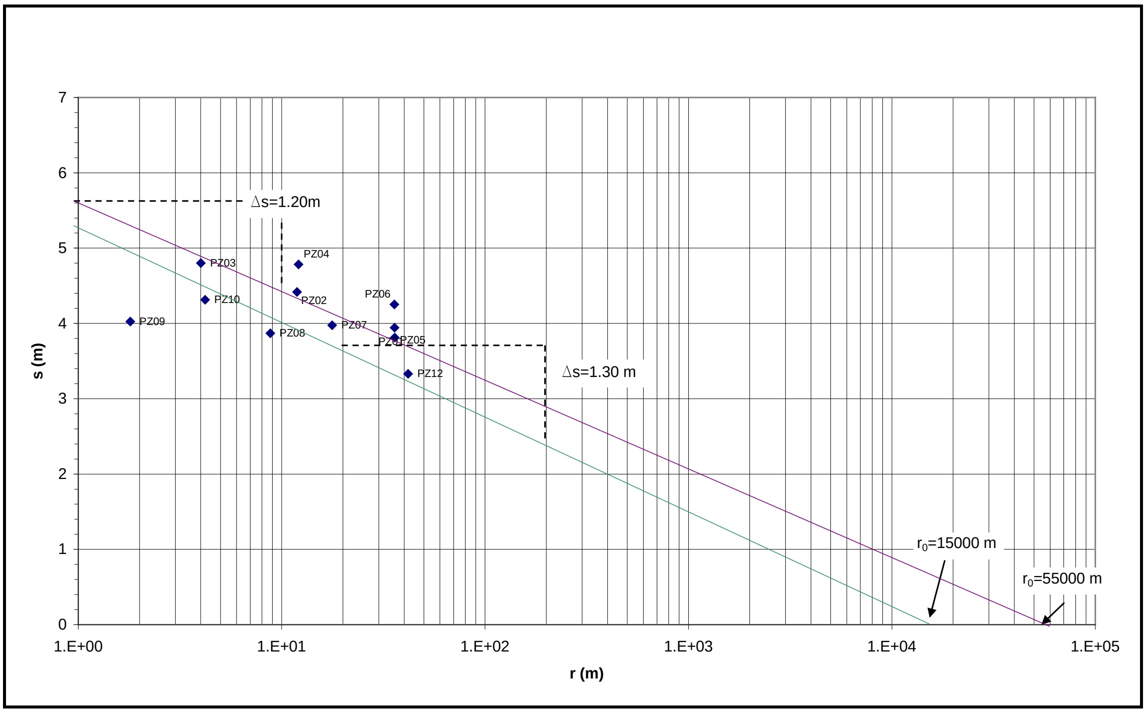


Figure 2-4 Distance-Drawdown plot 96 hours into test (t=345,600 sec).



Results of the analysis are summarised in Table 2.2.

Table 2.2 Distance Drawdown Analysis Results

	N-S Group	
Time, seconds	**Transmissivity (m^2/s)**	**Storage coefficient**
43,200	7.2E-04	7.8E-04
86,400	7.1E-04	8.6E-04
172,800	7.1E-04	1.6E-04
345,600	8.4E-04	2.9E-06
	E-W Group	
Time, seconds	**Transmissivity (m^2/s)**	**Storage coefficient**
43,200	1.0E-03	3.9E-06
86,400	9.5E-04	2.6E-06
172,800	9.3E-04	2.5E-07
345,600	9.2E-04	2.4E-07

The N-S group has an average transmissivity of $7.4x10^{-4}$, whilst the E-W group is $9.5x10^{-4}$. This shows evidence of horizontal anisotropy in the formation with T_{E-W}:T_{N-S} ratio of 1.3:1.

The storage coefficients derived by the distance drawdown method are extremely sensitive to the intercept of the fitted straight line. Therefore, little account is taken of storage estimates from this method.

3. Recovery test

Theis recovery analysis was conducted on 2 of the piezometers: PZ01 and PZ10. The initial recovery shows some straight line behaviour but recovery is very slow. Values of storage coefficient ratio taken from this early time are extremely low, which in turn gives storage values greater than 1. This indicates that some of the assumptions made for the analysis are not valid, such as the aquifer being confined.

Table 3.1 Summary of Theis Recovery analysis

	Manual analysis (early time)	
Piezometer	**Transmissivity (m^2/s)**	**Storage coefficient ratio**
PZ01	0.0018	1.8e-10
PZ10	0.0013	1.69e-7

4. Further interpretation

The response to pumping beyond around 5,000 seconds (~1.4 hours) shows increasing drawdown with log time. Under the Cooper-Jacob analysis this is interpreted as a boundary effect.

In the recovery analysis there is a strong suggestion that the test is providing an unconfined response. It is also the case that the pumped well is nearly dewatered during the test, to within only 0.5m of the base of the well.

Pumping Tests from PW2-1 at Hinkley C

1. Summary

The July 2010 pumping tests conducted from PW2-1 at the Hinkley Point C site have been analysed. Table 1.1 summarises the analysis methods applied and the results.

Table 1.1 Summary of analyses and results.

Method and data	Transmissivity (m2/s)	Storage coefficient [-]
Theis, PZ2-1 only	2.1×10^{-4}	3×10^{-5}
Cooper-Jacob, mid time. All Piezometers	2.0×10^{-4} to 3.0×10^{-4}	2×10^{-3} to 1×10^{-5}
Distance –drawdown, 12, 24, 48 and 96 hours	2.4×10^{-4} to 5.3×10^{-4}	3×10^{-4} to 2×10^{-11}
Theis recovery	2.1×10^{-4} to 7.5×10^{-4}	0.04[1] to 5×10^{-4}

Note these values are based on manual rather than automated analysis.
Values of storage below 10^{-6} are not taken to be realistic. [1] 0.04 represents an unconfined specific yield.

From the analysis the following conclusions are drawn:

1. The step test was conducted with recovery periods between steps. Normally steps are performed in succession with no break in pumping or recovery;

2. The constant rate test and data obtained are of a relatively high quality. Pumping rate did vary through the test, but only by ~4%;

3. During pumping phases, the responses at the observation piezometers do not show the influences of the dewatering of the aquifer around the pumped well;

4. The system is anisotropic. Distance-drawdown analysis shows horizontal anisotropy to be present with horizontal anisotropy in the formation with a $T_{E-W}:T_{N-S}$ ratio of ~2:1;

5. A barrier is present within the aquifer that acts to significantly reduce permeability. It is difficult to be precise in the distance and direction of the boundary, but calculations indicate an approximate distance of 400-600 m. The nature of the boundary is unknown, but it could be related to thinning of the formation to the south, indicate a fault or be related to other structures on the Hinkley site;

6. The recovery analysis shows unconfined behaviour due to dewatering of the aquifer around the pumped well. Storage values from the recovery are typically an order of magnitude, or more, greater than those derived from consideration of the pumped phase; and

7. Estimates of storage co-efficient vary widely, depending on analysis technique and the data used. The long term storage of an aquifer is usually only revealed by longer term pumping. It is, therefore, suggested that the higher values calculated from the recovery phase, 0.04 are adopted for further calculations and modelling, and that larger values will likely be found under longer term dewatering.

2. Introduction

The testing and monitoring were conducted by Stuart Well Services Ltd. The interpretation presented here is based on the following information received from EDF:

- Stuart Well Services Ltd report No.SWC4399/1, September 2010 (10986 page file Pumping Testing Report.pdf); and
- Electronic data files in Excel (.xlsx) and Acrobat (.pdf) format.

2.1 Schedule of tests

The testing scheduled comprised:

1. Initial set up and checking of pump, 8th to 12th July.
2. Step testing consisting of 4 steps. Steps 1 and 2 of 0.5 and 1 l/s were conducted on, 13th July for 100 minutes each with Steps 3 and 4 of 0.5 and 2.0 l/s conducted for 100 minutes on 14th July. Following step testing recovery was monitored prior to the constant rate test. Note that the pumped well was permitted to recovery during the step tests, with gaps of 2 hours 50 minutes between pumping Steps 1 and 2, and 3 hours 20 minutes between Steps 3 and 4;
3. The constant rate test at a nominal rate of 1.5 l/s lasted 4 days exactly, from 14:00 15th to 14:00 19th July 2010; and,
4. Manual recovery monitoring in the pumped and 12 piezometers continued for a further 4 days until 23rd July, with data loggers left in position to continue recording until 6th August, 18 days after pumping ceased.

The test analysis conducted in this document concentrates on the aquifer. For that reason the constant rate and recovery data are considered whilst the step test data are not.

3. Site description

The following description of the geology of the site is taken from Stuart Well Services Ltd report No.SWC4399/1, September 2010:

> *"Ground level ranges between 14.1 and 16.22mAOD. Geology is recorded as top soil and clay to between 12 to 14mAOD overlying layered mudstone siltstone with limestone bands that extends to the base of all test wells.*
>
> *The site geology has been extensively investigated in previous investigations. It is known that the Hinkley site is underlain by layered mudstone siltstone with limestone bands which have been identified as the Blue Lias formation. The*

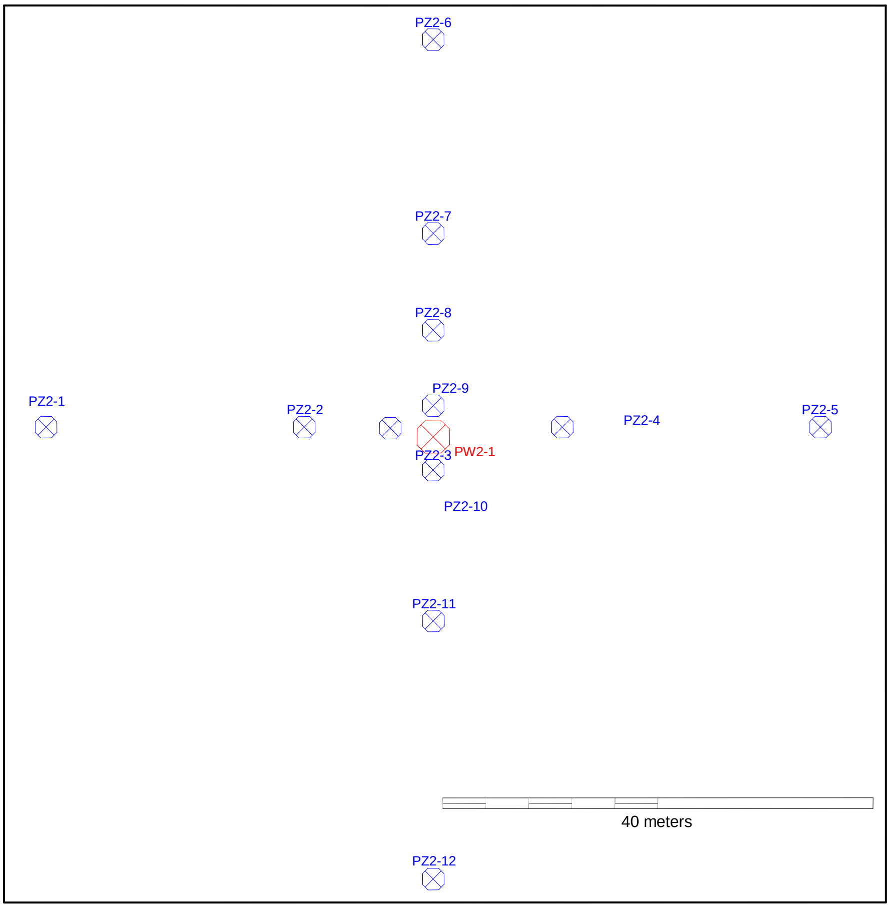
Blue Lias Formation is thinnest at the south of the site, approximately 10m thick. The formation base dips by about 10o to the north where it is approximately 65m. Underlying the the Blue Lias is the Penarth Group (Laminated limestone mudstone) of about 13m thickness that overlies the Blue Anchor Formation (Grey to green siltstone mudstone) which extends to approximately 120mBGL before the Red Mudstone Formation is encountered (Green to red siltstones and mudstones).

This report will refer to the upper layered mudstone siltstone as the Blue Lias to maintain continuity with previous investigative reports. All wells were therefore screened within the Blue Lias Formation. Where wells penetrated the underlying Penarth Group or Blue Anchor we understand that these wells were backfilled with bentonite grout up to the base of the screened section permitting only testing within the Blue Lias Formation."

3.1 Pumped and monitoring wells

Figure 3.1 shows the layout of the pumped well PW2-1 and the 12 piezometers arranged in north-south and east-west orientations.

Figure 3-1 Basic site layout of pumped well and piezometers



3.2 Antecedent and Meteorological conditions

Ideally groundwater levels are monitored for a number of days or weeks prior to testing to reveal any temporal trends in levels. Levels (below datum) are presented in Figure 3.2 for piezometer PZ2-1 for the 12 days prior to installation and initial testing of the pump on 12th July. This shows some trends for the aquifer, but with fluctuations of the order of 0.05 m, it is felt that there is no need to correct observed data for large scale temporal trends.

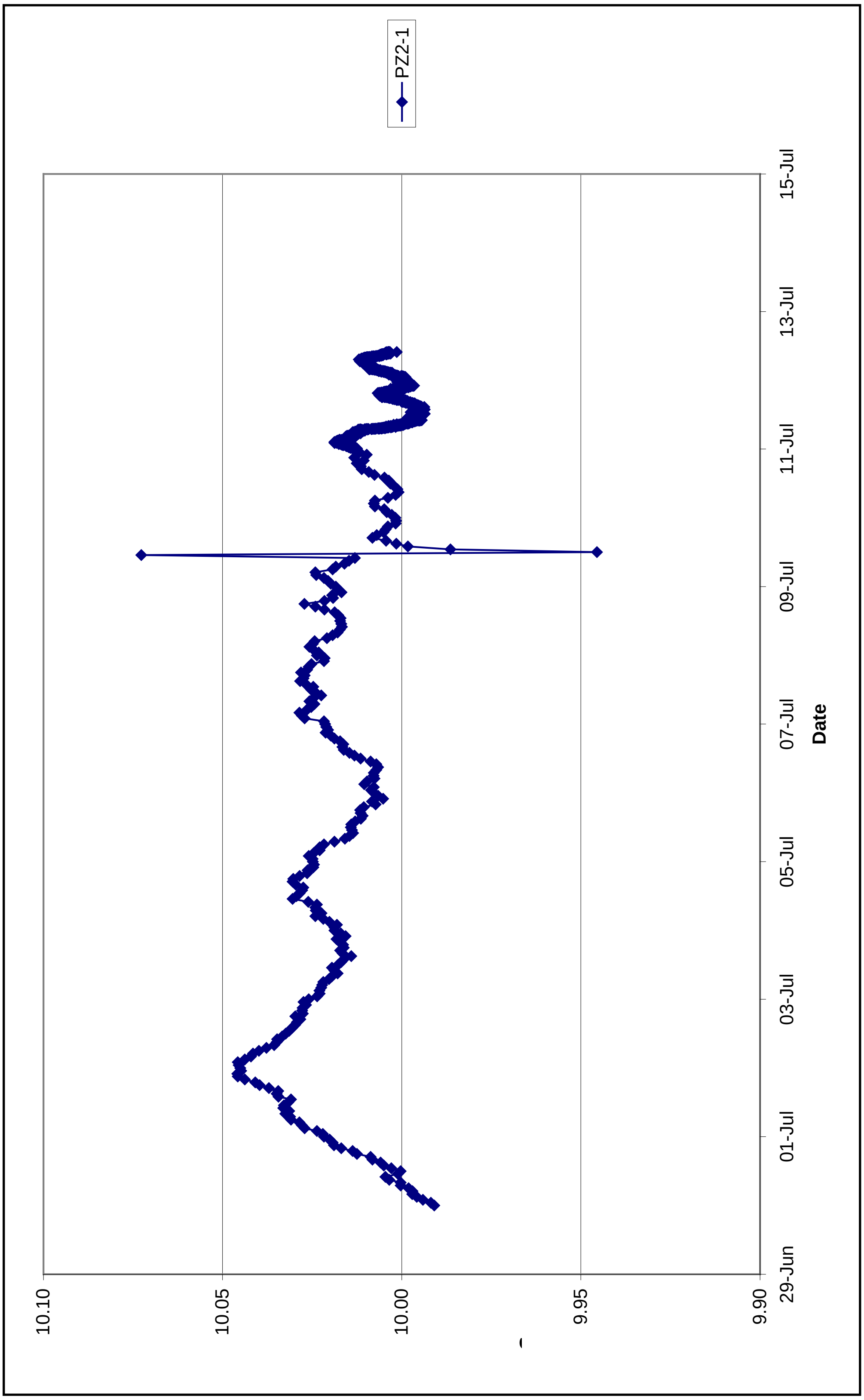
Rainfall during the test was recorded by SWS and is presented in Table 3.1 for the period 12/07/2010 – 23/07/2010.

Table 3.1 Rainfall recorded during pumping test. Readings are for 24 hour periods, 10:00am to 10:00am.

Date	Rainfall (mm)	Date	Rainfall (mm)
12/07/2010 to 13/07/2010	1.8	18/07/2010 to 19/07/2010	0
13/07/2010 to 14/07/2010	1.7	19/07/2010 to 20/07/2010	3
14/07/2010 to 15/07/2010	5	20/07/2010 to 21/07/2010	8.6
15/07/2010 to 16/07/2010	5.5	21/07/2010 to 22/07/2010	2
16/07/2010 to 17/07/2010	6.5	22/07/2010 to 23/07/2010	0
17/07/2010 to 18/07/2010	0.5		

Note that the spike response on 9th July is related to the transducer / data logger being removed from the borehole.

Figure 3-2 Groundwater levels prior to testing in piezometer PZ2-1



4. Constant Rate Test

The constant rate test lasted 4 days exactly, from 14:00 15th to 14:00 19th July 2010. The desired pumping rate was 1.5 l/s with records taken manually using totalising and electromagnetic flow meters. The recorded abstraction is presented in Figure 4.1 and following points are made:

- Average pumping rate was 1.52 l/s;
- From 3300 seconds to 6000 seconds (55 to 100 minutes) flows rate increased to 1.57 l/s;
- Some significant variation in flow rate is observed from ~ 30,000 to 54,000 Seconds (550 to 900 minutes); and,
- Later in the test the pumping rate declines to 1.52 and 1.51 l/s.

Whilst these variations appear minor, they do influence the recorded drawdown in the observation piezometers.

Figure 4.2 presents the water level recorded in the pumped well during the step and constant rate tests. This figure shows that recovery from the step testing on 13th and 14th July was not fully complete. However, the overall recovery from the step tests is ~99% with a residual drawdown of 0.12m at the start of the constant rate test. This compares to a drawdown of 12.26 in the pumped well during the constant rate test, and 9.25 m during the last step of the step test. Due to the small residual, the constant rate data was not corrected.

The pumping well drawdown of 12.26 m takes water levels to 18 m below datum, and apparently only 2 m above the base of the borehole. Such a low level of water in the pumped well would normally cause issues such as cavitation, but no mention is made of such issues which may be due to the low flow rate. The water level at the start of the test (5.95m BD) is approximately 2m below the top of the siltstone sequence of the Blue Lias beds.

The test was monitored in the 12 piezometers listed in Table 3.1 using downhole pressure transducers and loggers. The data were corrected for barometric pressure by the testing contractor, and the analysis presented below uses pressure corrected data.

Additionally manual monitoring was conducted by SWS in the pumped well and piezometers. This data corroborates the logger data and is not analysed. It is presented in Appendix B the SWS report.

4.1 Theis analysis

Stuart Well Services completed analysis of data from all 12 piezometers using the Theis curve matching method, as presented in Figure 8 (report page 5932). The Theis analysis has been repeated for piezometer PZ2-1, located 35.98 m to the west of the pumped well. Figure 4.3 presents the Theis method curve for this piezometer and the hydraulic properties calculated are:

- Transmissivity of 2.1×10^{-4} m^2/s; and
- Confined storage coefficient of 3.4×10^{-5}.

Figure 4-1 Abstraction rate for constant rate test

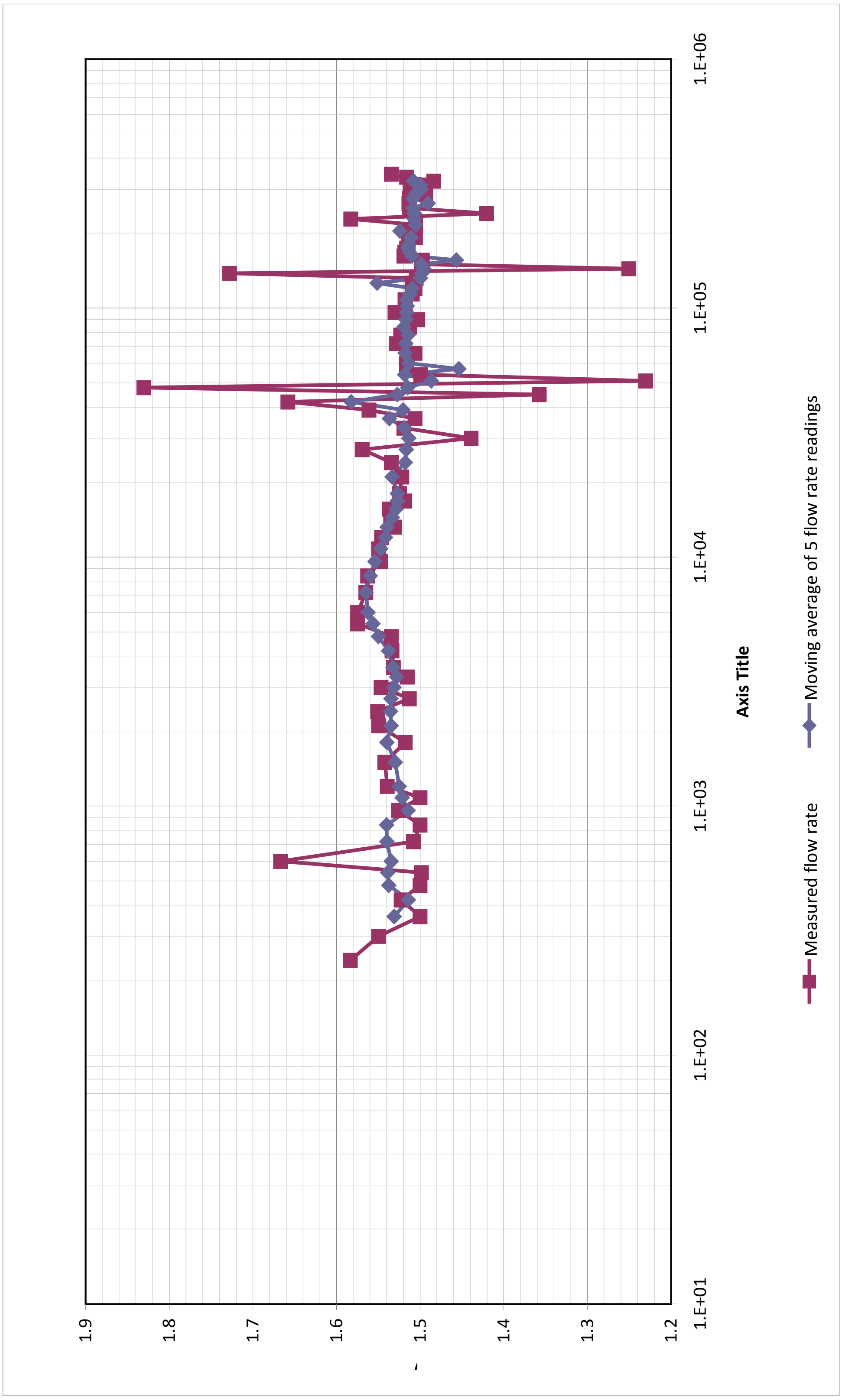


Figure 4-2 Water levels in the pumped well and flow rates for step and constant rate tests.

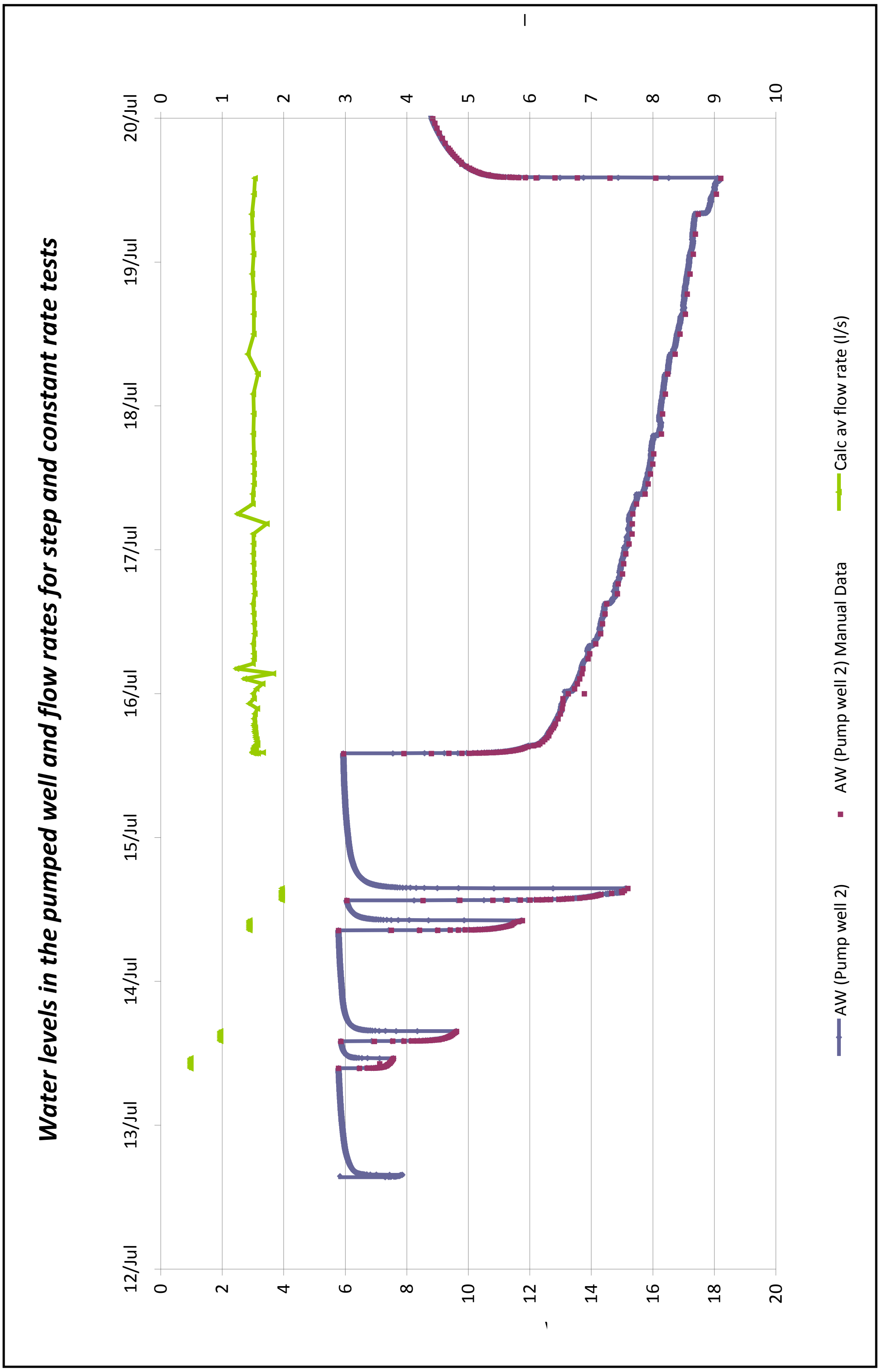
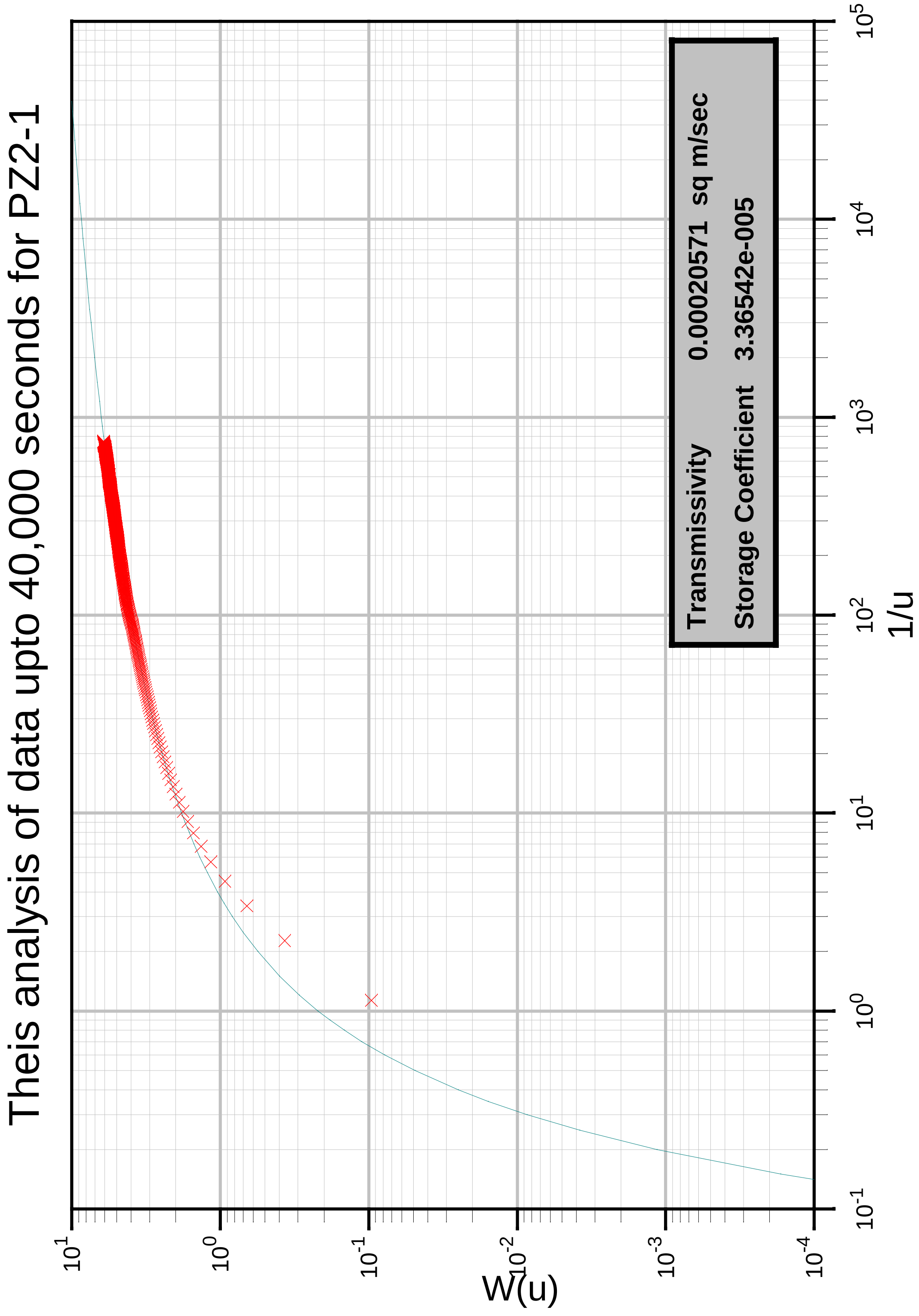


Figure 4-3 Theis analysis of data upto 40,000 seconds for PZ2-1.



For the same Theis analysis and similar periods of data SWS calculated values of, 1.9 x 10^{-4} m^2/s and 4.5 x 10^{-5} respectively. The transmissivity results agree closely, with a larger difference between storage values. The discrepancy highlights the sensitivity of the Theis method to choice of curve fit, and the data used for the analysis, but the overall conclusion is that SWS have applied the Theis method without error.

There is a question mark regarding the assumption of a confined, fully saturated aquifer made in the Theis solution, which does not really apply at the start of the test and becomes less valid as drawdown increases. However, the response seen in the piezometers does not suggest that the partial dewatering is having a large effect on the test, particularly up to ~ 11 hrs, 40,000 seconds.

4.2 Cooper Jacob Analysis

The Cooper-Jacob semi-log analysis method follows the same assumptions as for the Theis. It uses an approximation that becomes more valid at later times. The level to which the approximation is valid can be calculated using parameter u, given by:

$$u = \frac{r^2 S}{4KDt}$$

where:

- r is the radial distance to the observation well;
- S is the dimensionless storage of the aquifer;
- K is the hydraulic conductivity;
- D the aquifer thickness; and,
- t, the time since commencement of pumping.

For values of $u<0.15$ the error introduced by the approximation is 10% and this declines to 1% for $u<0.03$ (Krusemann and de Ridder, 1990). The condition of u being small is usually satisfied relatively quickly in confined aquifers. It means that early time data needs to be treated with caution, but this information can also be affected by wellbore storage.

Cooper-Jacob analysis has been performed separately for all 12 observation piezometers. The analysis has been completed both with manual and automatic line fitting with Aquifer Win32 pumping test software, with figures presented in Appendix A. The manual line fitting took greatest account of the straight line section between approximately 500 and 40,000 seconds. Early time data was discounted due to the $u<0.03$ condition and the later time analysis due to clear deviation and increasing drawdown.

As an additional check, the test data from PZ2-1 has been analysed manually, drawing a straight line by hand and calculating transmissivity and storage values.

The trends observed in the piezometers follow a similar pattern of:

- early time response following an approximately straight line trend;
- at around 5,000 seconds (83 minutes) a slight kink of increased drawdown. From this straight line trend is re-established at a similar slope;

- at around 40,000 seconds (11 hours) a break from straight line behaviour occurs with an increasing trend in drawdown. This trend does not settle into a straight line, but continues as an increasing drawdown curve. Increasing drawdown at later time may be due to thinning of the aquifer to the south or a low permeability boundary.

Exceptions to this behaviour include:

- Piezometers PZ2-6 and PZ2-7 (36.93 and 18.90 m to the north of the pumped well) show different early time responses. Both start to respond to pumping later than other piezometers, at 800 and 1,000 seconds. PZ2-6 quickly settles to a straight line response, whilst PZ2-7 shows a cu rved response of rapidly increasing drawdown between 800 and 2,500 seconds.
- In piezometer PZ2-6 the switch from (log) linear response to an increasing drawdown appears to be slightly earlier at ~30,000 seconds;

The Cooper-Jacob plots do not show clear signs of the aquifer starting to move to unconfined behaviour. Given that piezometric levels are lowered to within the aquifer unit, there is the potential for an unconfined response, but if this is present, it is swamped by the influence of a boundary that becomes increasingly apparent from around 11 hours (40,000 seconds). A move to unconfined conditions would be expected to decrease the rate of drawdown as more water is released from storage close to the pumped well.

Table 4.1 and Table 4.2 list the results of the analysis for hydraulic parameters T and S based on an automatic fit and manual fit on early data respectively.

Table 4.1 Transmissivity and Storage values for observation wells based on an automatic fit.

Observation Well	T (m2/s)	T (m2/d)	S [-]
PZ2-1	0.00013	11.2	0.00014
PZ2-2	0.00012	10.4	0.00104
PZ2-3	0.00013	11.2	0.00381
PZ2-4	0.00013	11.2	0.00076
PZ2-5	0.00013	11.2	0.00013
PZ2-6	0.00014	12.1	0.00096
PZ2-7	0.00012	10.4	0.00086
PZ2-8	0.00013	11.2	0.00202
PZ2-9	0.00011	9.5	0.01439
PZ2-10	0.00012	10.4	0.01798
PZ2-11	0.00014	12.1	0.00261
PZ2-12	0.00017	14.7	0.00061

Table 4.2 Transmissivity and Storage values for observation wells based on a manual fit on early data (up to 40000 seconds).

Observation Well	T (m2/s)	T (m2/d)	S [-]
PZ2-1	0.00021	18.1	0.00002
PZ2-2	0.00022	19.0	0.00009
PZ2-3	0.00021	18.1	0.00033
PZ2-4	0.00022	19.0	0.00008
PZ2-5	0.00022	19.0	0.00001
PZ2-6	0.00025	21.6	0.00054
PZ2-7	0.00020	17.3	0.00025
PZ2-8	0.00022	19.0	0.00033
PZ2-9	0.00020	17.3	0.00085
PZ2-10	0.00023	19.9	0.0020
PZ2-11	0.00027	23.3	0.00084
PZ2-12	0.00029	25.1	0.00030

The automated fit is biased to later times on the $\log_{10}$ simply due to the larger number of data points. The trend to increasing drawdown verses log-time indicates another influence within the aquifer that does not conform to the Theis / Cooper-Jacob assumptions. Therefore, the manual analysis of earlier time data is thought more reliable than the automated analysis biased towards later log-time.

With the manual calculations, Transmissivity values average 2.3×10^{-4} m^2/s. A calculation of the time at which U<0.15 for the nearest and furthest piezometers (PZ2-9 and PZ2-12) are 70 and 14,000 seconds respectively.

4.3 Distance drawdown analysis

Distance drawdown analysis has been completed at 4 times during the constant rate test:

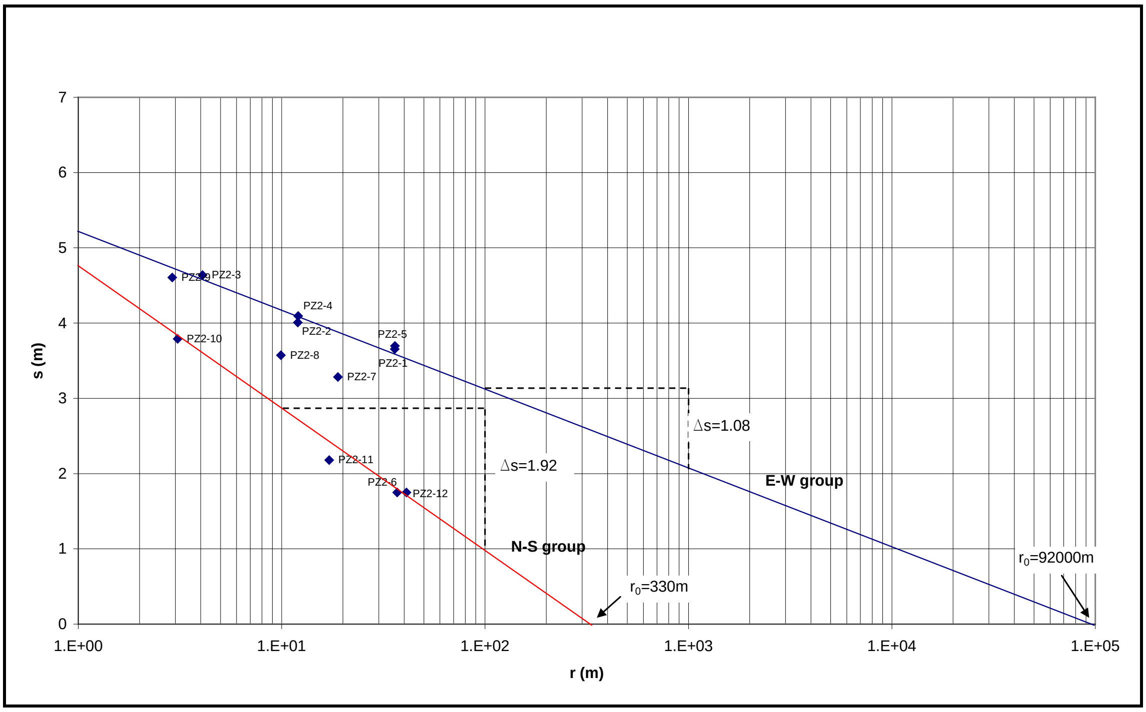
- 43,200 seconds, 12 hours;
- 86,400 seconds, 24 hours;
- 172,800 seconds, 48 hours; and
- 345,600 seconds, 96 hours.

Figures 4.4 to 4.7 present the distance-drawdown analysis. The analysis has considered two groups of boreholes:

- A north-south orientated group consisting of: PZ2-6, PZ2-10, PZ2-11 and PZ2-12; and
- An east-west orientated group consisting of: PZ2-1, PZ2-2, PZ2-3, PZ2-4, and PZ2-5.

The other piezometers PZ2-7, PZ2-8 and PZ2-9 show some anomalous behaviour and are not considered.

Figure 4-4 Distance-Drawdown plot 12 hours into test (t=43,200 seconds).



Note greater drawdown in E-W compared to N-S group indicating anisotropy.

Figure 4-5 Distance-Drawdown plot 24 hours into test (t=86,400 sec).

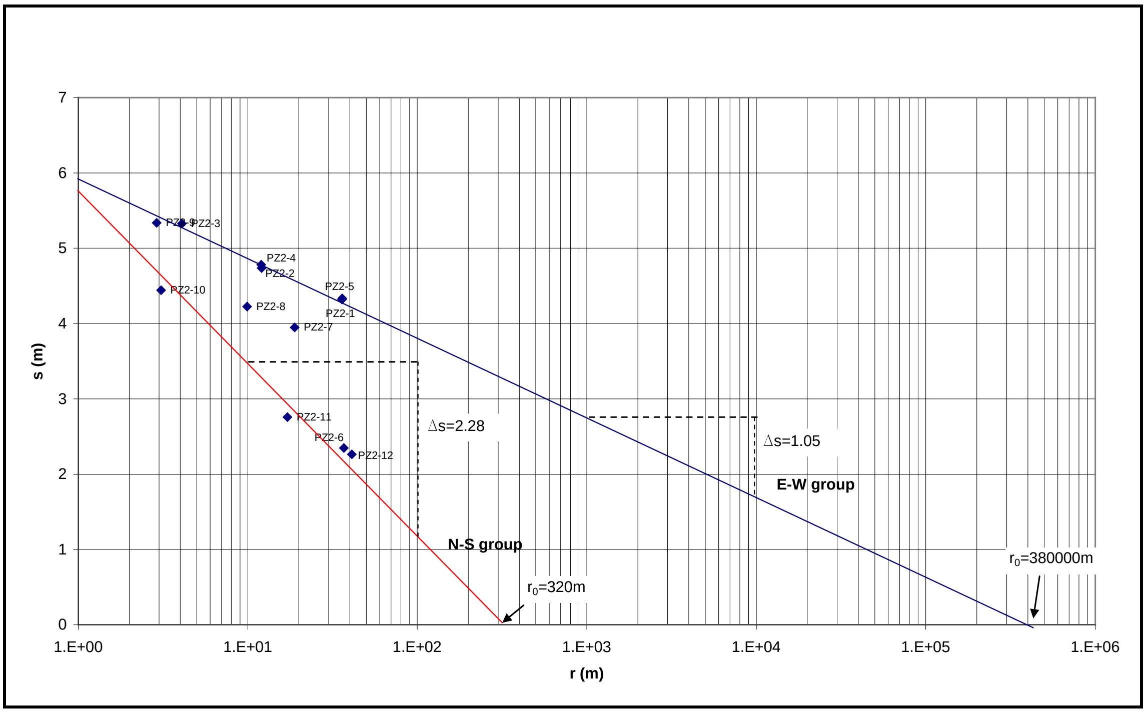


Figure 4-6 Distance-Drawdown plot 48 hours into test (t=172,800 sec).

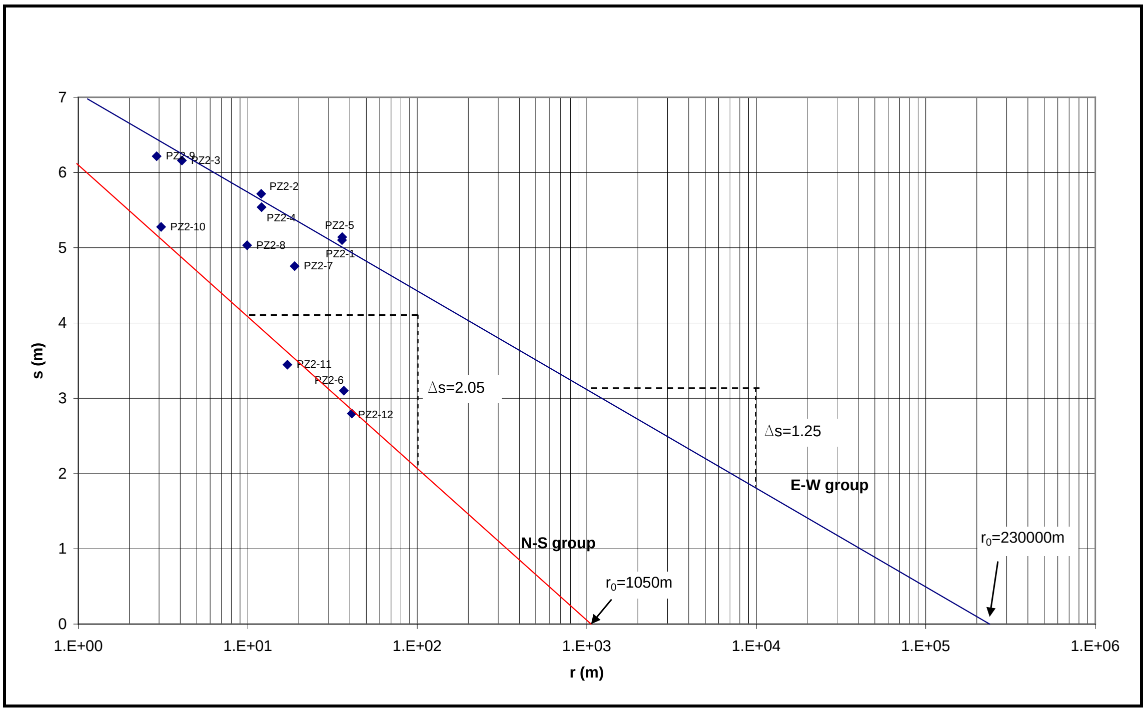
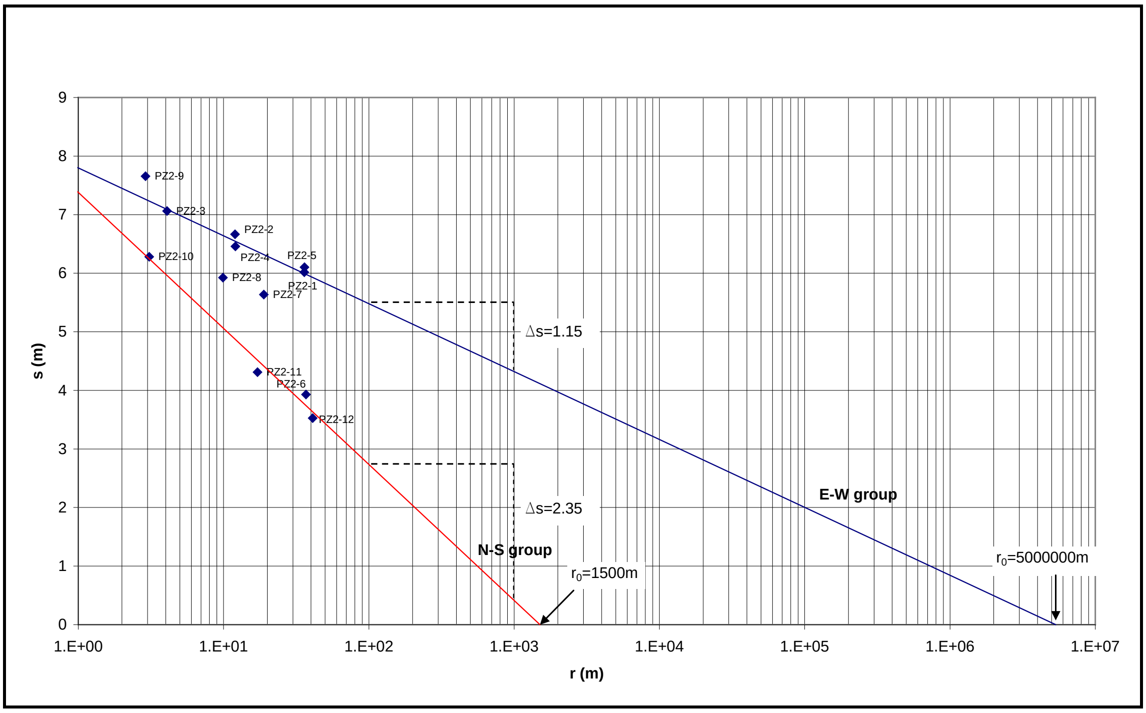


Figure 4-7 Distance-Drawdown plot 96 hours into test (t=345,600 sec).



Results of the analysis are summarised in Table 4.3.

Table 4.3 Distance Drawdown Analysis Results

	N-S Group	
Time, seconds	**Transmissivity (m^2/s)**	**Storage coefficient**
43,200	2.9E-04	2.6E-04
86,400	2.4E-04	4.6E-04
172,800	2.7E-04	9.6E-05
345,600	2.4E-04	8.2E-05
	E-W Group	
Time, seconds	**Transmissivity (m^2/s)**	**Storage coefficient**
43,200	5.2E-04	6.0E-09
86,400	5.3E-04	1.1E-09
172,800	4.5E-04	3.3E-09
345,600	4.9E-04	1.5E-11

The N-S group has an average transmissivity of 2.6×10^{-4}, whilst the E-W group is 5.0×10^{-4}. This shows strong evidence of horizontal anisotropy in the formation with $T_{E\text{-}W}$:$T_{N\text{-}S}$ ratio of ~2:1 (actually 1.89:1).

The storage confidents derived by the distance drawdown method are extremely sensitive to the intercept of the fitted straight line. Therefore, little account is taken of storage estimates from this method.

5. Recovery test

Theis recovery analysis was conducted on 4 of the piezometers: PZ2-1, PZ2-4, PZ2-8 and PZ2-12 . These were chosen to as representative of the 4 lines of piezometers extending from the pumped well. The resulting plots are presented in Appendix B and, in the same way as the Cooper-Jacob analysis, two plots show a manual fit to the early time data, and an automated fit to the whole of the recovery information. Table 5.1 summarises the results of the analysis.

Table 5.1 Summary of Theis Recovery analysis

	Manual analysis (early time)	
Piezometer	**Transmissivity (m^2/s)**	**Storage coefficient ratio**
PZ2-1	2.1E-04	0.037
PZ2-4	2.5E-04	0.013
PZ2-8	2.5E-04	8.7E-03
PZ2-12	7.6E-04	7.6E-08
	Automated analysis	
Piezometer	**Transmissivity (m^2/s)**	**Storage coefficient ratio**
PZ2-1	8.4E-05	1.3
PZ2-4	8.7E-05	1.3
PZ2-8	8.6E-05	1.2
PZ2-12	1.0E-04	1.1

As before, the manual analysis of early time recovery is thought more accurate due to increasing influence of the postulated boundary at later times. The plots of recovery data from the piezometers show the aquifer to have nearly fully recovered by the end of monitoring on 6th August, with a residual drawdown of 0.07 to 0.11 m compared to maximum drawdowns of 3.5-6.5 m.

The Storage coefficient ratio is given by:

$$Storage\ ratio = \frac{S}{S'}$$

Where:

- S is the storage seen during the pumping phase; and,
- S' is the storage seen during recovery.

Taking the storage values from the pumping phase derived by Cooper-Jacob manual analysis, given in Table 4.2, the following estimates of the storage from the early part of the recovery analysis are:

- PZ2-1, $5x10^{-4}$;
- PZ2-4, $6x10^{-3}$; and,
- PZ2-8, 0.04.

These are much closer to specific yield values typically found for unconfined aquifers, 0.01-0.2. Note that the value of storage ratio for PZ2-12 yields a storage value greater than 1, which is nonsensical.

The recovery plots show some straight line behaviour at early recovery times, when the t/t' ratio is 100-1000. This corresponds to approximately the first hour of the recovery period. The rest of the recovery shows a curved response (in log time) with recovery becoming more rapid. This is interpreted as:

- The early time response corresponds to recovering levels replacing unconfined storage around the pumped well. Hence the rate of recovery is relatively slow.
- At later times (lower values of t/t'), after approximately 10 hours of recovery, levels have recovered such that the dewatered part of the aquifer has refilled, the aquifer is once again confined and recovery occurs more rapidly (on log time).

This switch during pumping and recovery phases, from confined, to unconfined and then back to confined behaviour, can not be represented fully by analytical analysis. More information, particularly concerning the unconfined storage (specific yield) could be obtained from numerical analysis of pumping and recovery phases.

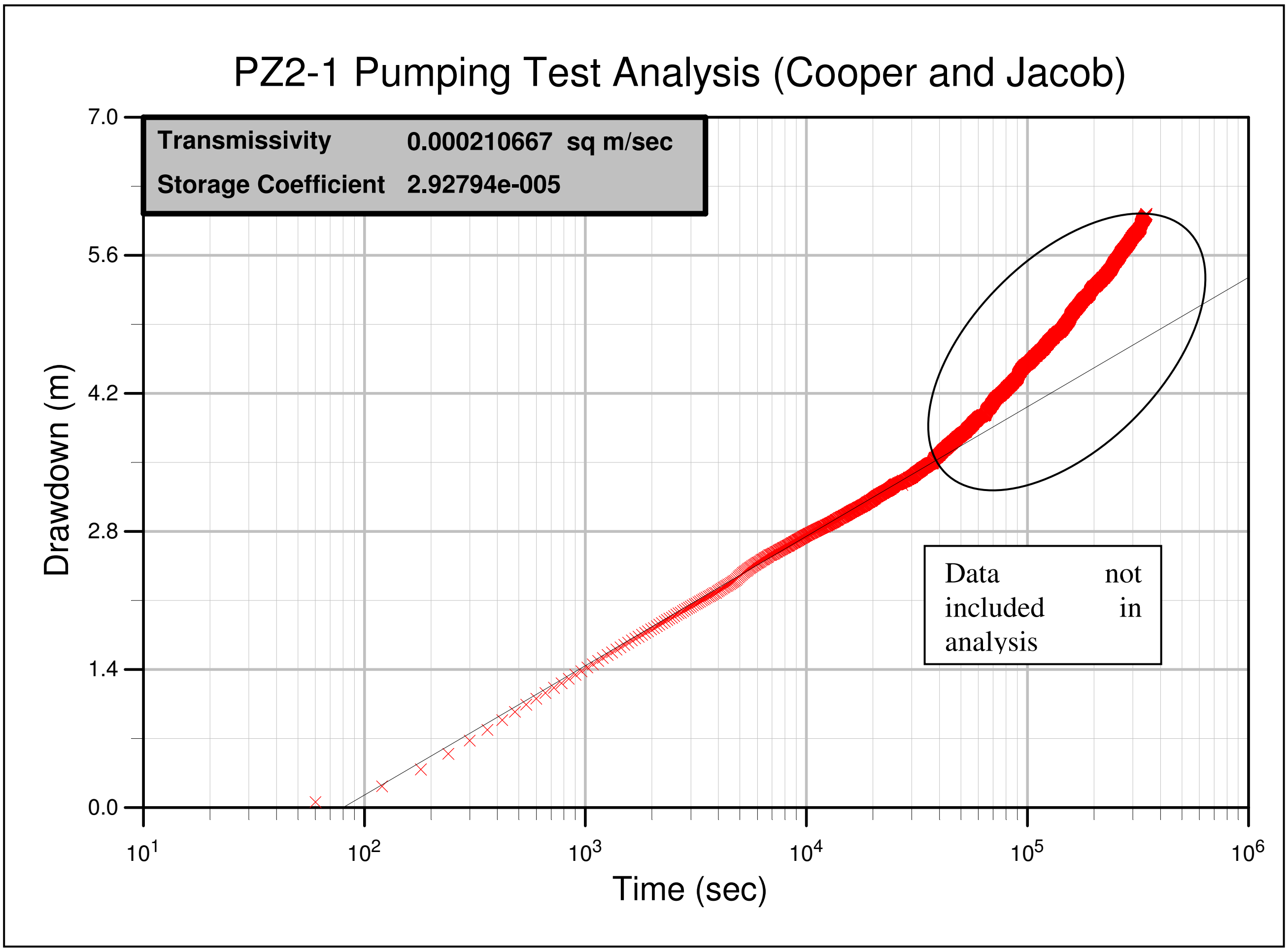
6. Further interpretation

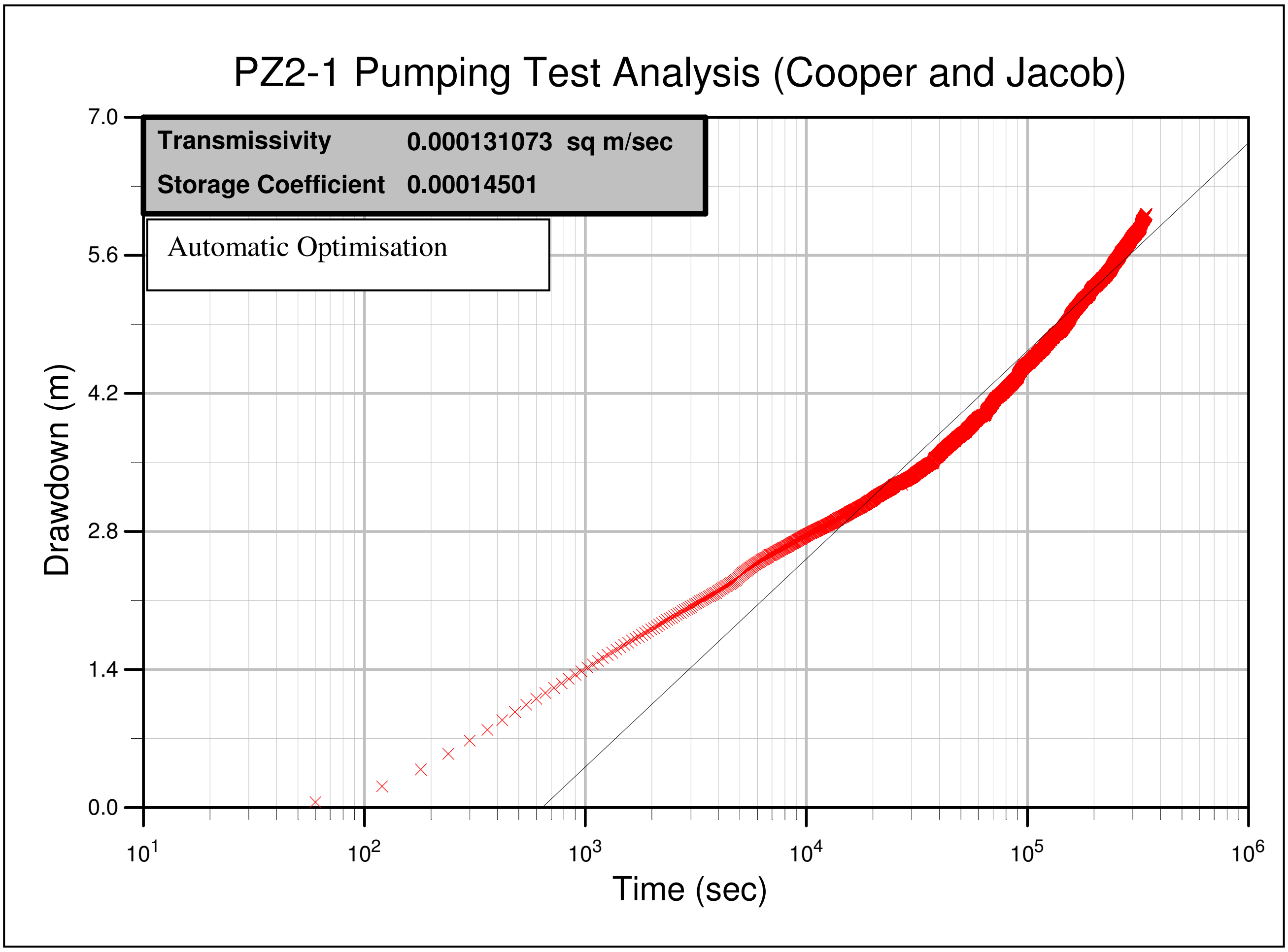
The response to pumping beyond around 40,000 seconds (~ 11 hours) shows increasing drawdown with log time. Under the Cooper-Jacob analysis this is interpreted as a boundary effect.

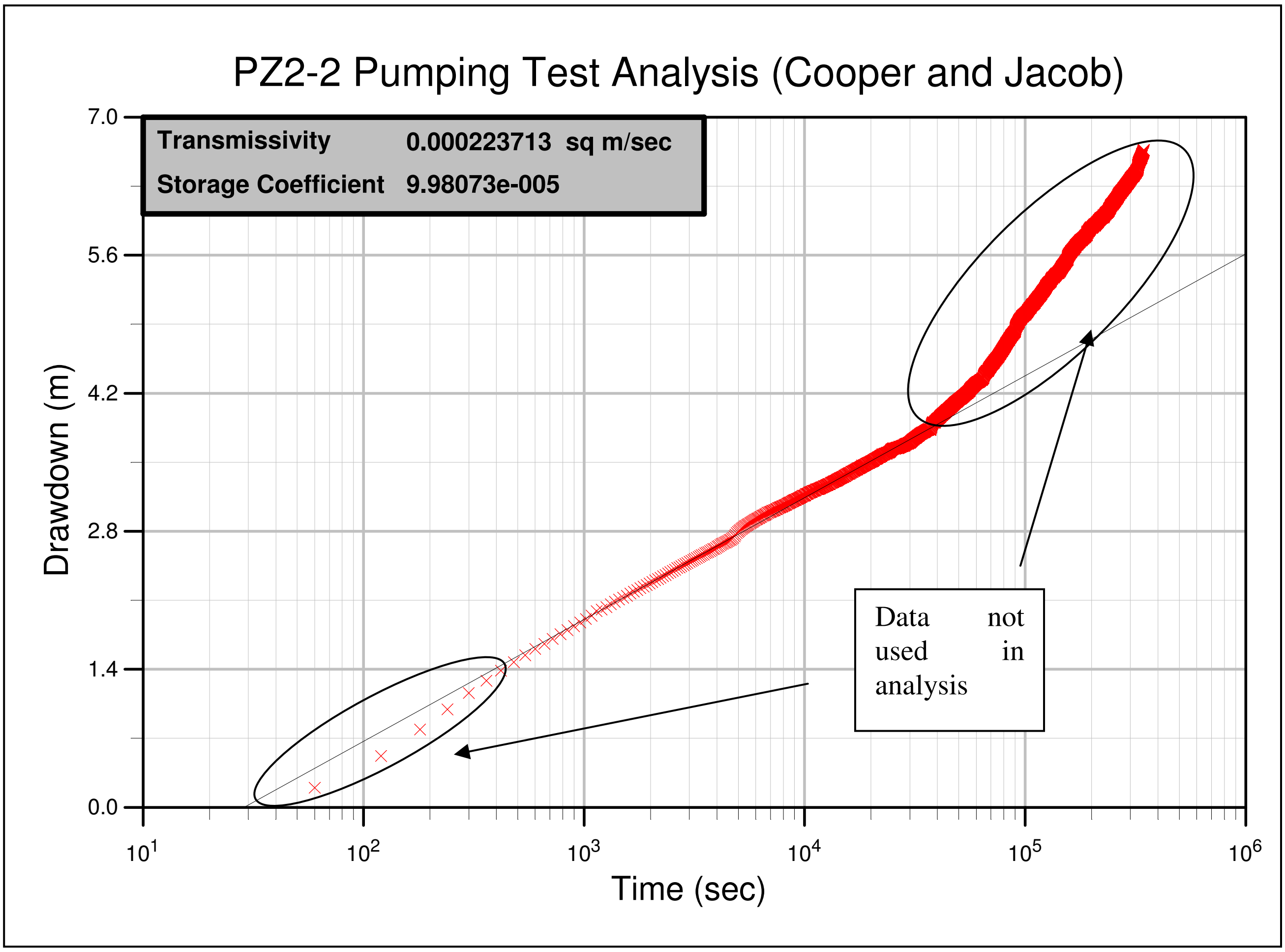
In the recovery analysis there is a strong suggestion that the test is providing an unconfined response, and that this is present to around 10 hours. It is also the case that the pumped well is substantially dewatered during the test, to within only 2-3m of the base of the well.

The dewatering and low water levels in the pumped well should not influence the response seen at observation piezometers, other than a switch to unconfined conditions. Therefore, the presence of a boundary is the most likely interpretation of the pumping response seen. This barrier acts to significantly reduce permeability. It is difficult to be precise in the distance and direction of the boundary, but calculations based on the Cooper-Jacob derived hydraulic properties indicate an approximate distance of 400-600 m (based on a transmissivity of 2.5×10^{-4} m^2/s and storage 5×10^{-4}). The direction of the boundary is not clear. The exact nature of the boundary is unknown, but it could be related to thinning of the formation to the south or indicate a fault.

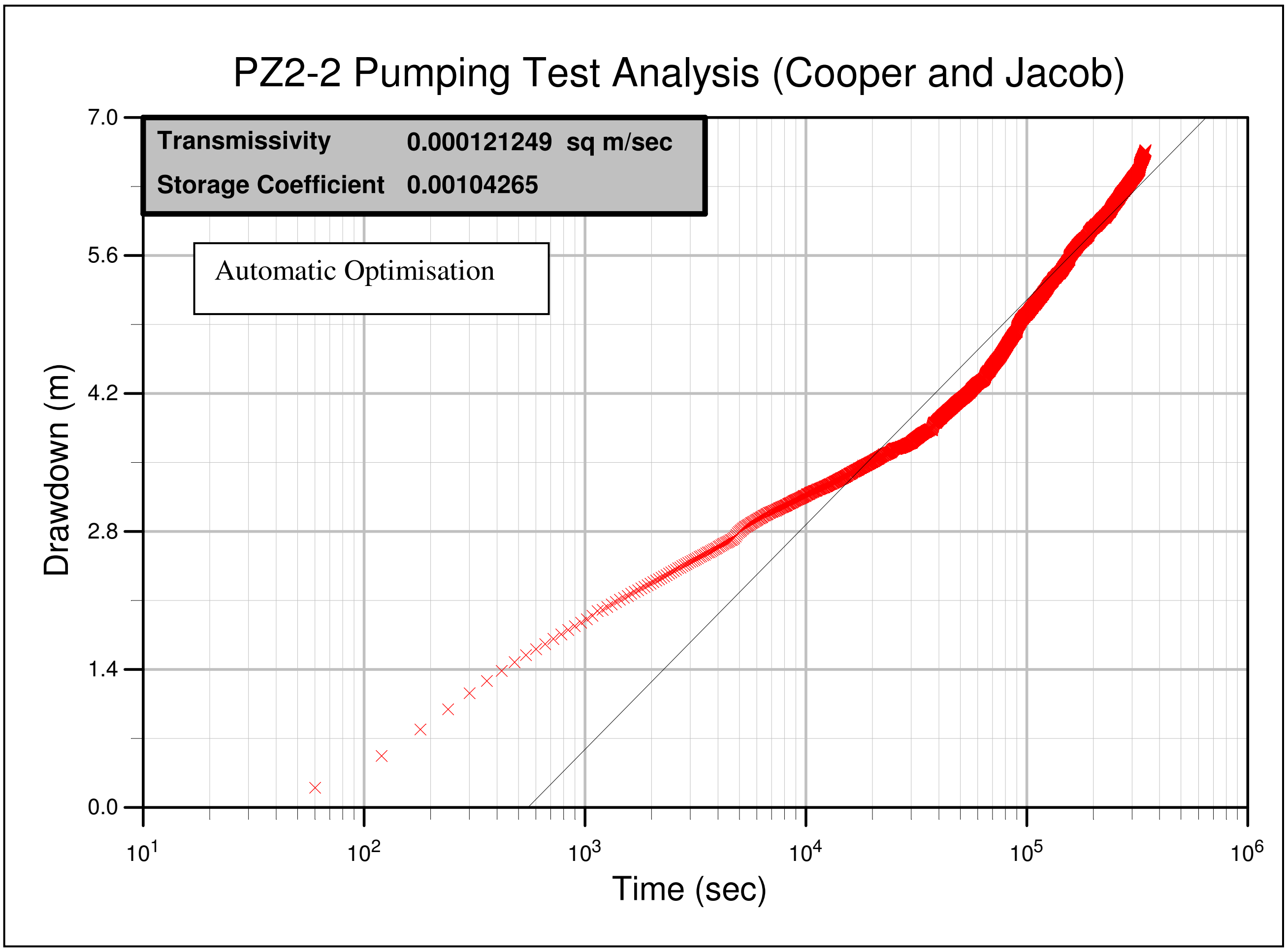
Appendix A
Cooper-Jacob Analysis Figures


PZ2-1 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000210667 sq m/sec
Storage Coefficient 2.92794e-005
Data not included in analysis
Drawdown (m)
Time (sec)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6

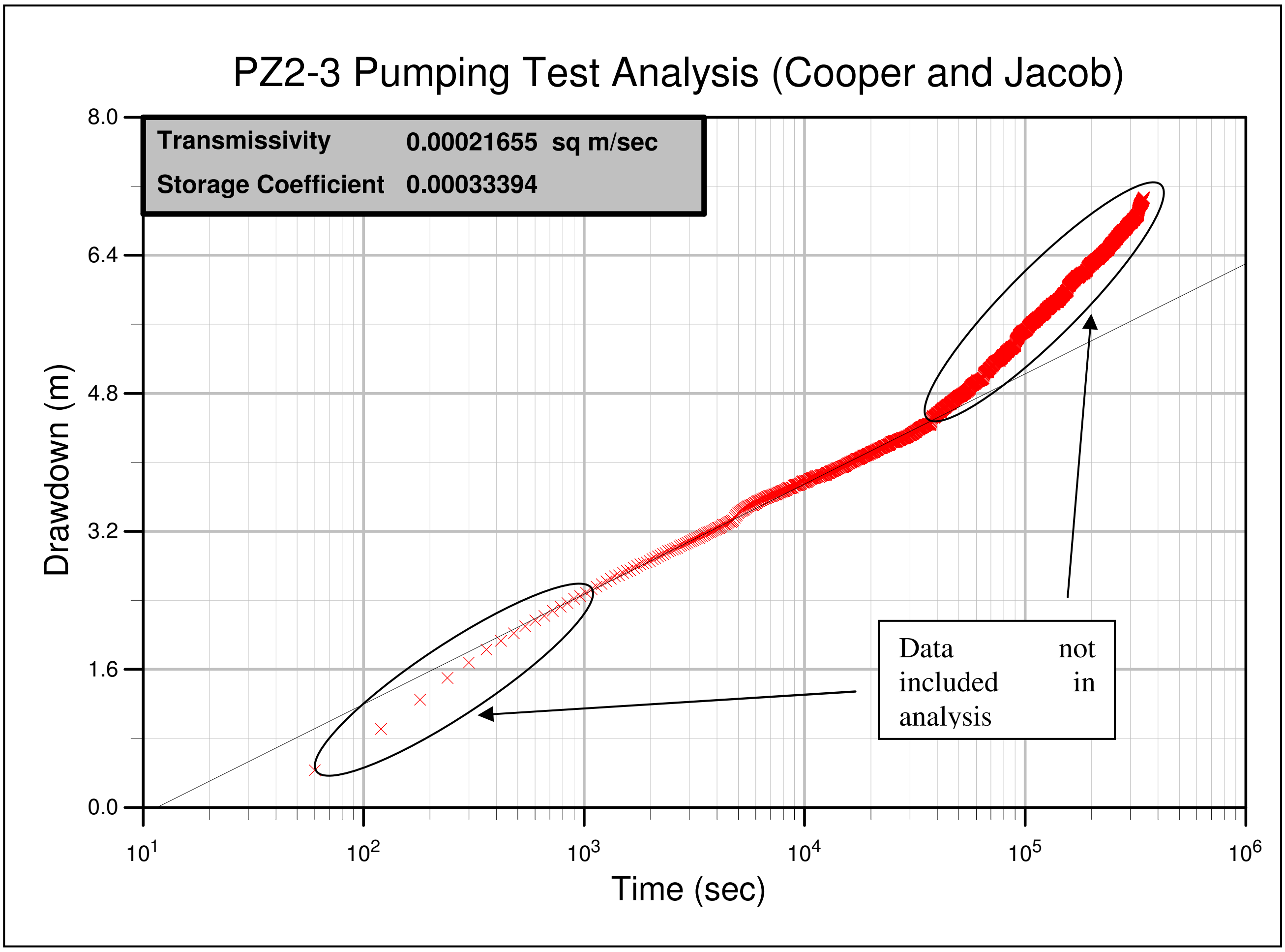

PZ2-1 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000131073 sq m/sec
Storage Coefficient 0.00014501
Automatic Optimisation
Drawdown (m)
Time (sec)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6

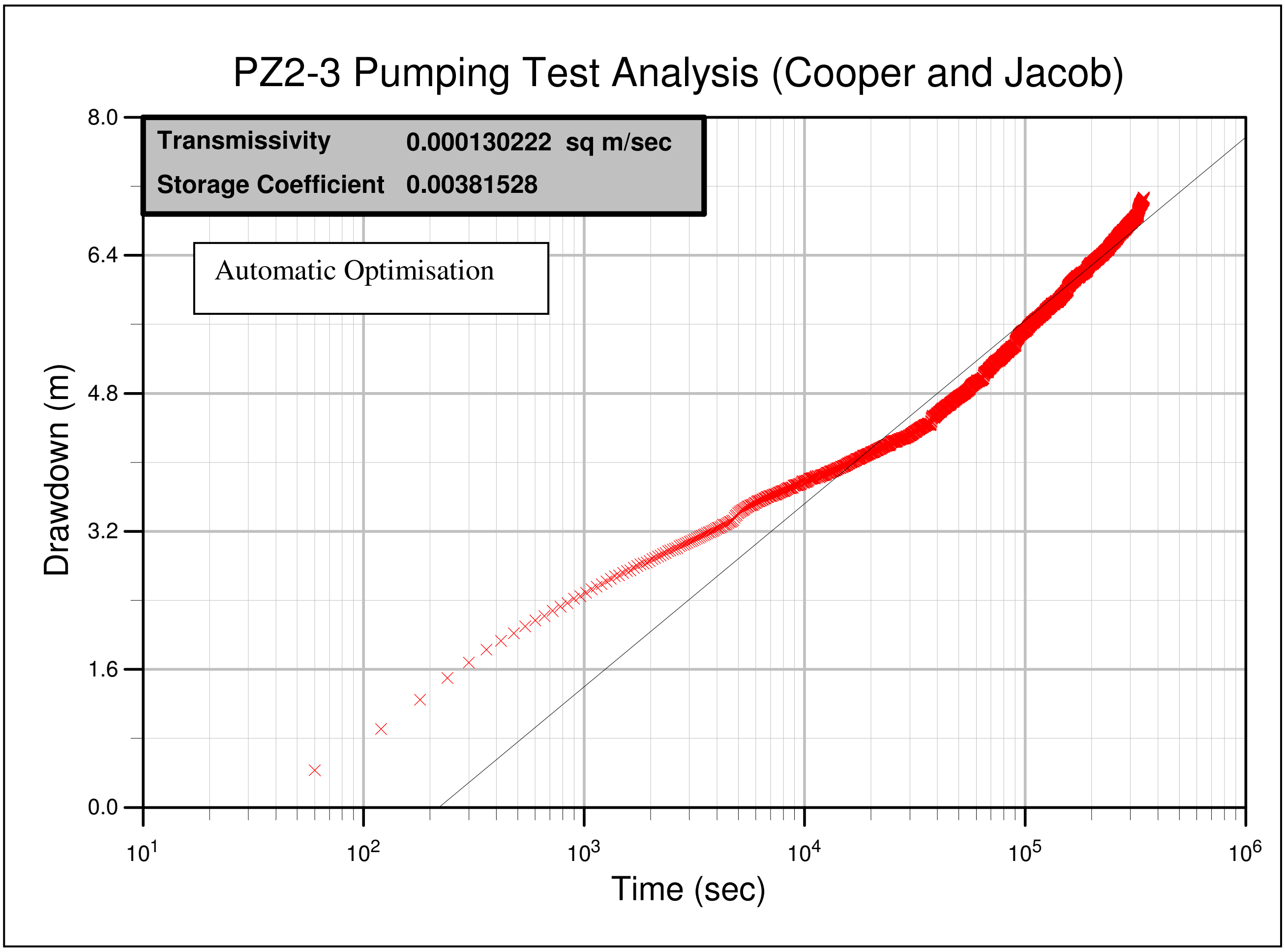


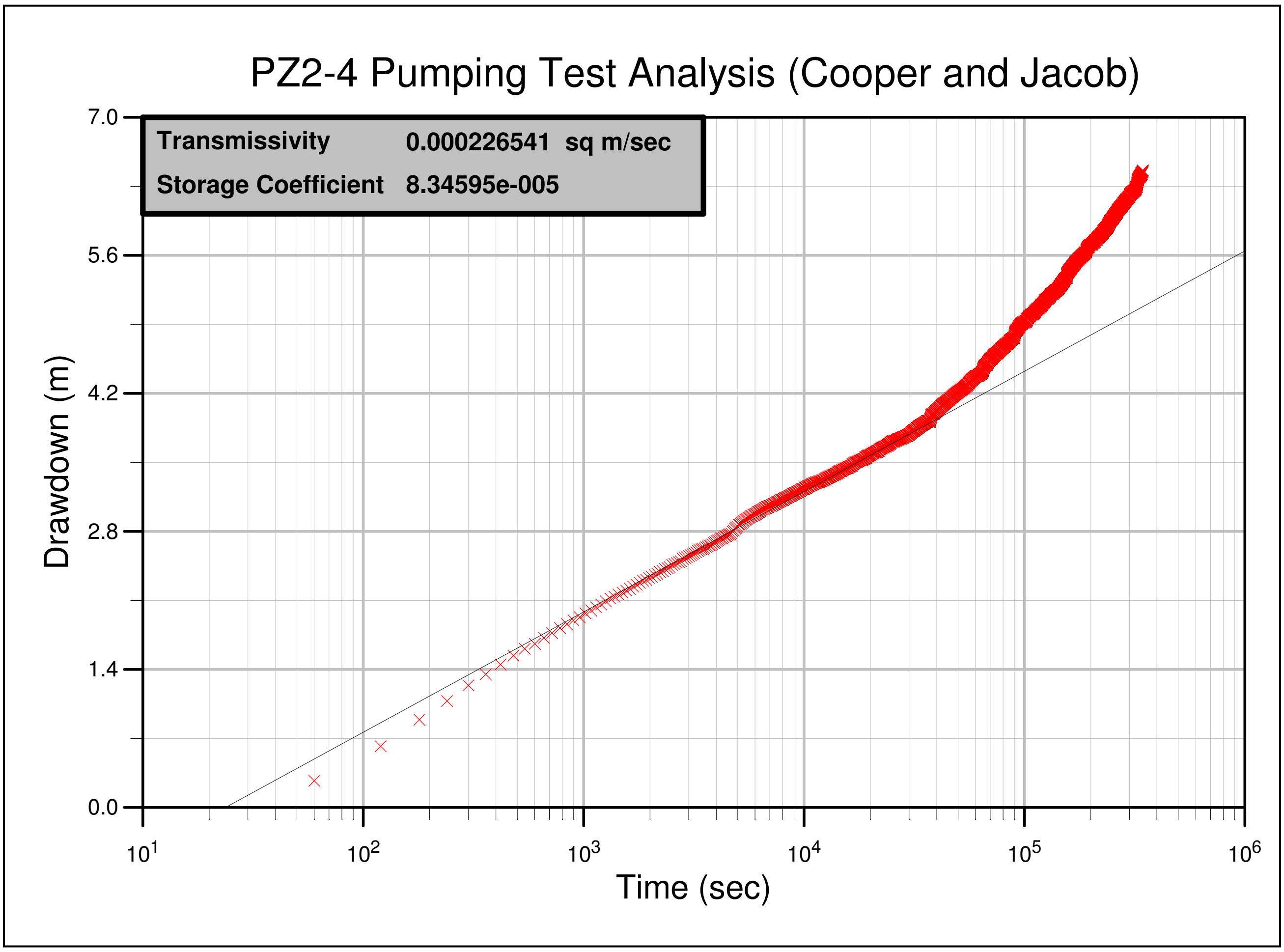
PZ2-2 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000223713 sq m/sec
Storage Coefficient 9.98073e-005
Data not used in analysis
Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)



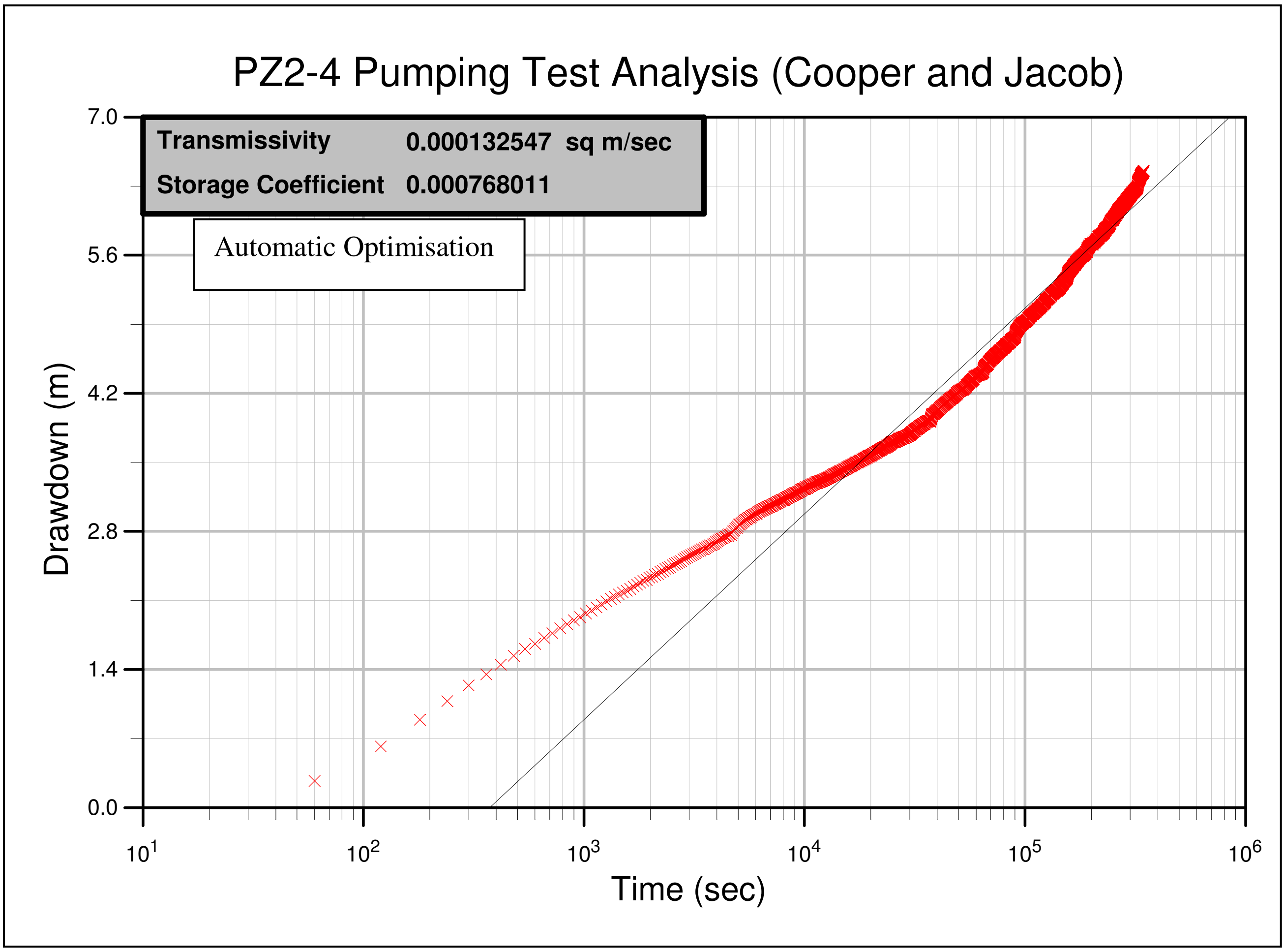
PZ2-2 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000121249 sq m/sec
Storage Coefficient 0.00104265
Automatic Optimisation
Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)


PZ2-3 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.00021655 sq m/sec
Storage Coefficient 0.00033394
Data not included in analysis
Drawdown (m)
Time (sec)
8.0
6.4
4.8
3.2
1.6
0.0
10^1
10^2
10^3
10^4
10^5
10^6

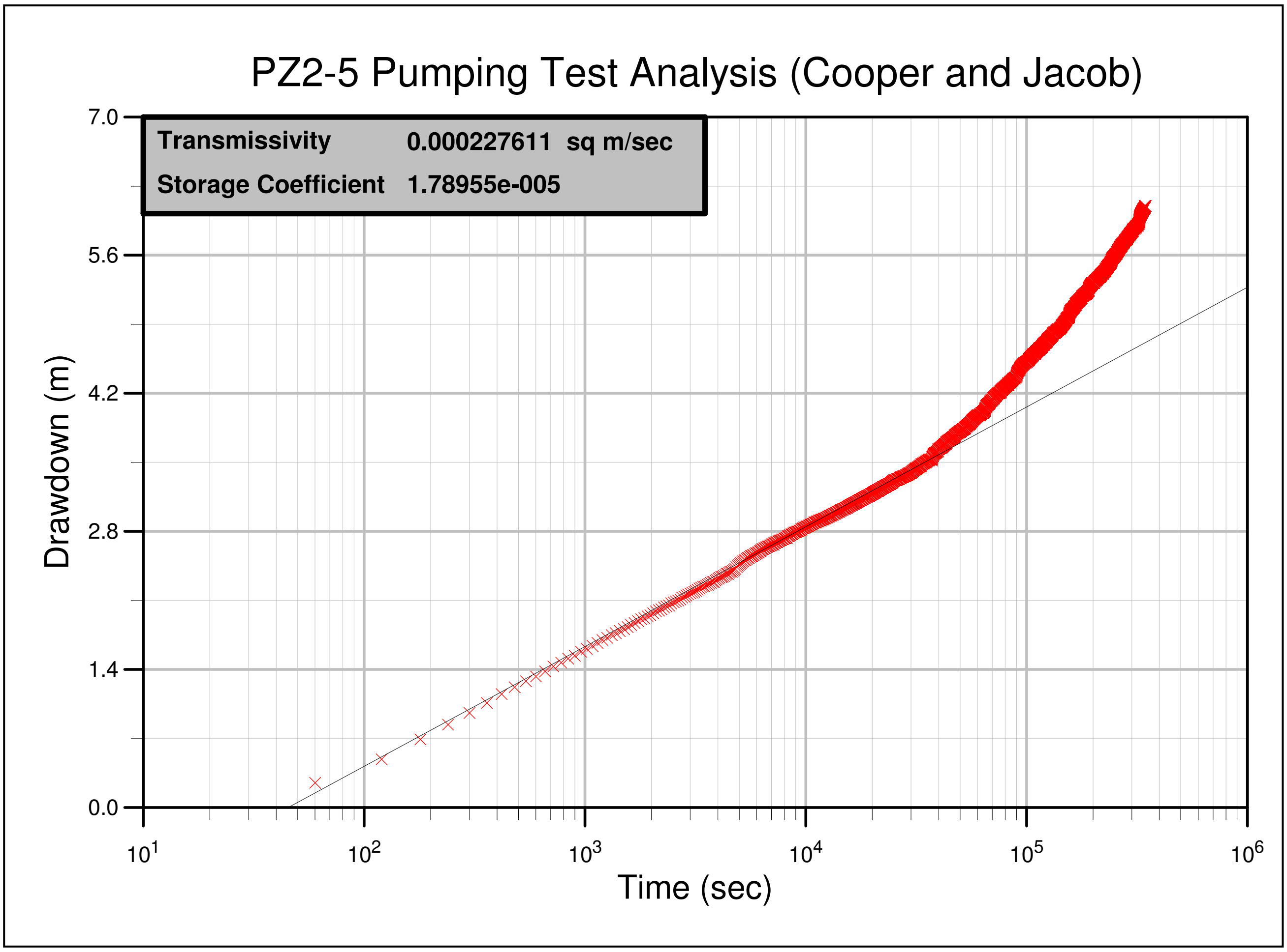

PZ2-3 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000130222 sq m/sec
Storage Coefficient 0.00381528
Automatic Optimisation
Drawdown (m)
Time (sec)
8.0
6.4
4.8
3.2
1.6
0.0
10^1
10^2
10^3
10^4
10^5
10^6



PZ2-4 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000226541 sq m/sec
Storage Coefficient 8.34595e-005
Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)



PZ2-4 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000132547 sq m/sec
Storage Coefficient 0.000768011
Automatic Optimisation
Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)


PZ2-5 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000227611 sq m/sec
Storage Coefficient 1.78955e-005
Drawdown (m)
7.0
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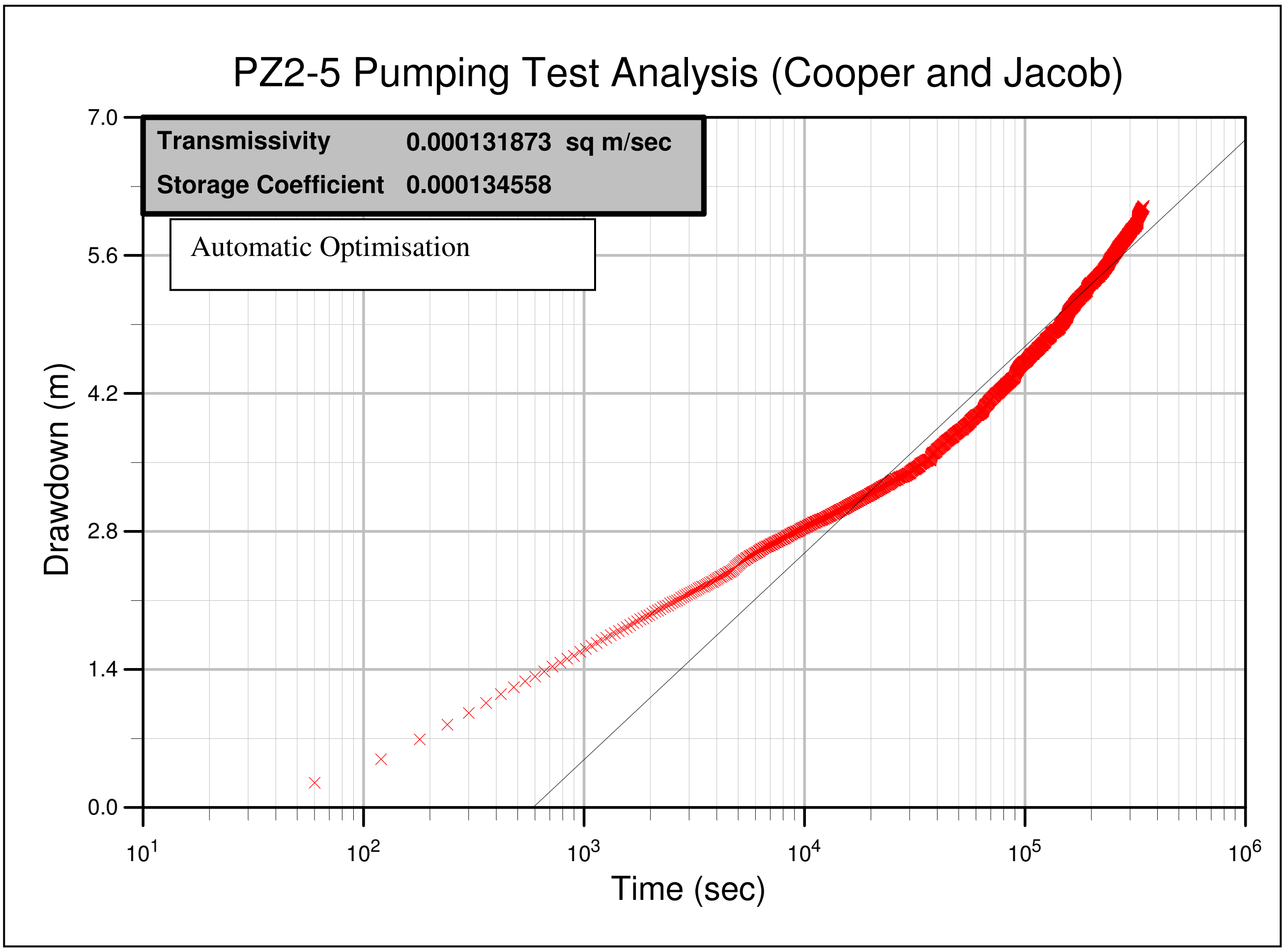
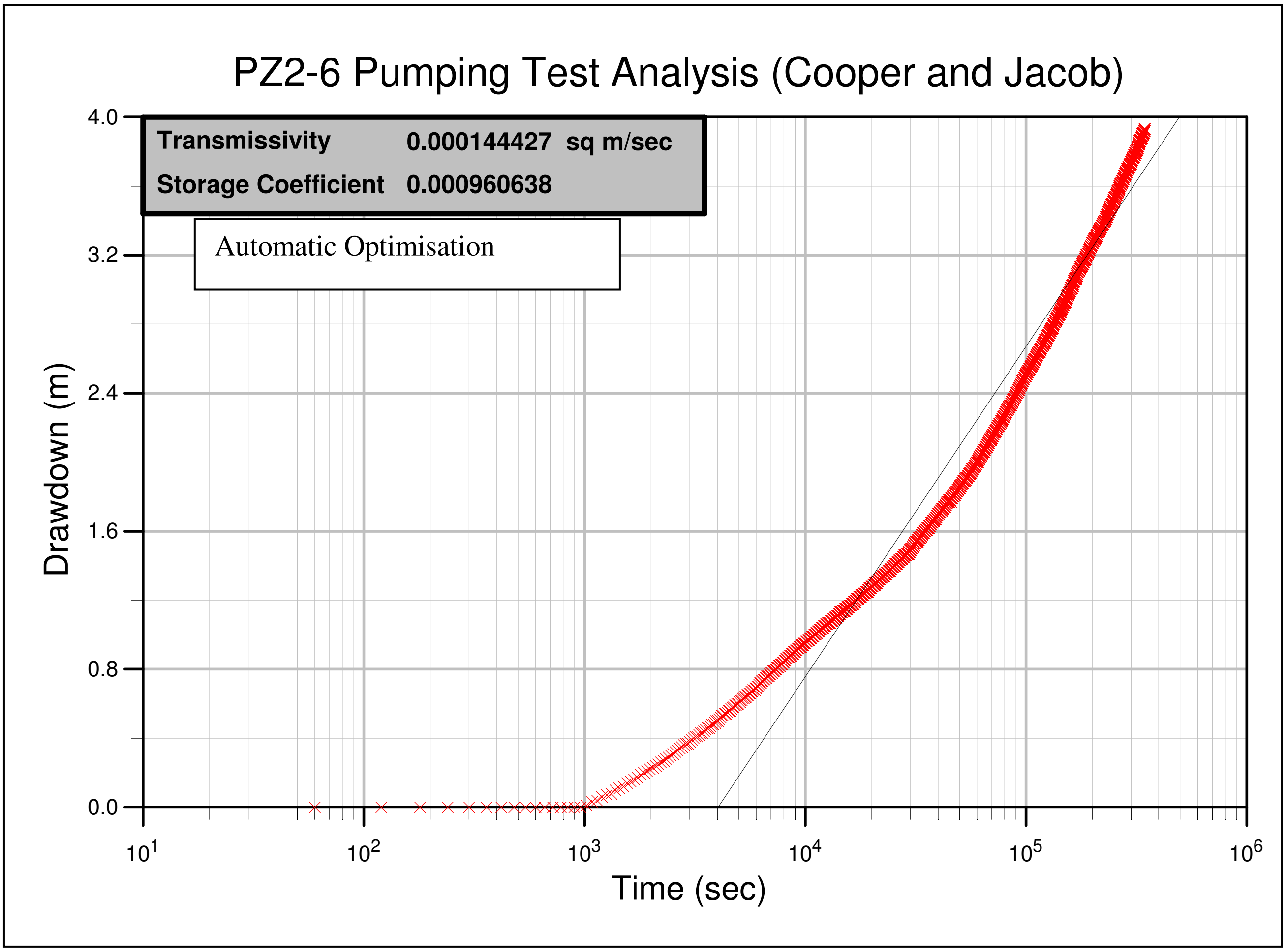
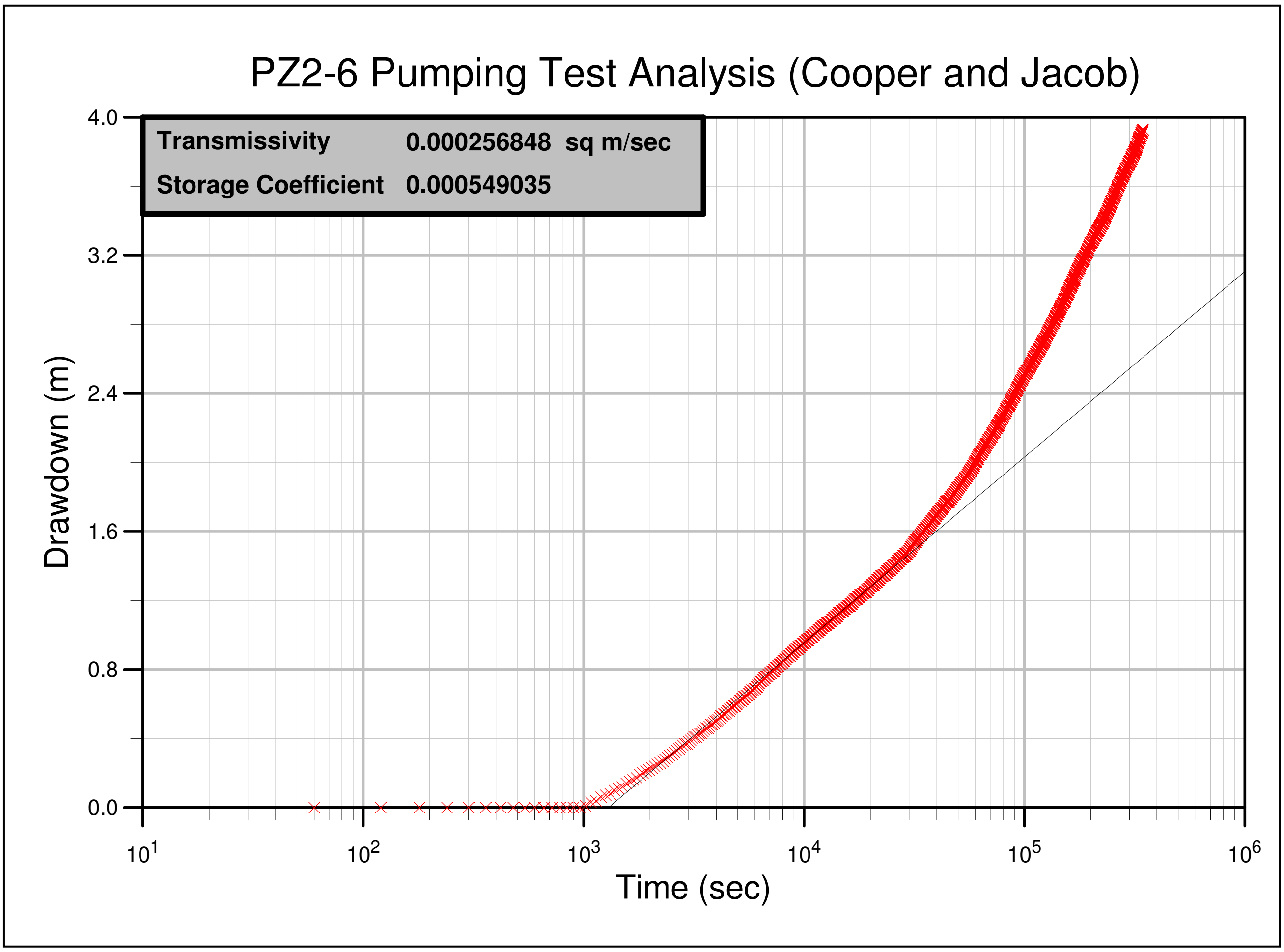
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)

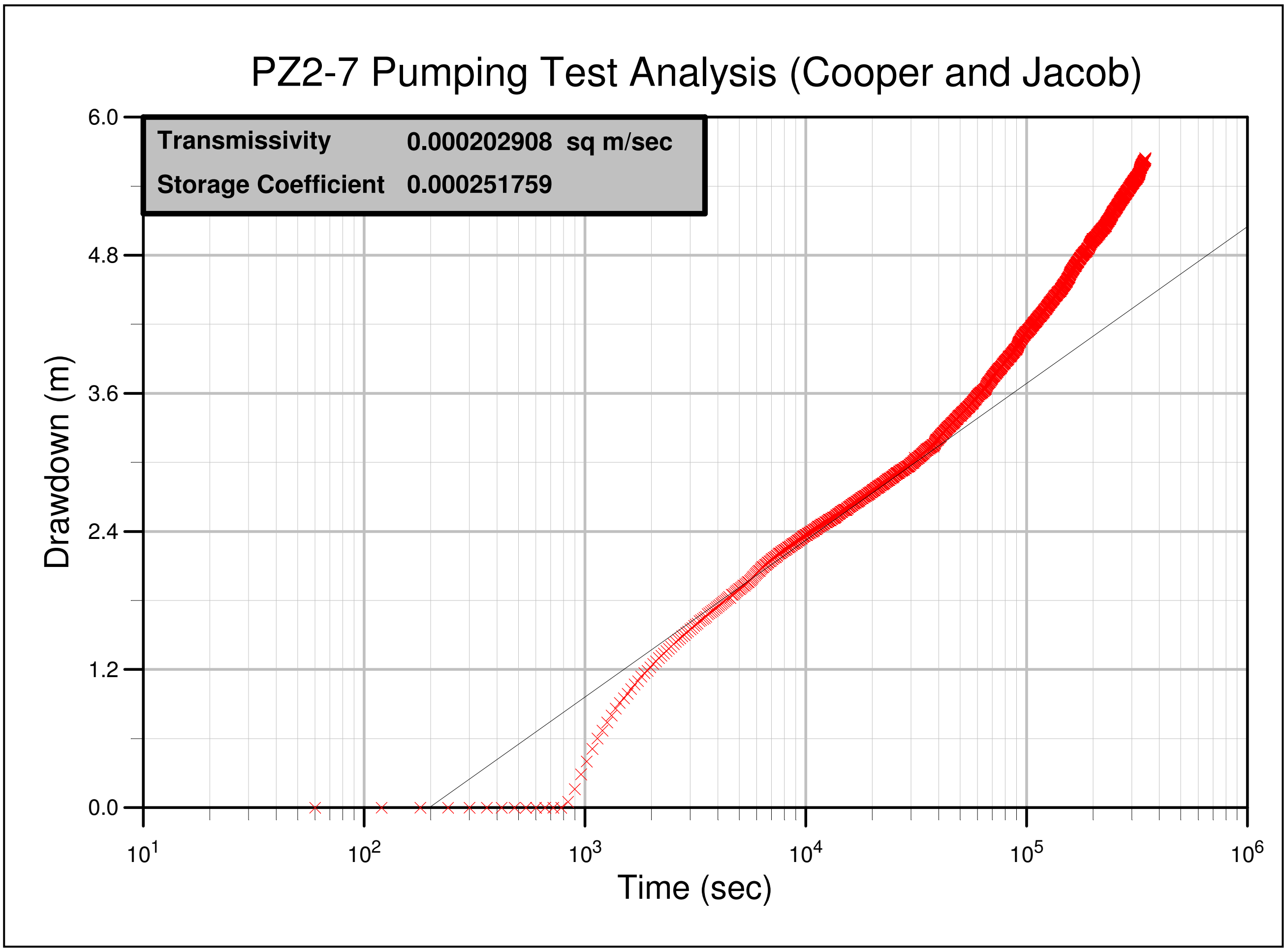

PZ2-5 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000131873 sq m/sec
Storage Coefficient 0.000134558
Automatic Optimisation
Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)



PZ2-6 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000144427 sq m/sec
Storage Coefficient 0.000960638
Automatic Optimisation
Drawdown (m)
Time (sec)



PZ2-6 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000256848 sq m/sec
Storage Coefficient 0.000549035
Drawdown (m)
Time (sec)


PZ2-7 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000202908 sq m/sec
Storage Coefficient 0.000251759
Drawdown (m)
Time (sec)
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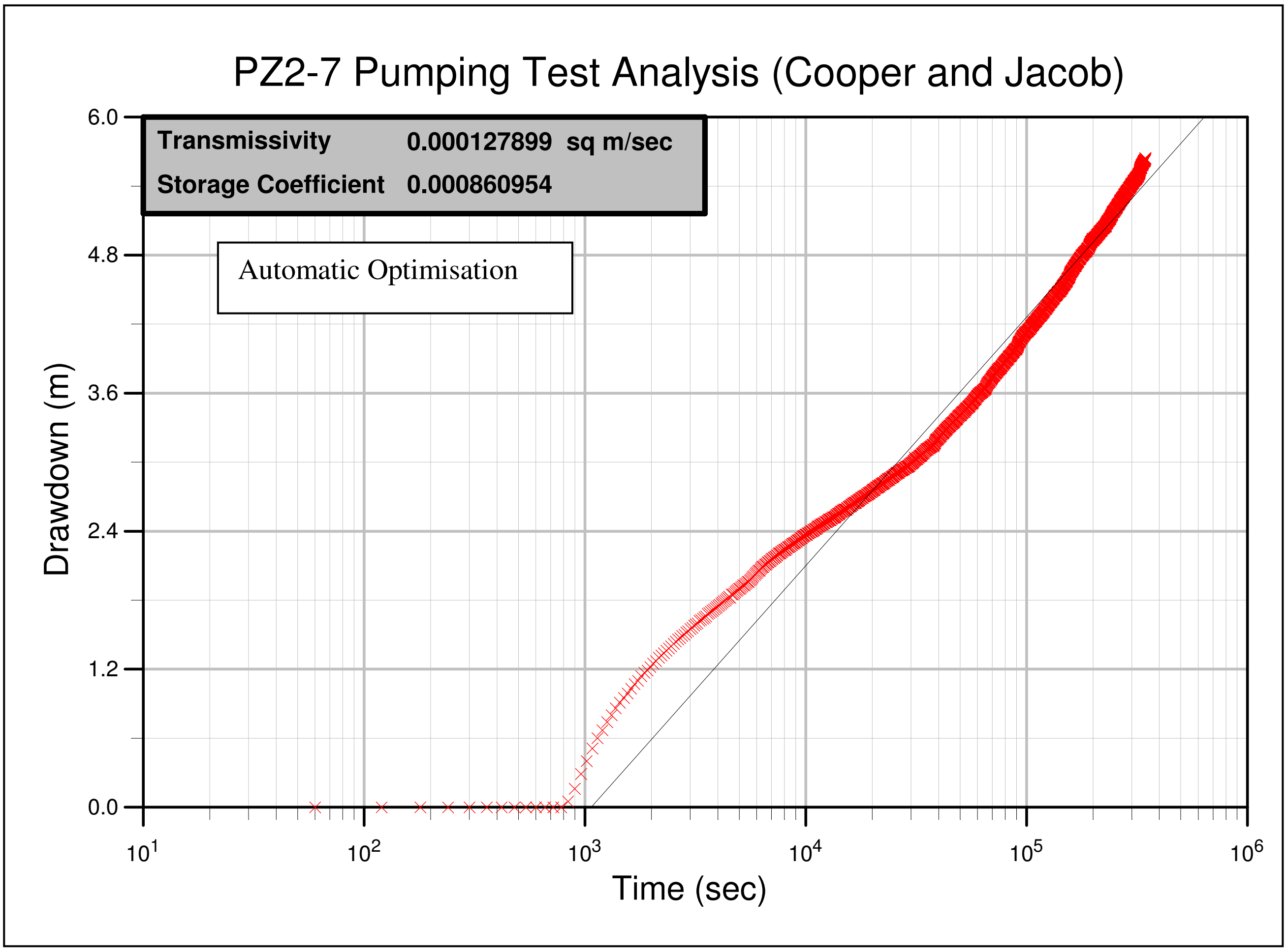
3.6
2.4
1.2
0.0
10^1
10^2
10^3
10^4
10^5
10^6


PZ2-7 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000127899 sq m/sec
Storage Coefficient 0.000860954
Automatic Optimisation
Drawdown (m)
Time (sec)
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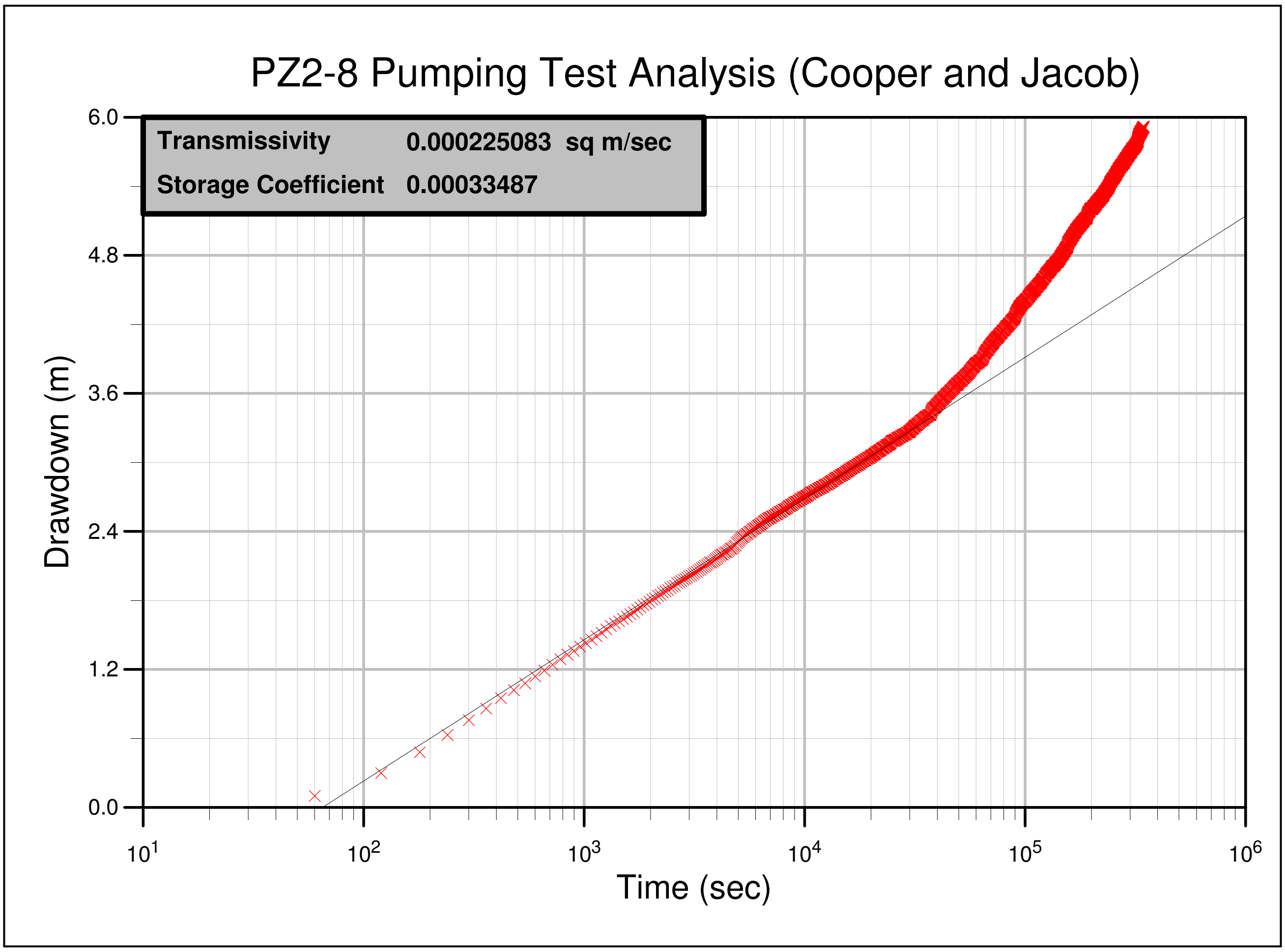
4.8
3.6
2.4
1.2
0.0
10^1
10^2
10^3
10^4
10^5
10^6


PZ2-8 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000225083 sq m/sec
Storage Coefficient 0.00033487
Drawdown (m)
6.0
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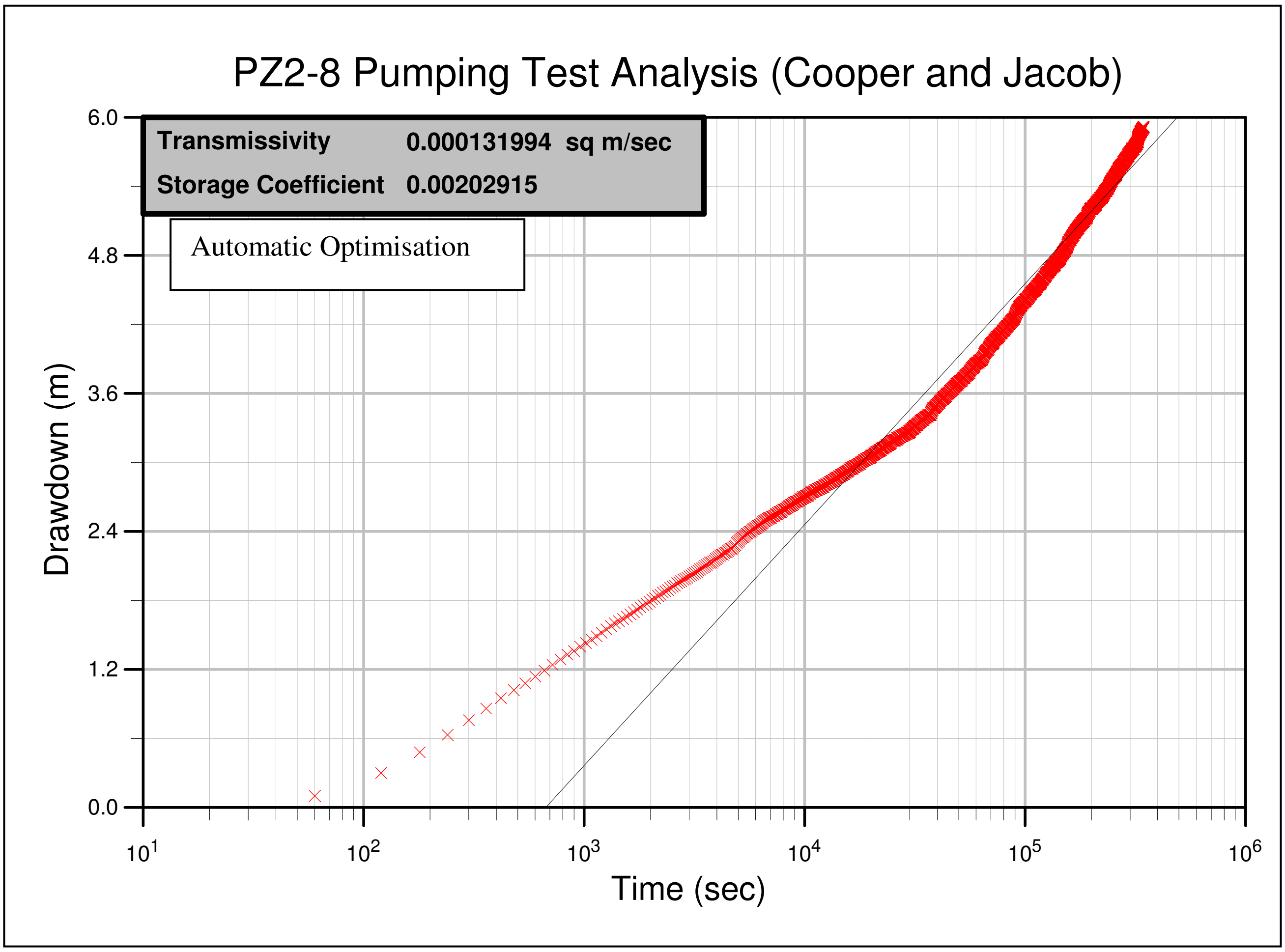
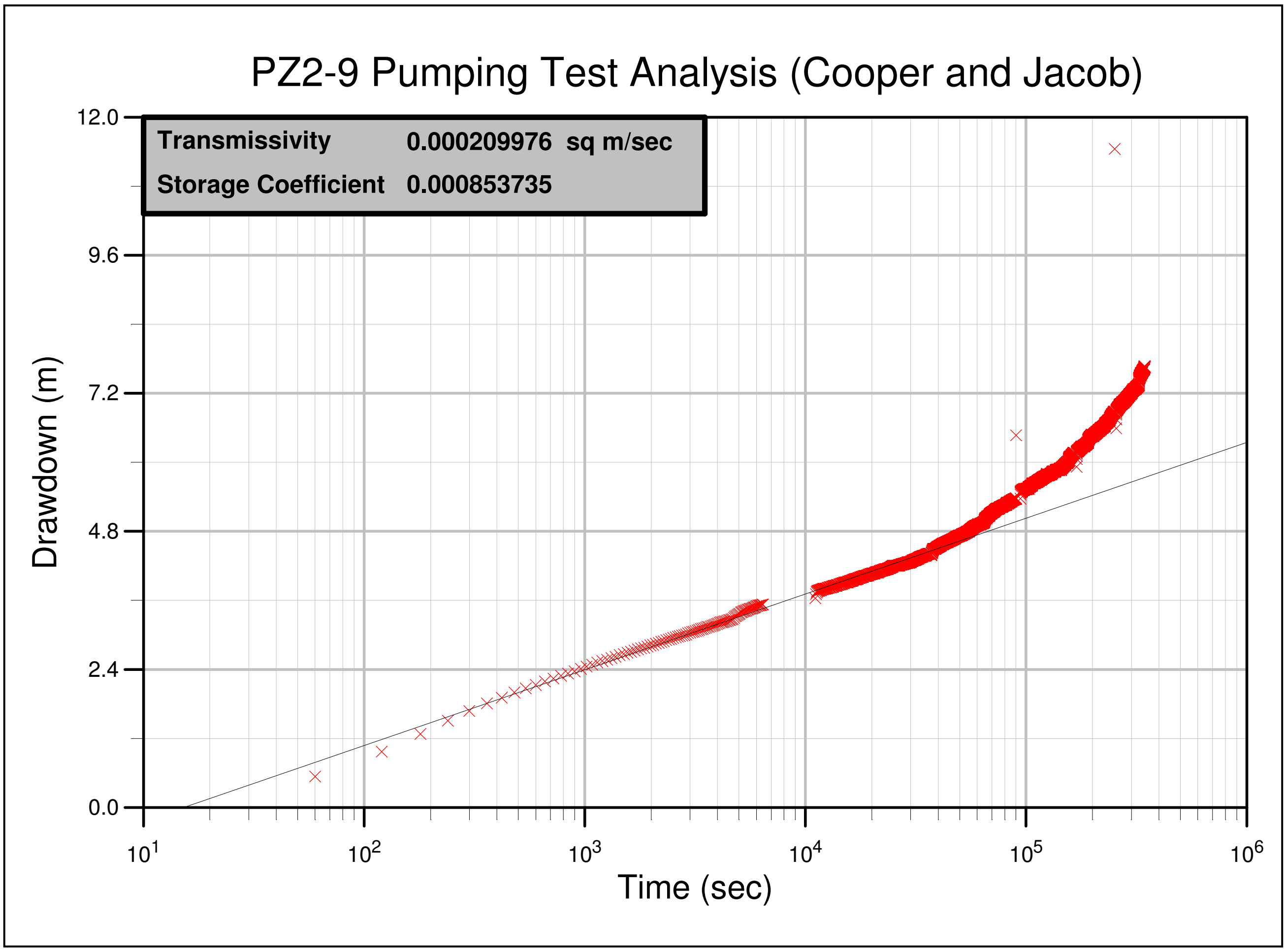
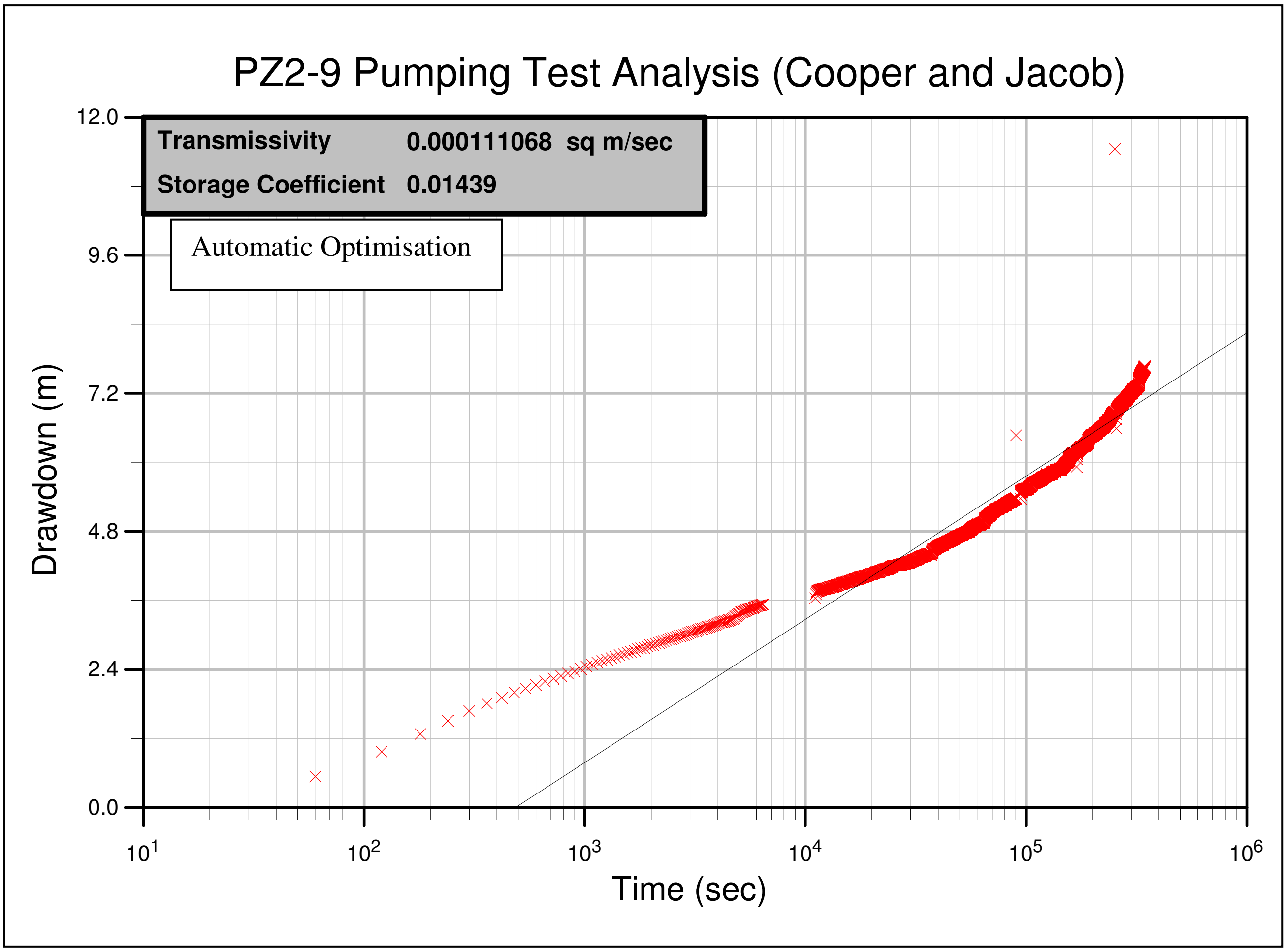
3.6
2.4
1.2
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)


PZ2-8 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000131994 sq m/sec
Storage Coefficient 0.00202915
Automatic Optimisation
Drawdown (m)
6.0
4.8
3.6
2.4
1.2
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)


PZ2-9 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000209976 sq m/sec
Storage Coefficient 0.000853735
Drawdown (m)
Time (sec)
12.0
9.6
7.2
4.8
2.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6


PZ2-9 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000111068 sq m/sec
Storage Coefficient 0.01439
Automatic Optimisation
Drawdown (m)
Time (sec)
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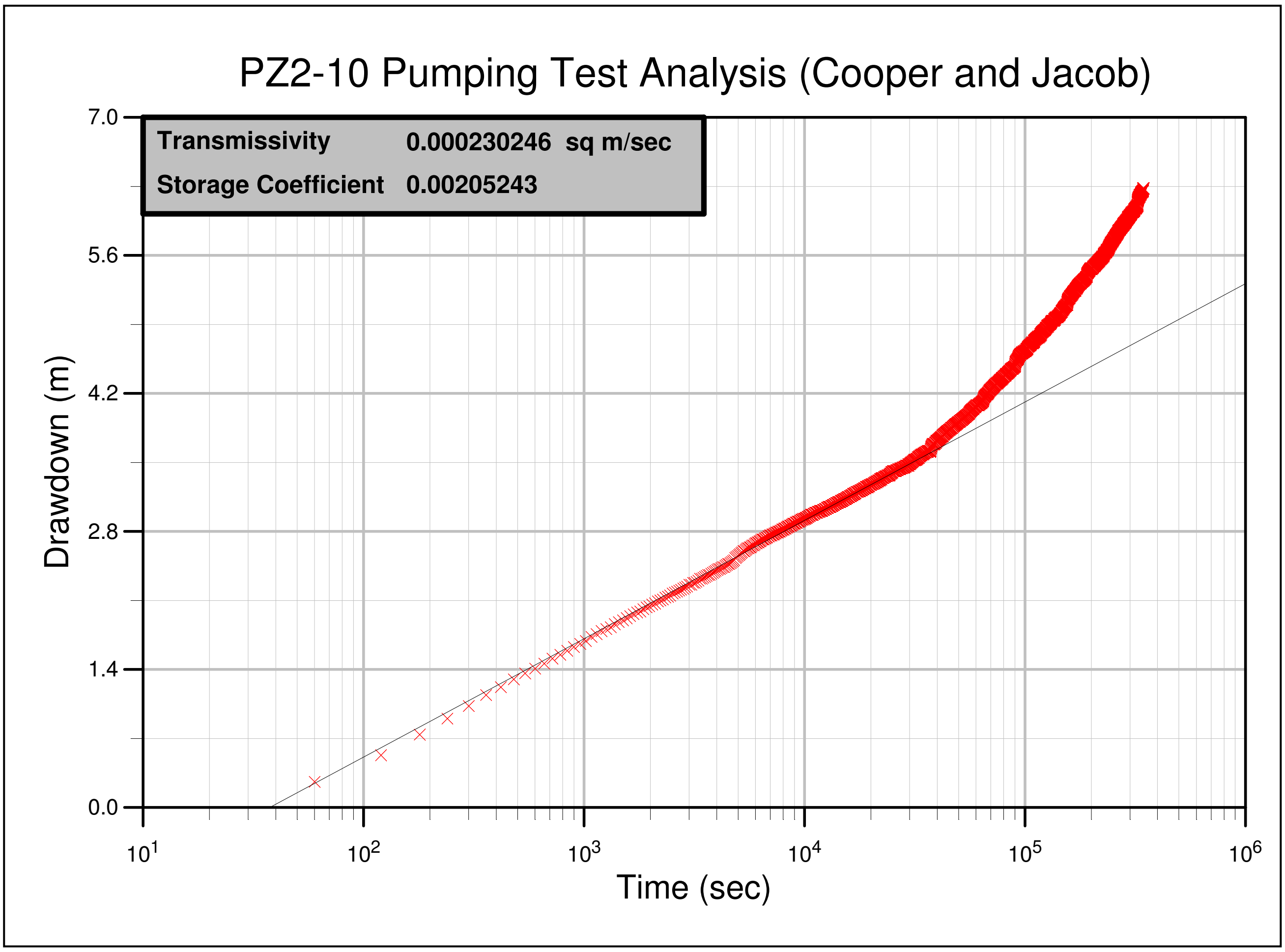
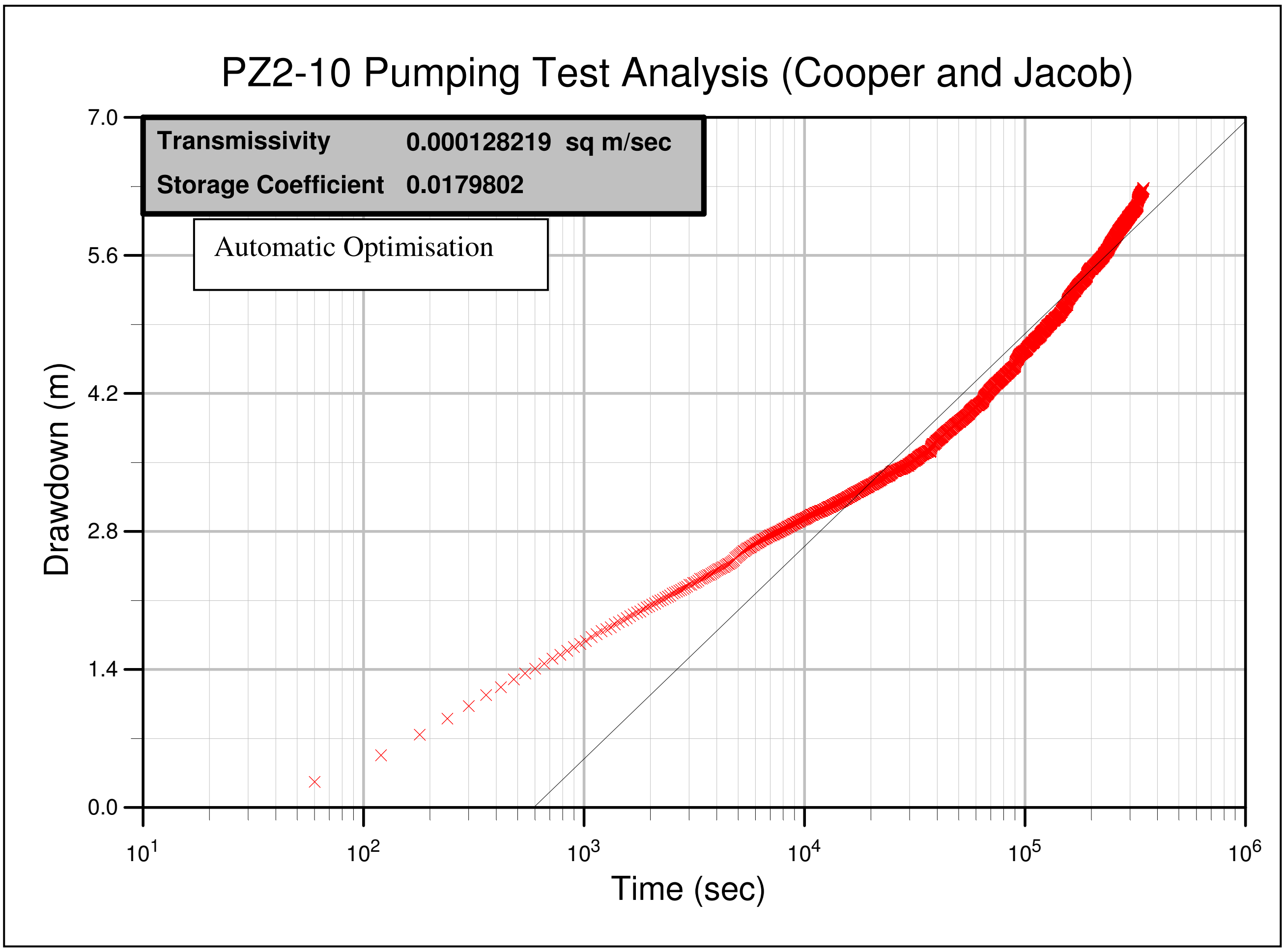
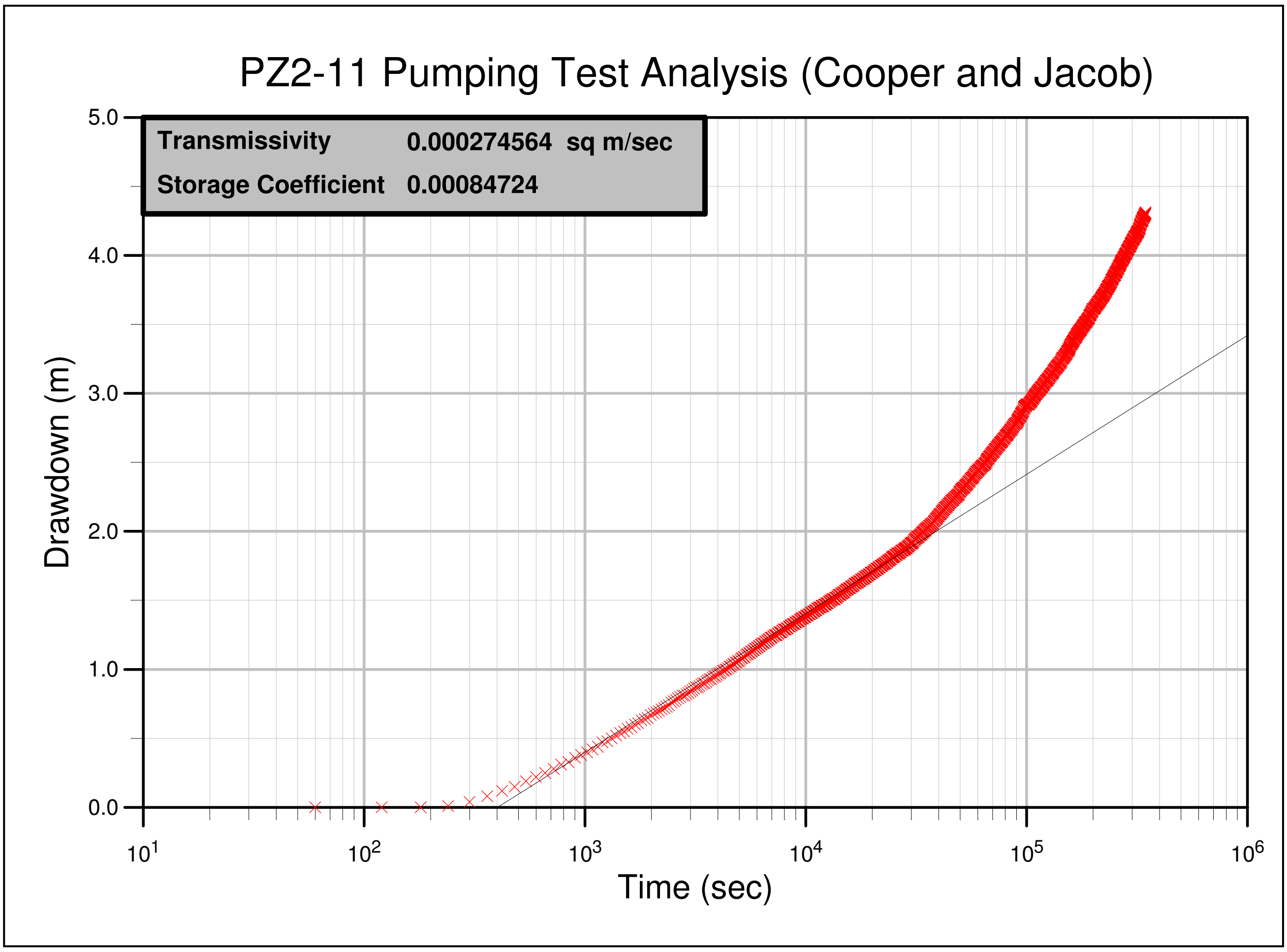
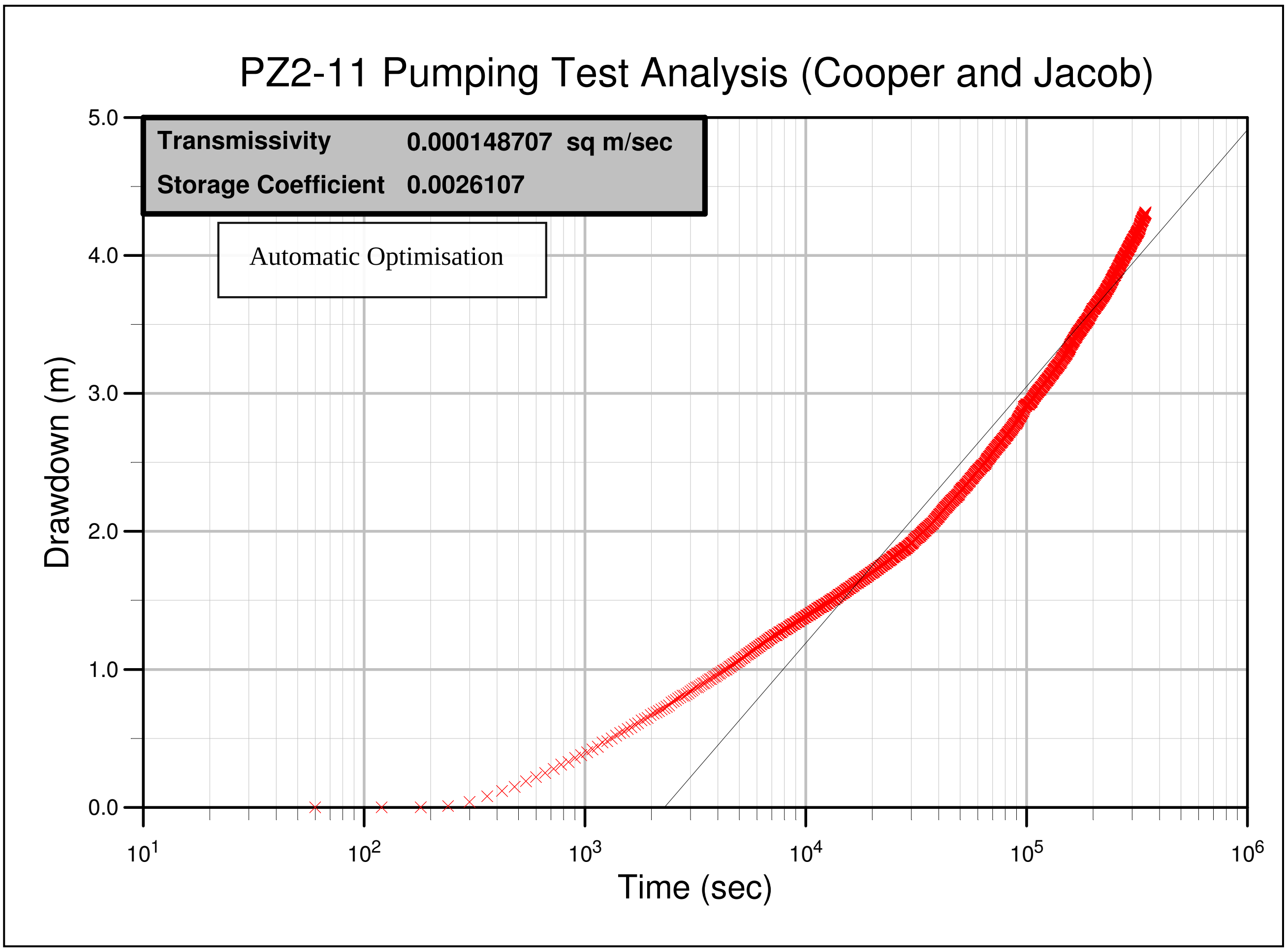
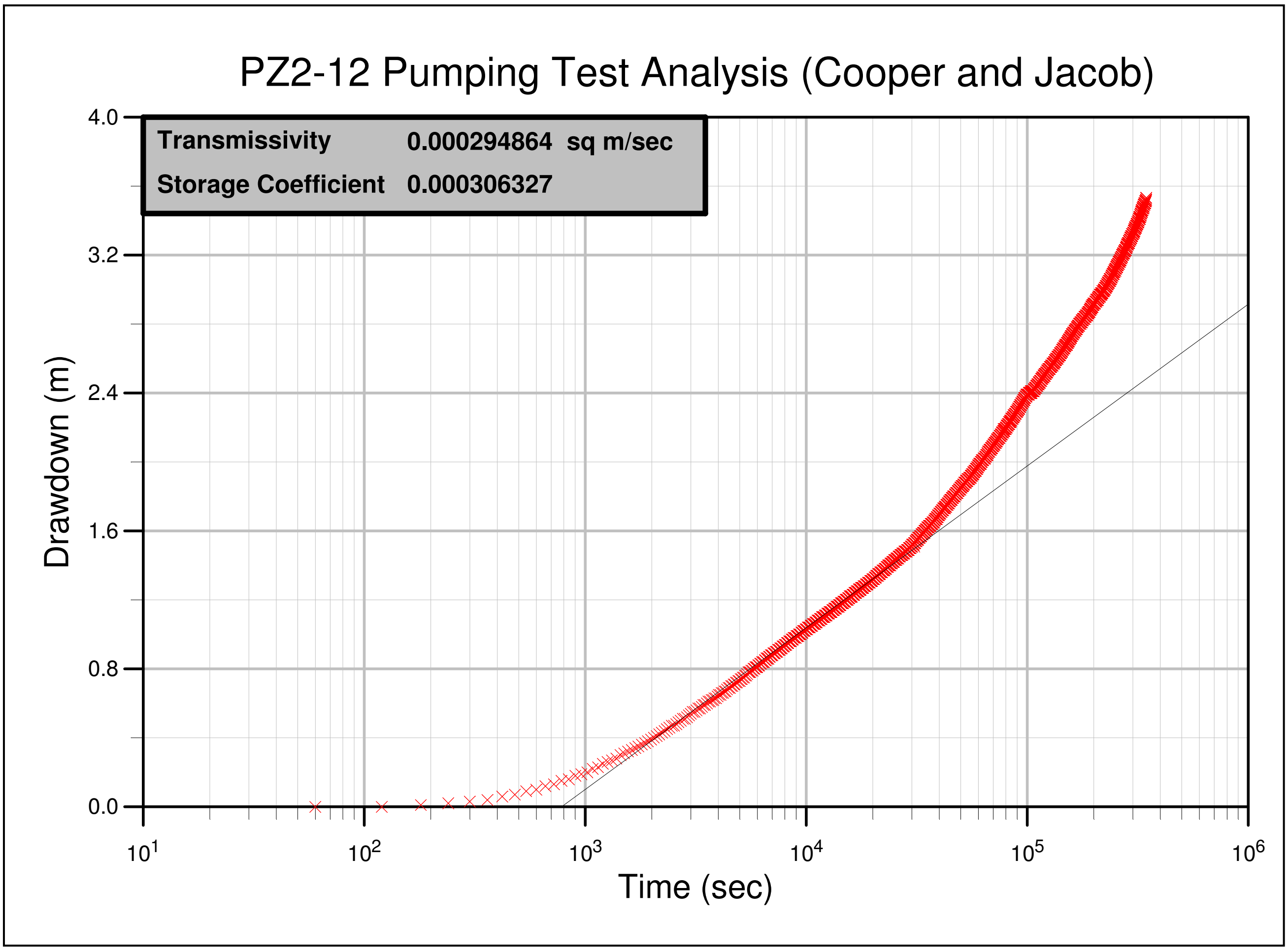
9.6
7.2
4.8
2.4
0.0
10^1
10^2
10^3
10^4
10^5
10^6

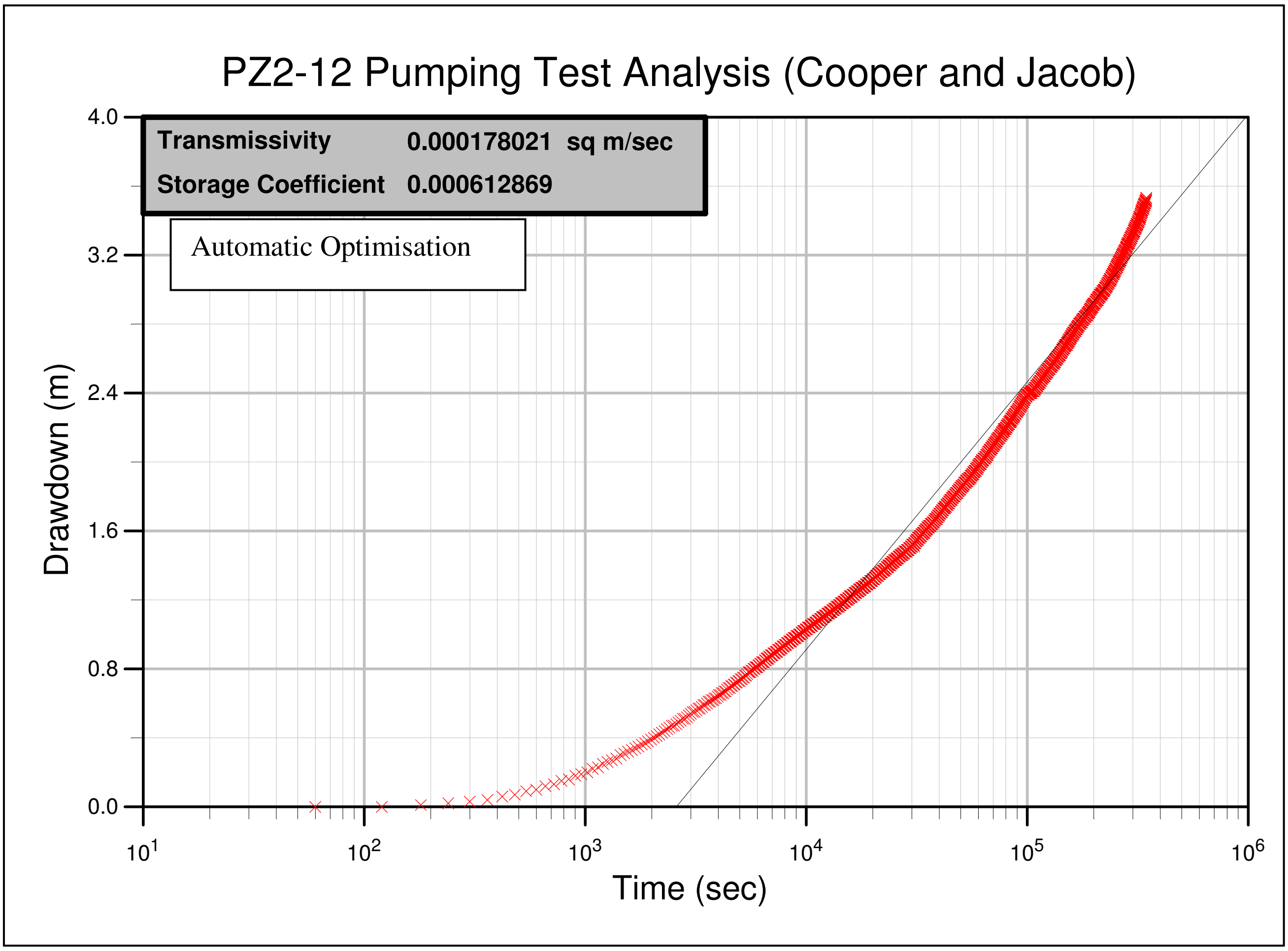

PZ2-10 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000230246 sq m/sec
Storage Coefficient 0.00205243
Drawdown (m)
Time (sec)


PZ2-10 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000128219 sq m/sec
Storage Coefficient 0.0179802
Automatic Optimisation
Drawdown (m)
Time (sec)

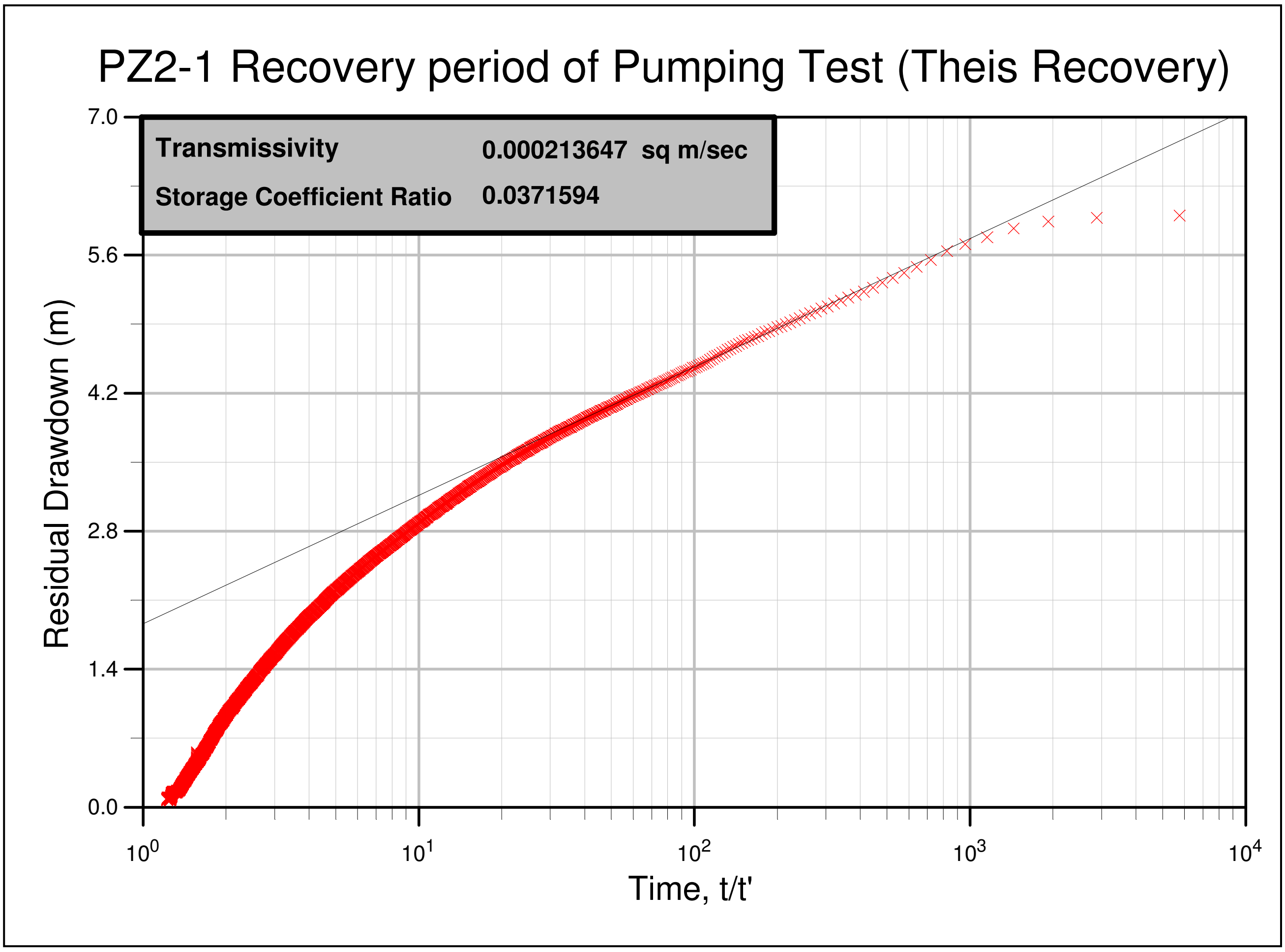

PZ2-11 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000274564 sq m/sec
Storage Coefficient 0.00084724
Drawdown (m)
Time (sec)

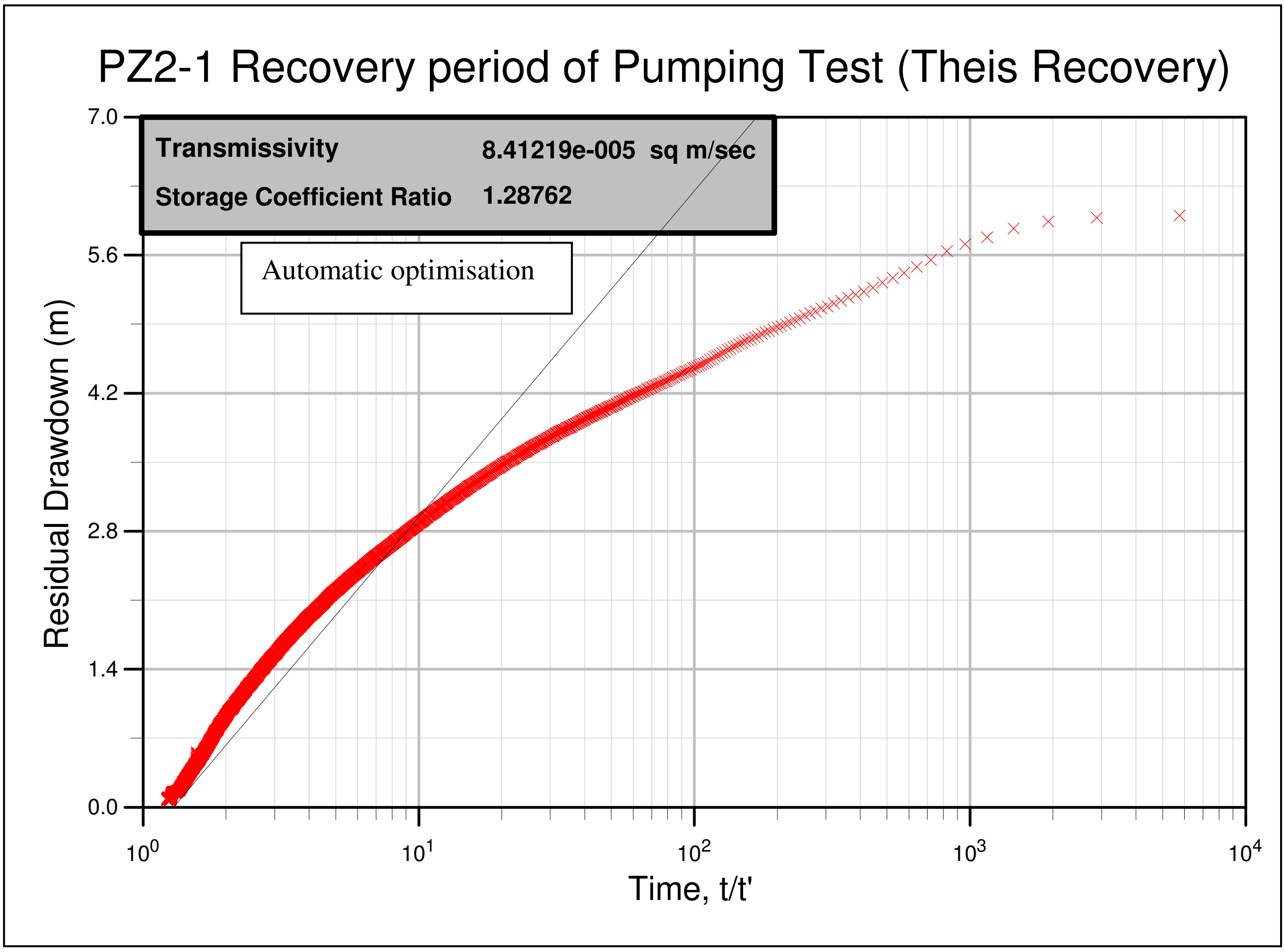

PZ2-11 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000148707 sq m/sec
Storage Coefficient 0.0026107
Automatic Optimisation
Drawdown (m)
Time (sec)

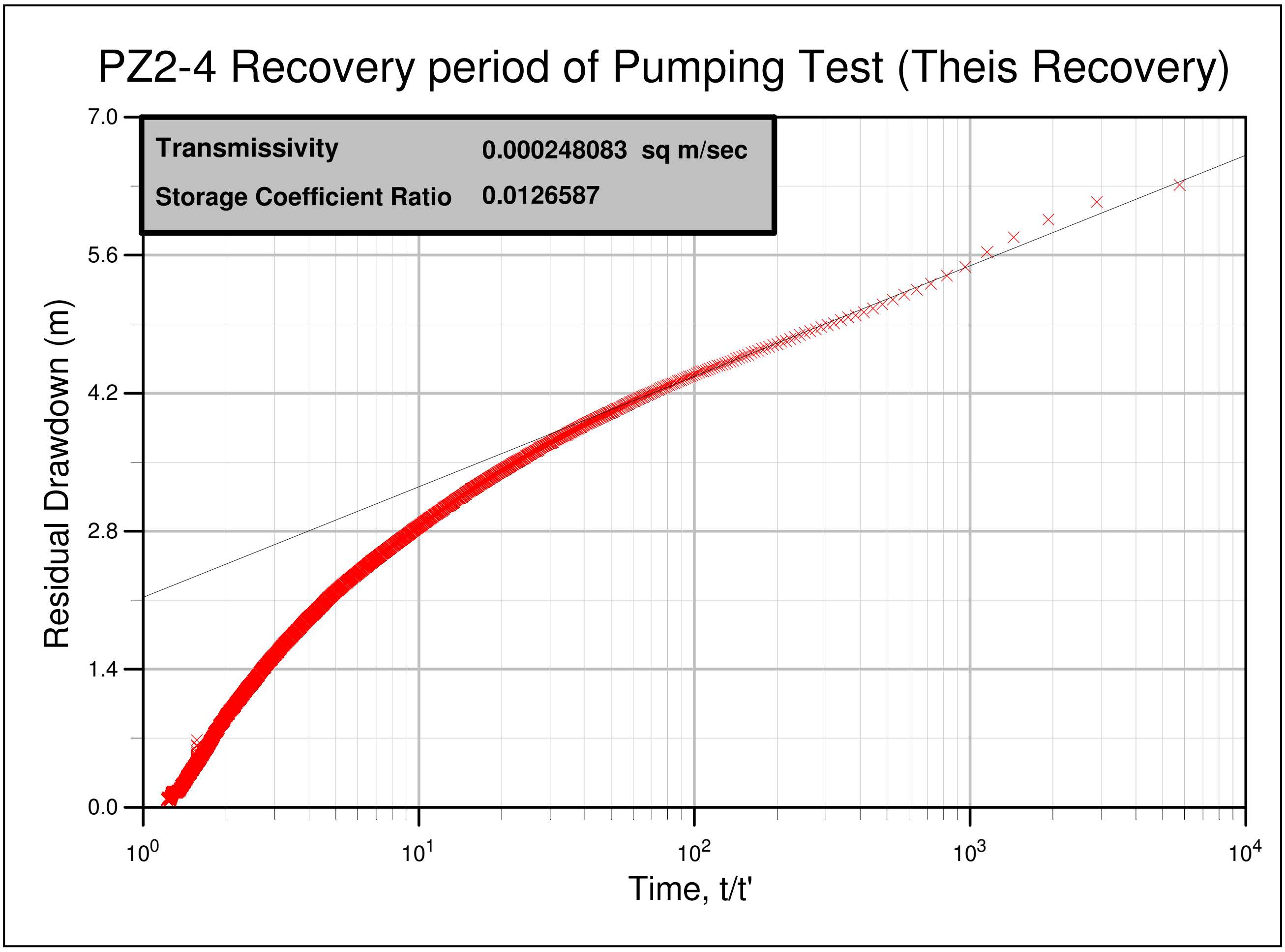

PZ2-12 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000294864 sq m/sec
Storage Coefficient 0.000306327
Drawdown (m)
4.0
3.2
2.4
1.6
0.8
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)

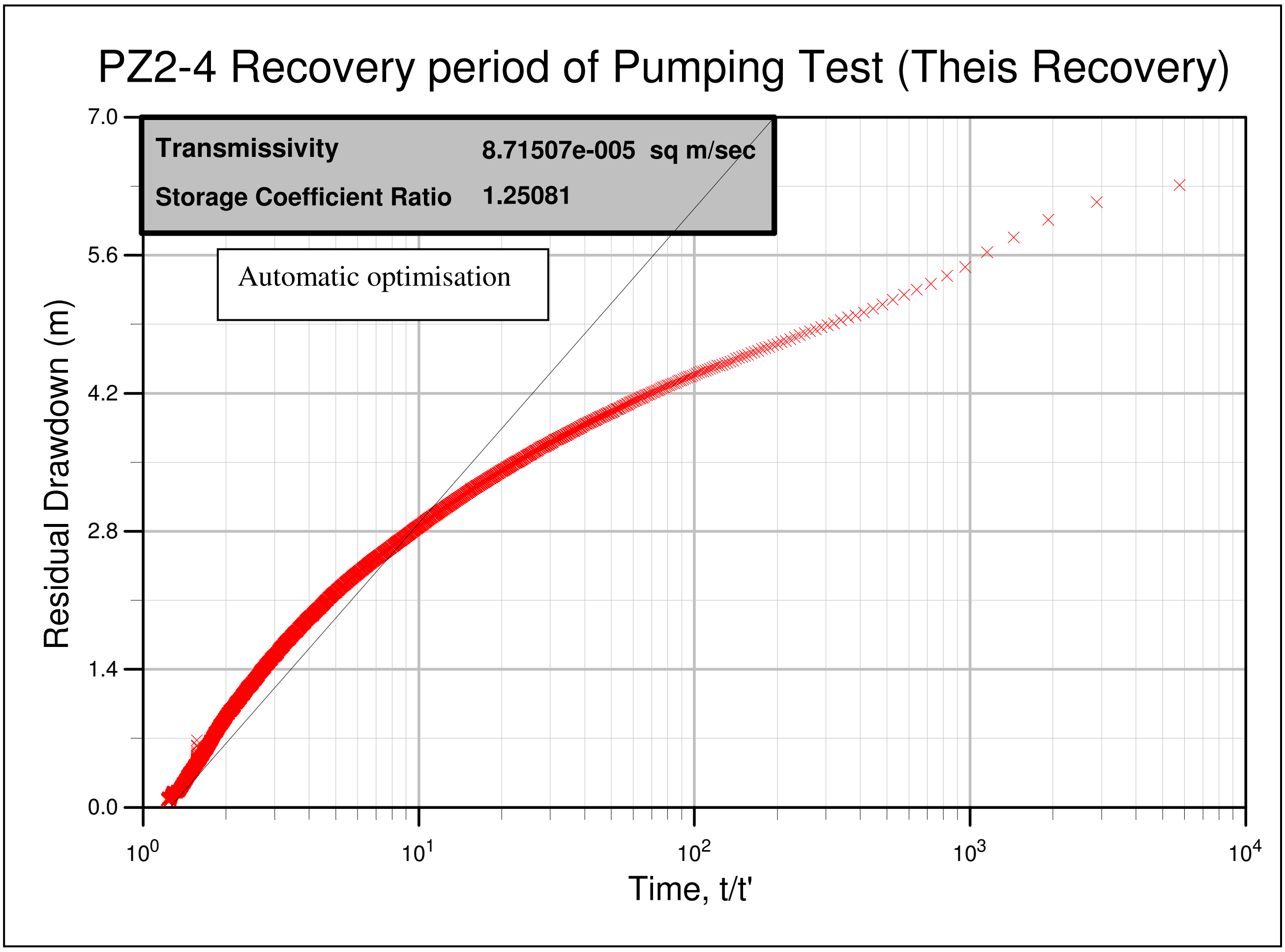

PZ2-12 Pumping Test Analysis (Cooper and Jacob)
Transmissivity 0.000178021 sq m/sec
Storage Coefficient 0.000612869
Automatic Optimisation
Drawdown (m)
4.0
3.2
2.4
1.6
0.8
0.0
10^1
10^2
10^3
10^4
10^5
10^6
Time (sec)

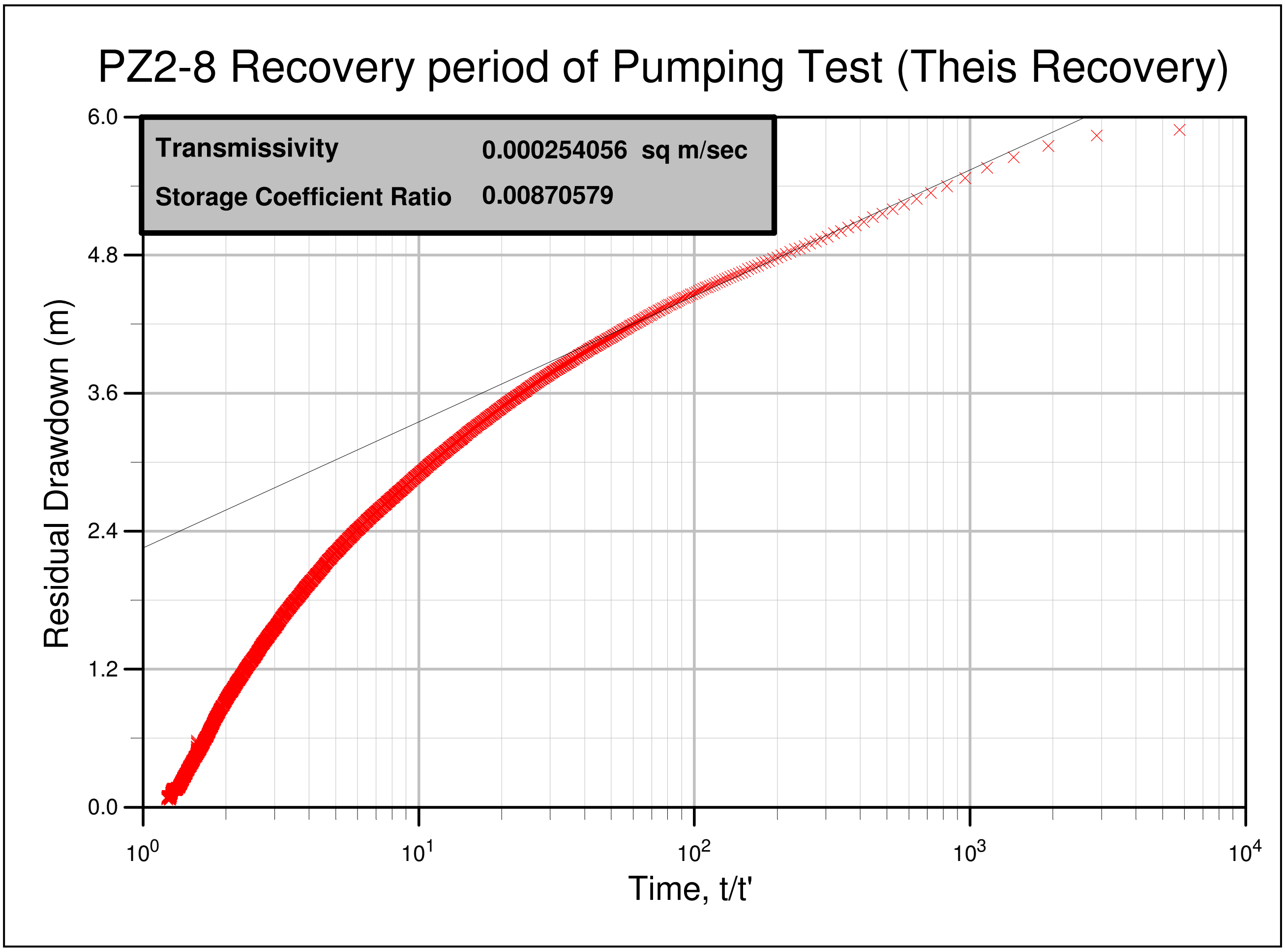
Appendix B
Theis Recovery Analysis Figures

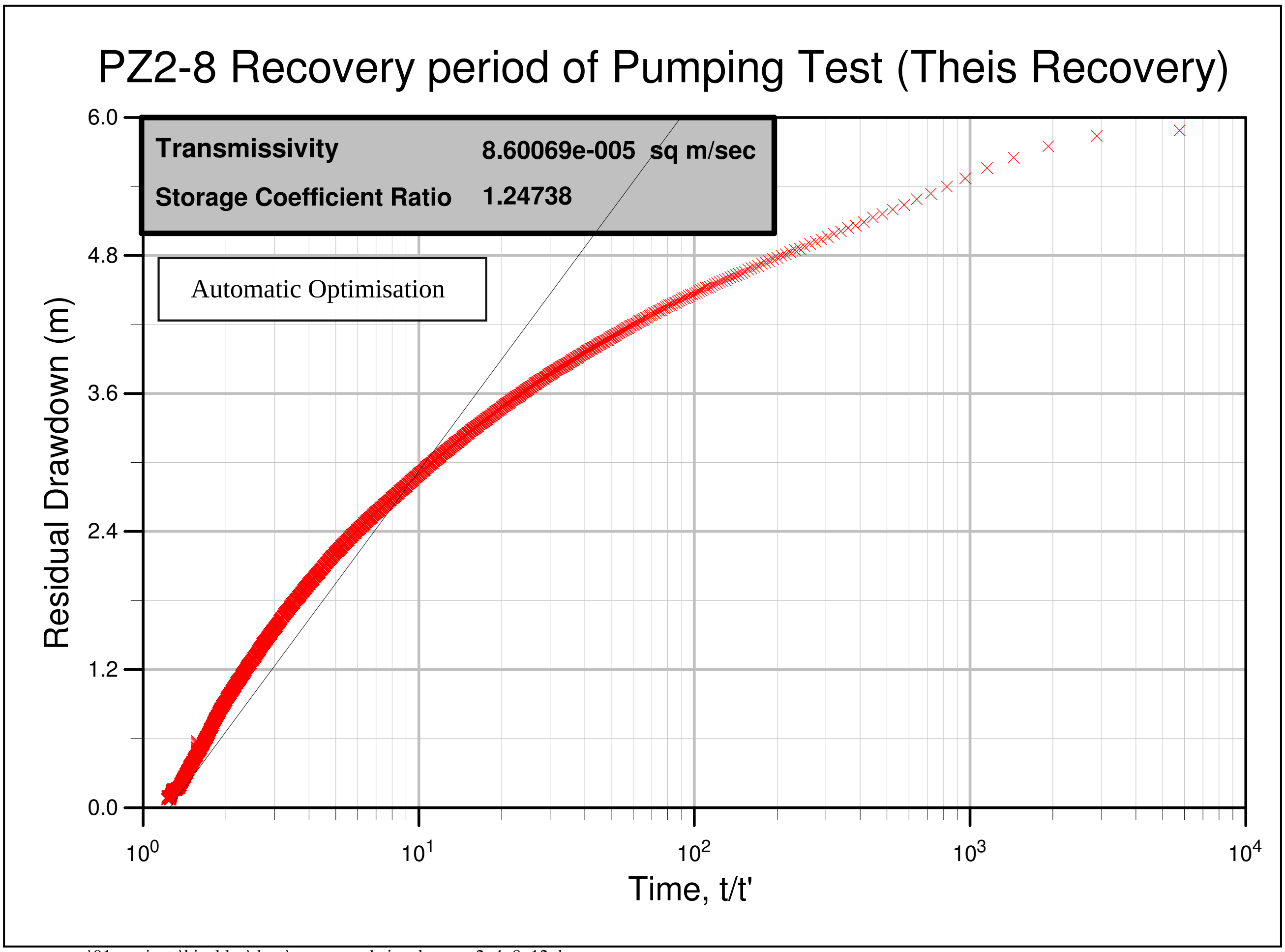

PZ2-1 Recovery period of Pumping Test (Theis Recovery)
Transmissivity
0.000213647 sq m/sec
Storage Coefficient Ratio
0.0371594
Residual Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'

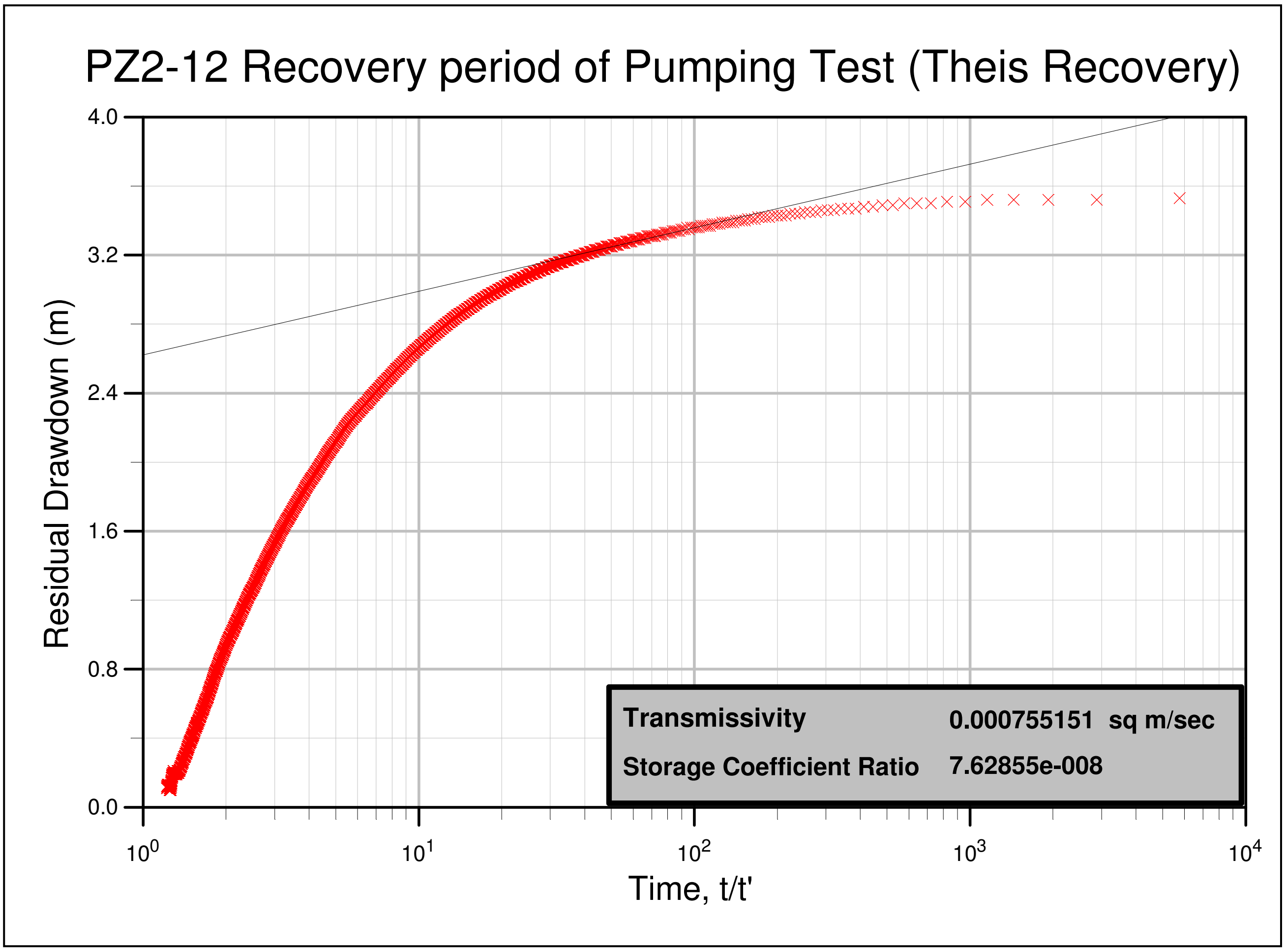

PZ2-1 Recovery period of Pumping Test (Theis Recovery)
Transmissivity
8.41219e-005 sq m/sec
Storage Coefficient Ratio
1.28762
Automatic optimisation
Residual Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'

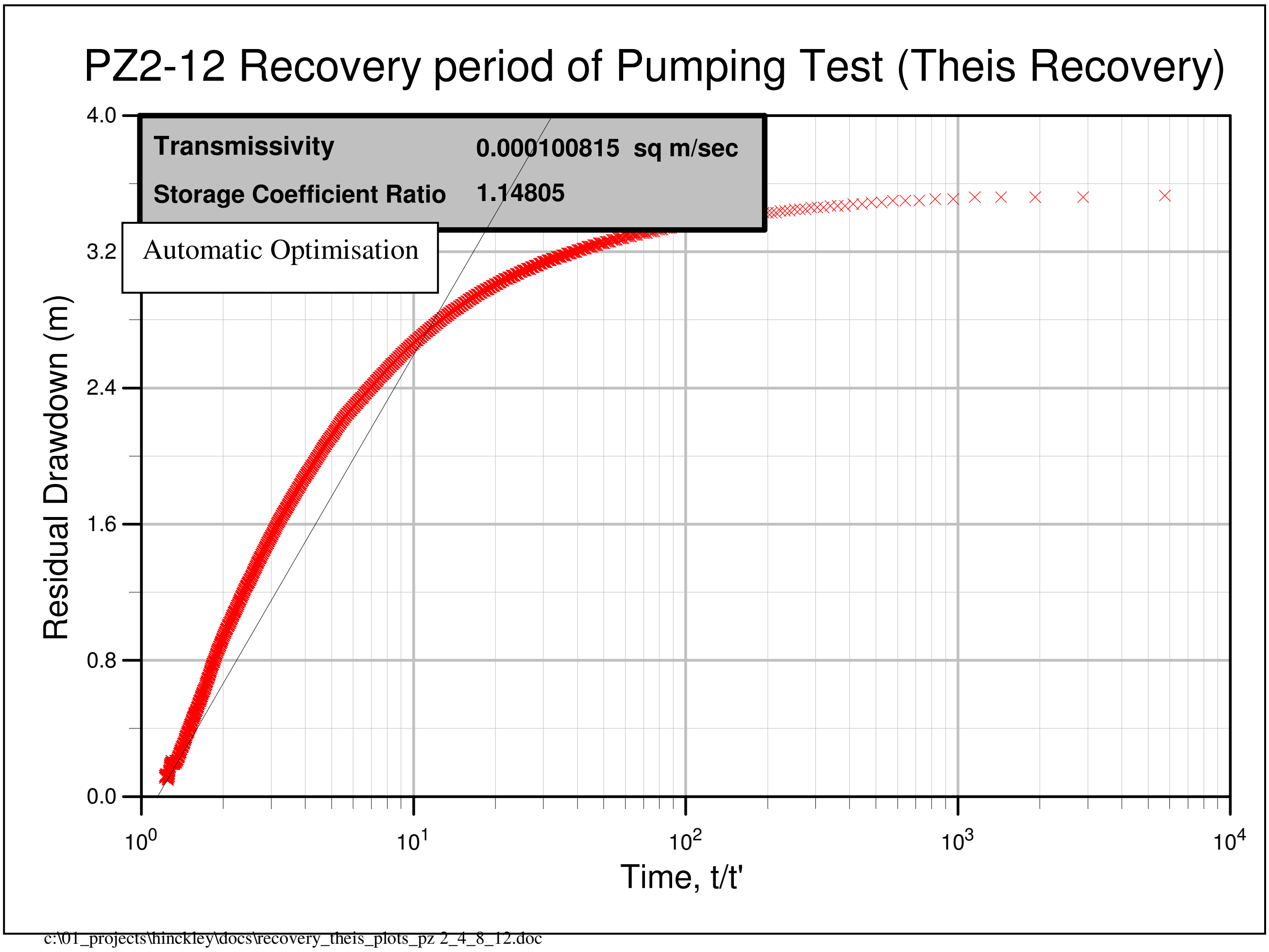

PZ2-4 Recovery period of Pumping Test (Theis Recovery)
Transmissivity
0.000248083 sq m/sec
Storage Coefficient Ratio
0.0126587
Residual Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'


PZ2-4 Recovery period of Pumping Test (Theis Recovery)
Transmissivity
8.71507e-005 sq m/sec
Storage Coefficient Ratio
1.25081
Automatic optimisation
Residual Drawdown (m)
7.0
5.6
4.2
2.8
1.4
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'


PZ2-8 Recovery period of Pumping Test (Theis Recovery)
Transmissivity 0.000254056 sq m/sec
Storage Coefficient Ratio 0.00870579
Residual Drawdown (m)
6.0
4.8
3.6
2.4
1.2
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'


PZ2-8 Recovery period of Pumping Test (Theis Recovery)
Transmissivity 8.60069e-005 sq m/sec
Storage Coefficient Ratio 1.24738
Automatic Optimisation
Residual Drawdown (m)
6.0
4.8
3.6
2.4
1.2
0.0
10^0
10^1
10^2
10^3
10^4
Time, t/t'


PZ2-12 Recovery period of Pumping Test (Theis Recovery)
Transmissivity 0.000755151 sq m/sec
Storage Coefficient Ratio 7.62855e-008
Residual Drawdown (m)
Time, t/t'


PZ2-12 Recovery period of Pumping Test (Theis Recovery)
Transmissivity 0.000100815 sq m/sec
Storage Coefficient Ratio 1.14805
Automatic Optimisation
Residual Drawdown (m)
Time, t/t'

APPENDIX 15B: VERTICAL ANISOTROPY CALCULATIONS

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Vertical anisotropy

Values of b shown correspond to nominal effective lithological distribution corroborated by calibration.

Based on Anderson & Woessner* equations 3.4a and 3.4b:

Kh = (limestone K * thickness + mudstone K * thickness) / total thickness

Kv = total thickness / (total b/K)

b can be relative proportions or actual as appropriate

		b	K m/s	b/K	
L1	**Mudstone**	7	1.00E-08	7.00E+08	Based on lowest Lugeon values in L1
	Limestone	3	4.00E-05	7.50E+04	Based on highest Lugeon values in L1
	Kh		1.20E-05		
	Kv		1.43E-08		
	Kh/Kv		841		
L2	**Mudstone**	7	1.00E-08	7.00E+08	Based on lowest Lugeon values in L2
	Limestone	3	5.80E-06	5.17E+05	Based on highest Lugeon values in L2
	Kh		1.75E-06		
	Kv		1.43E-08		
	Kh/Kv		122		

L3	**Mudstone**	7	1.00E-08	7.00E+08	Based on lowest Lugeon values in L3
	Limestone	3	2.00E-07	1.50E+07	Based on highest Lugeon values in L3
	Kh		6.70E-08		
	Kv		1.40E-08		
	Kh/Kv		5		
L4	**Mudstone**	7	4.00E-08	1.75E+08	Based on lowest Lugeon values in L4
	Mudstone	3	1.74E-05	1.72E+05	Based on highest Lugeon values in L4
	Kh		5.25E-06		
	Kv		5.71E-08		
	Kh/Kv		92		
L5	**Sandstone**	7	1.00E-08	7.00E+08	Based on lowest Lugeon values in L5
	Siltstone	3	2.00E-07	1.50E+07	Based on highest Lugeon values in L5
	Kh		6.70E-08		
	Kv		1.40E-08		
	Kh/Kv		5		

* Anderson, P and Woessner W
Applied Groundwater Modeling - Simulation of Flow and Advective Transport
Academic Press 1992

APPENDIX 15C: GROUNDWATER HYDROGRAPHS FROM BOREHOLE PIEZOMETERS

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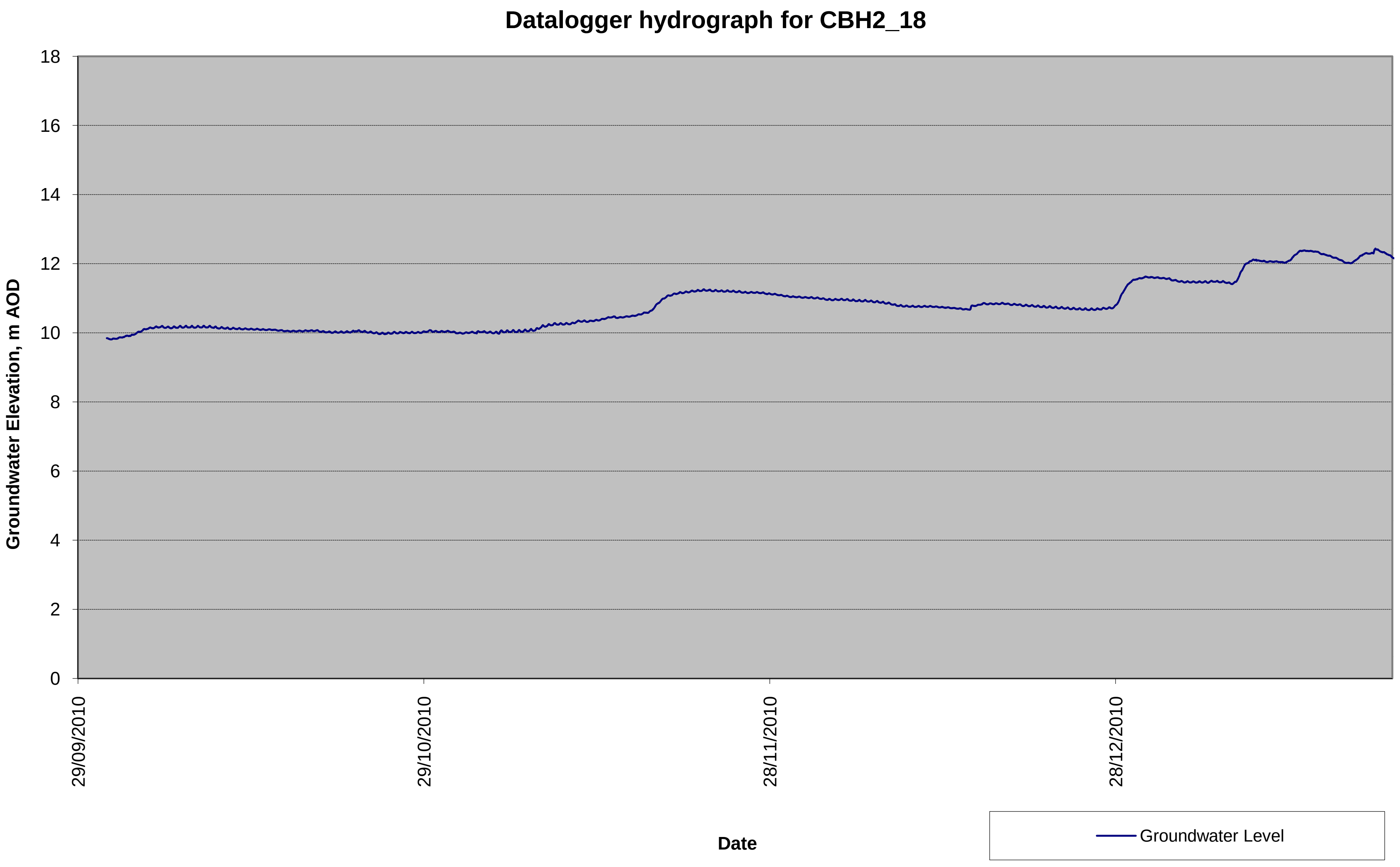
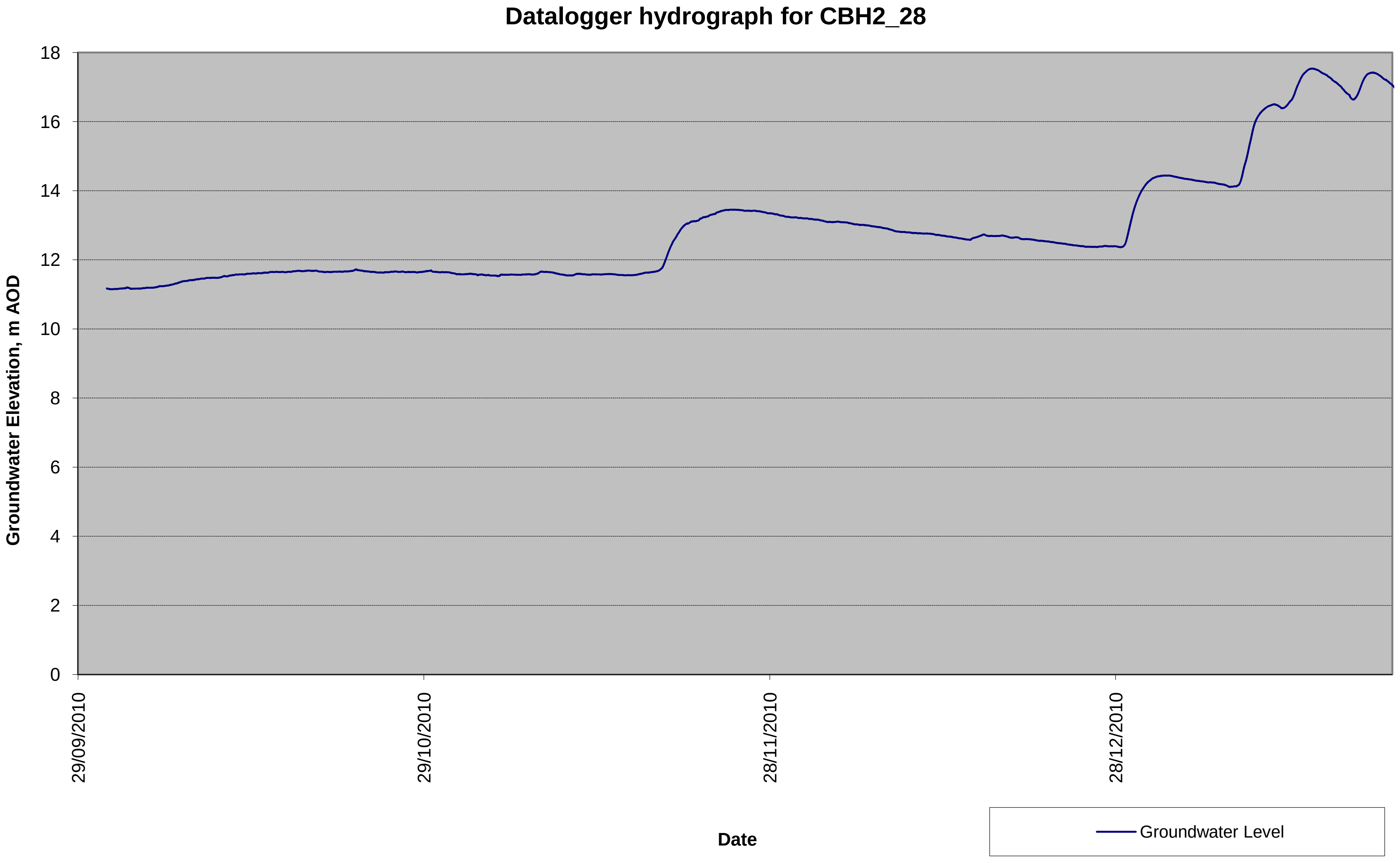
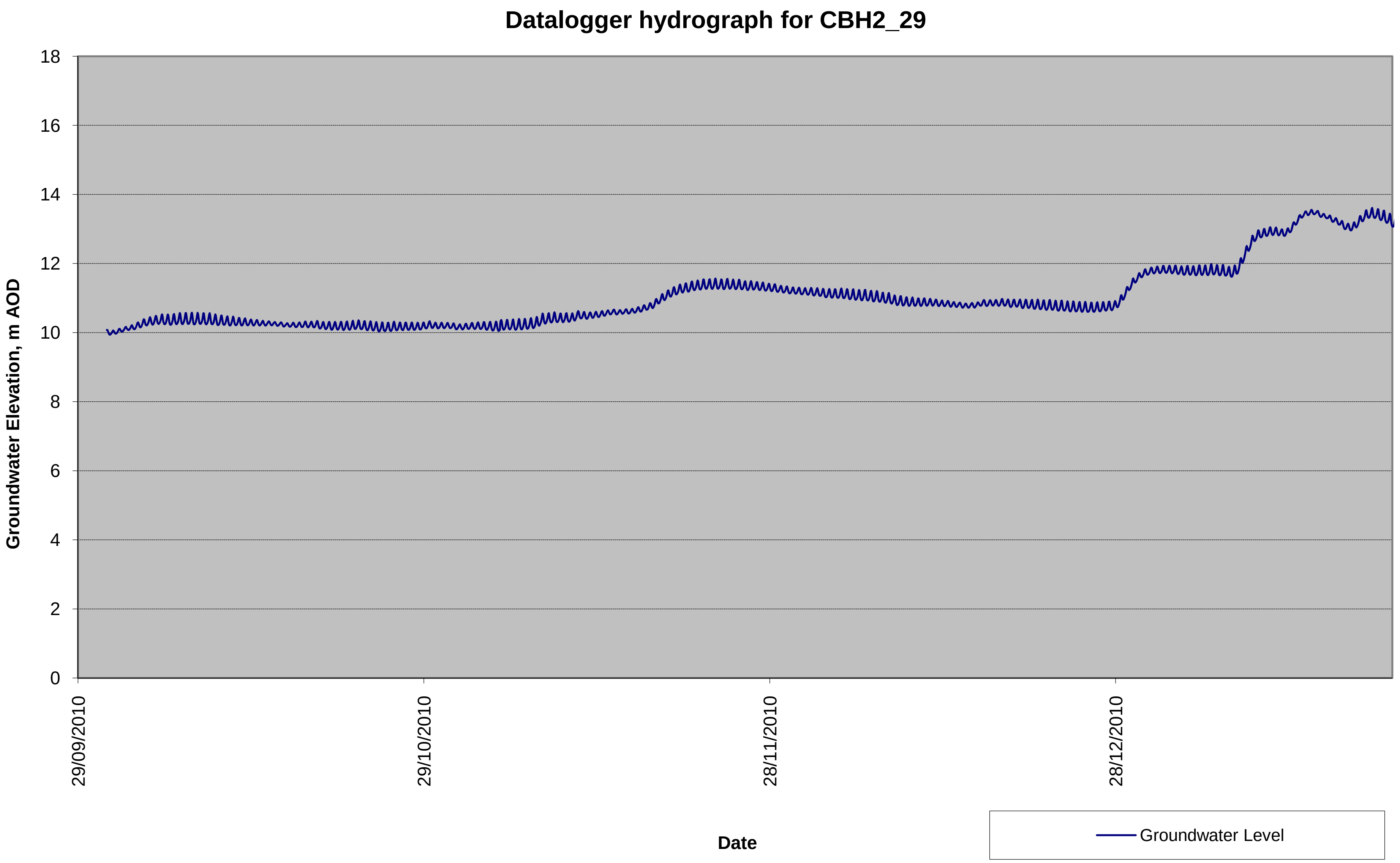


Datalogger hydrograph for CBH2_18
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

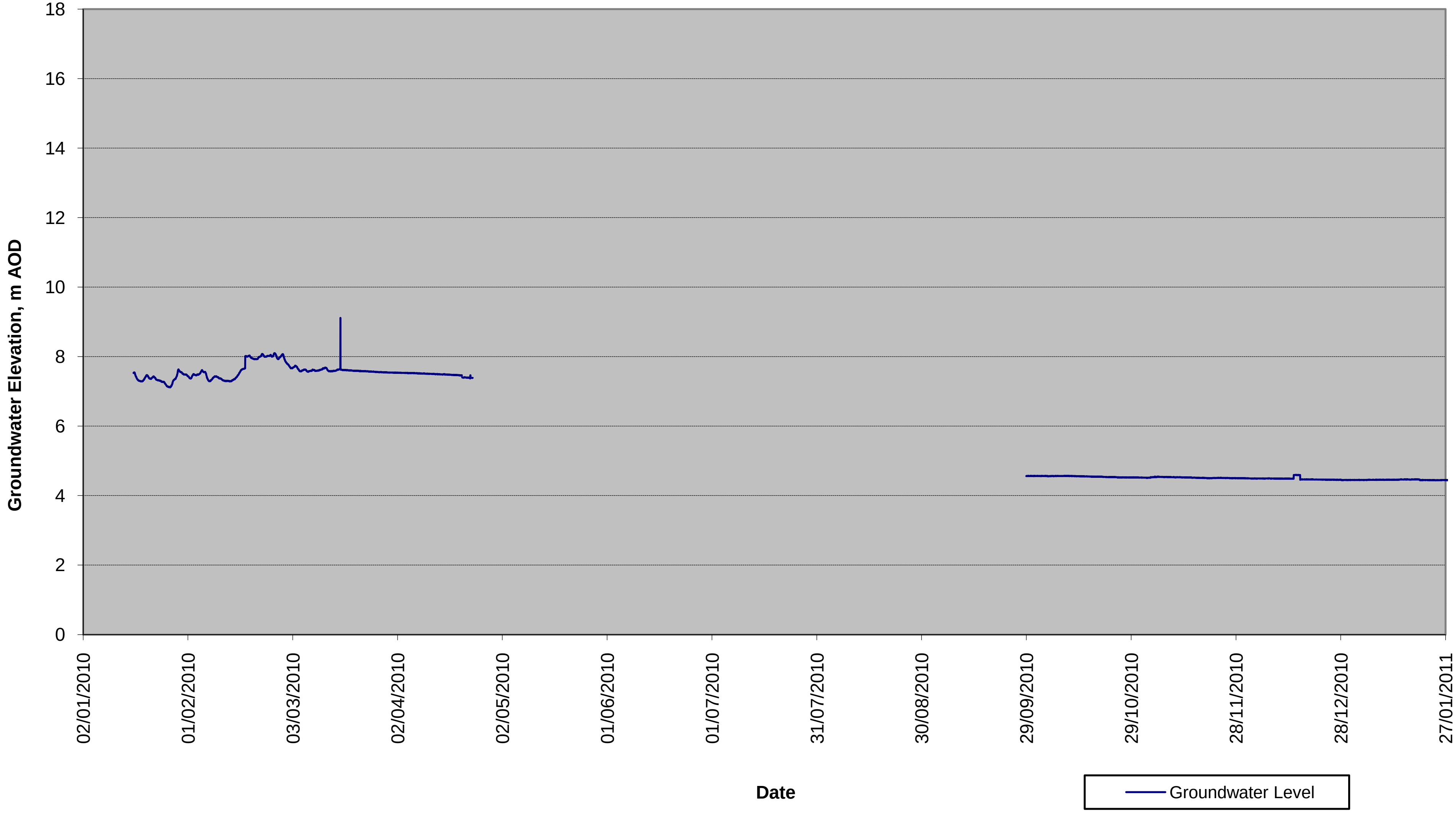


Datalogger hydrograph for CBH2_28
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

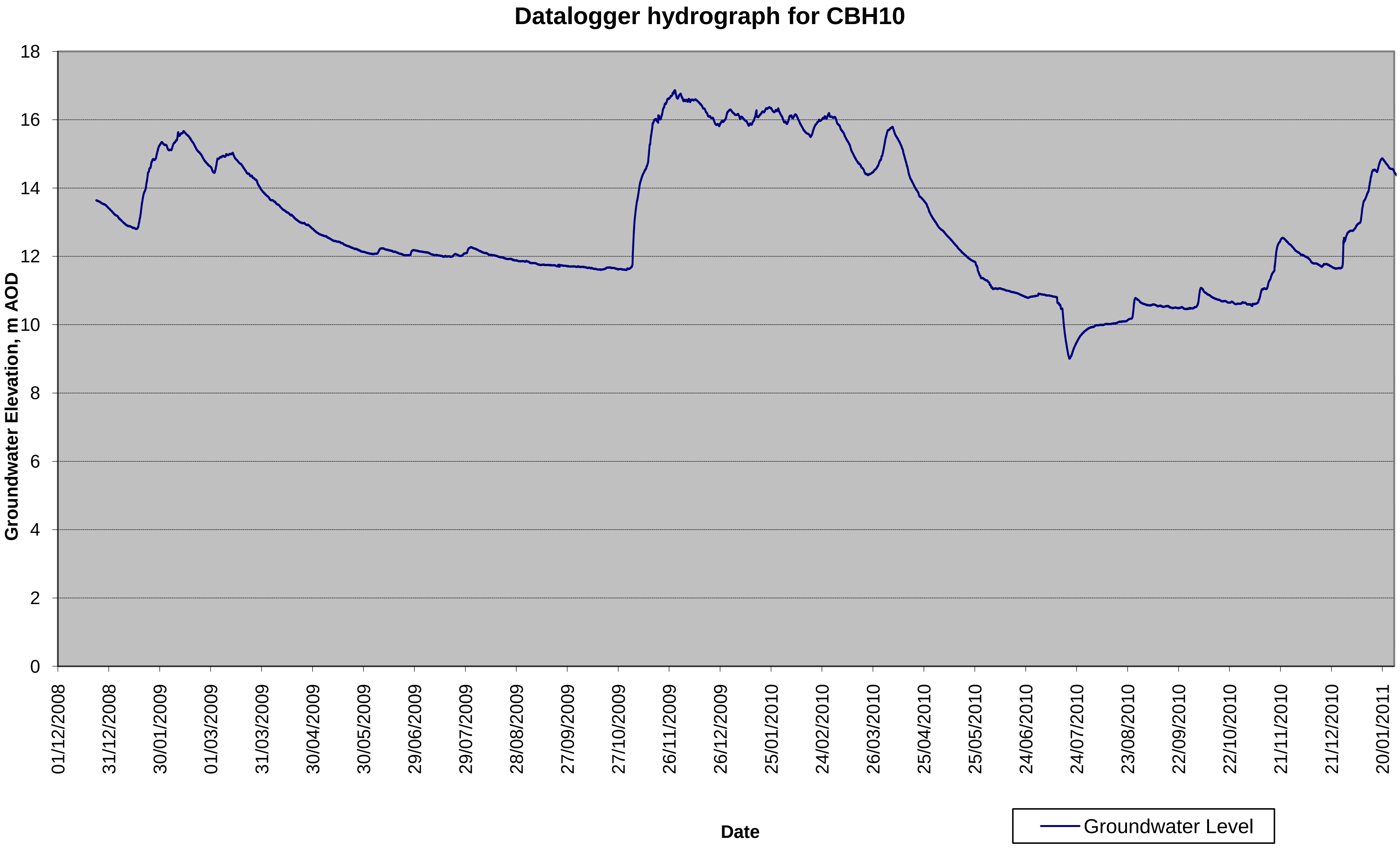


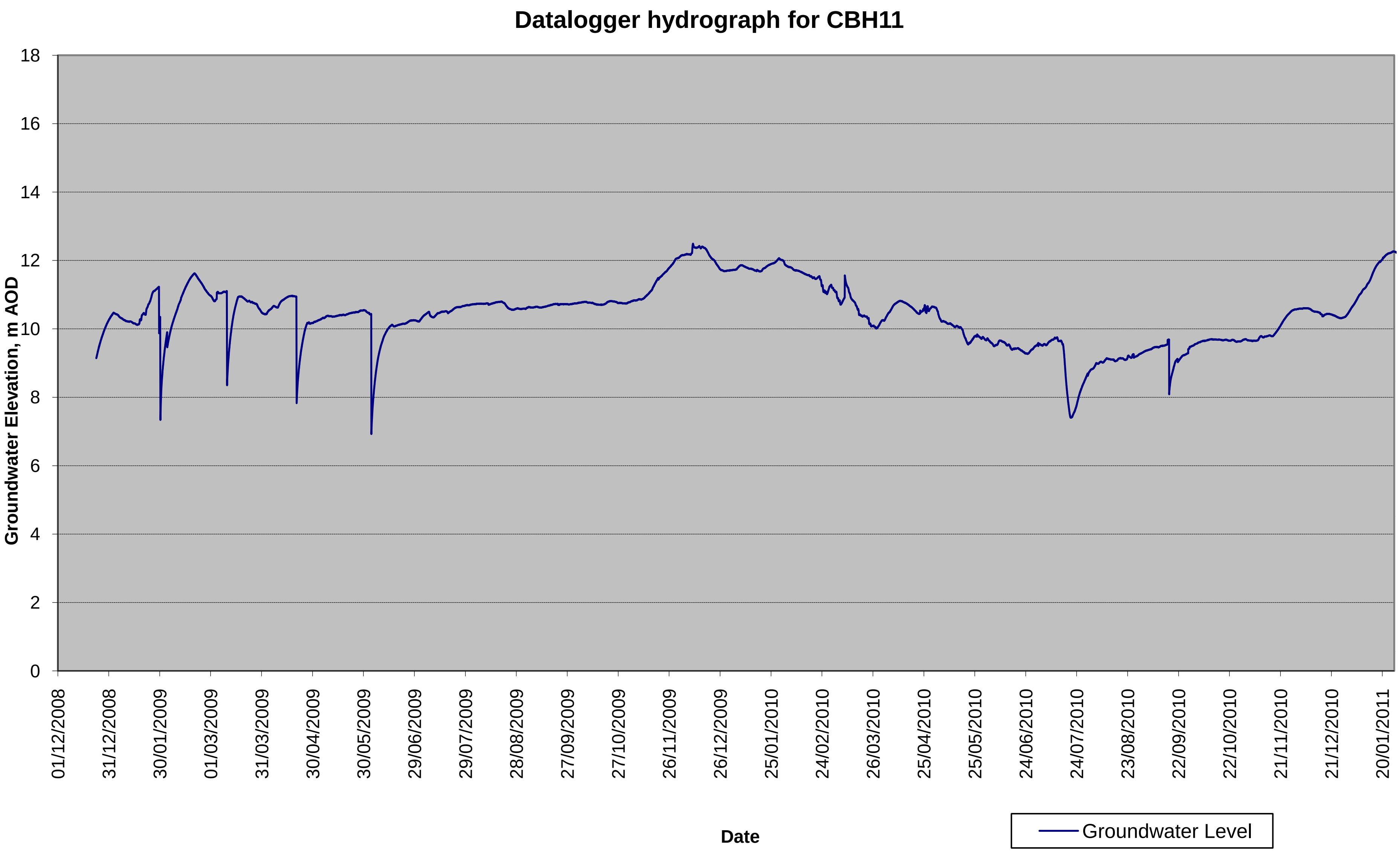
Datalogger hydrograph for CBH2_29
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

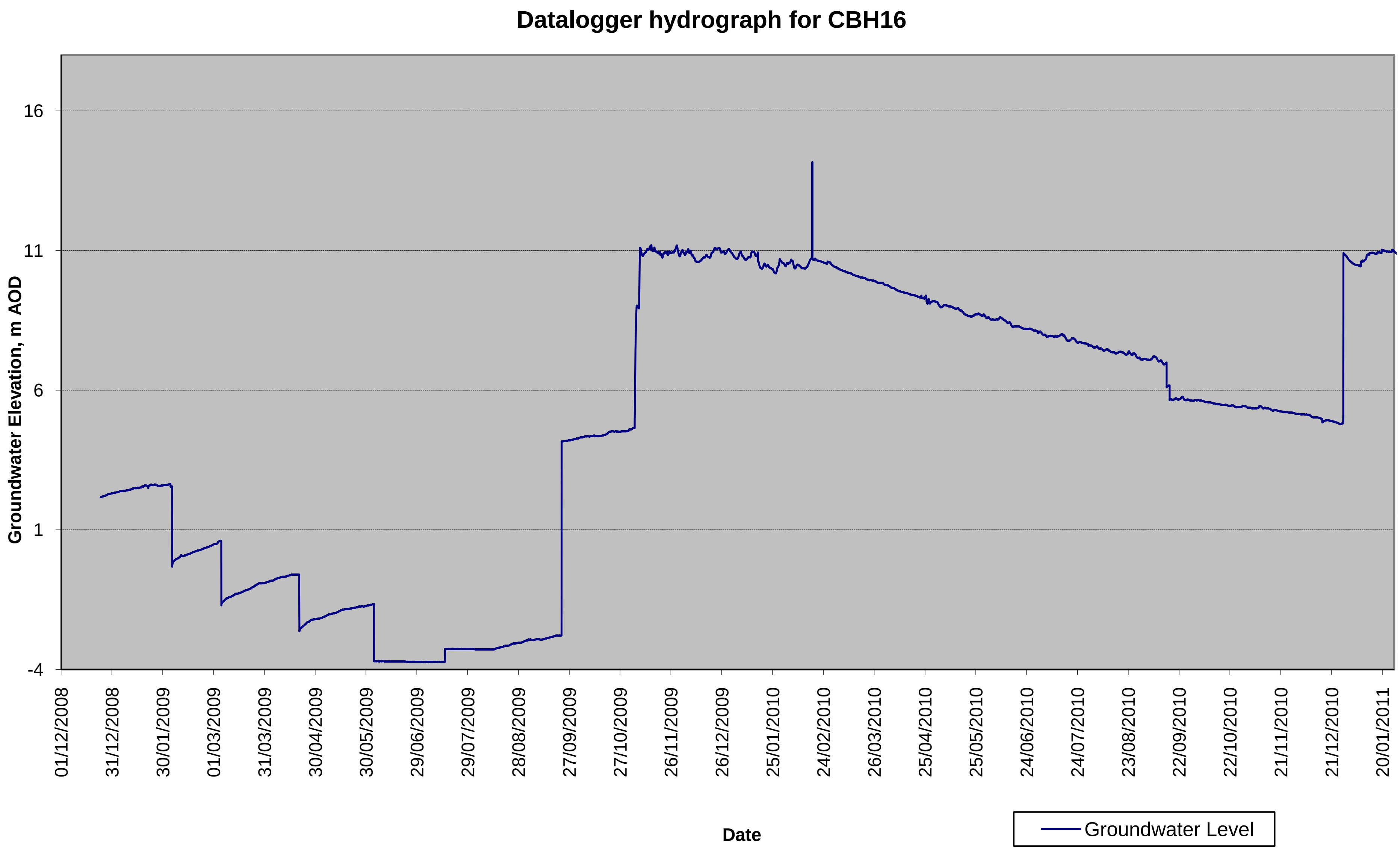
Datalogger hydrograph for CBH09



Datalogger hydrograph for CBH10

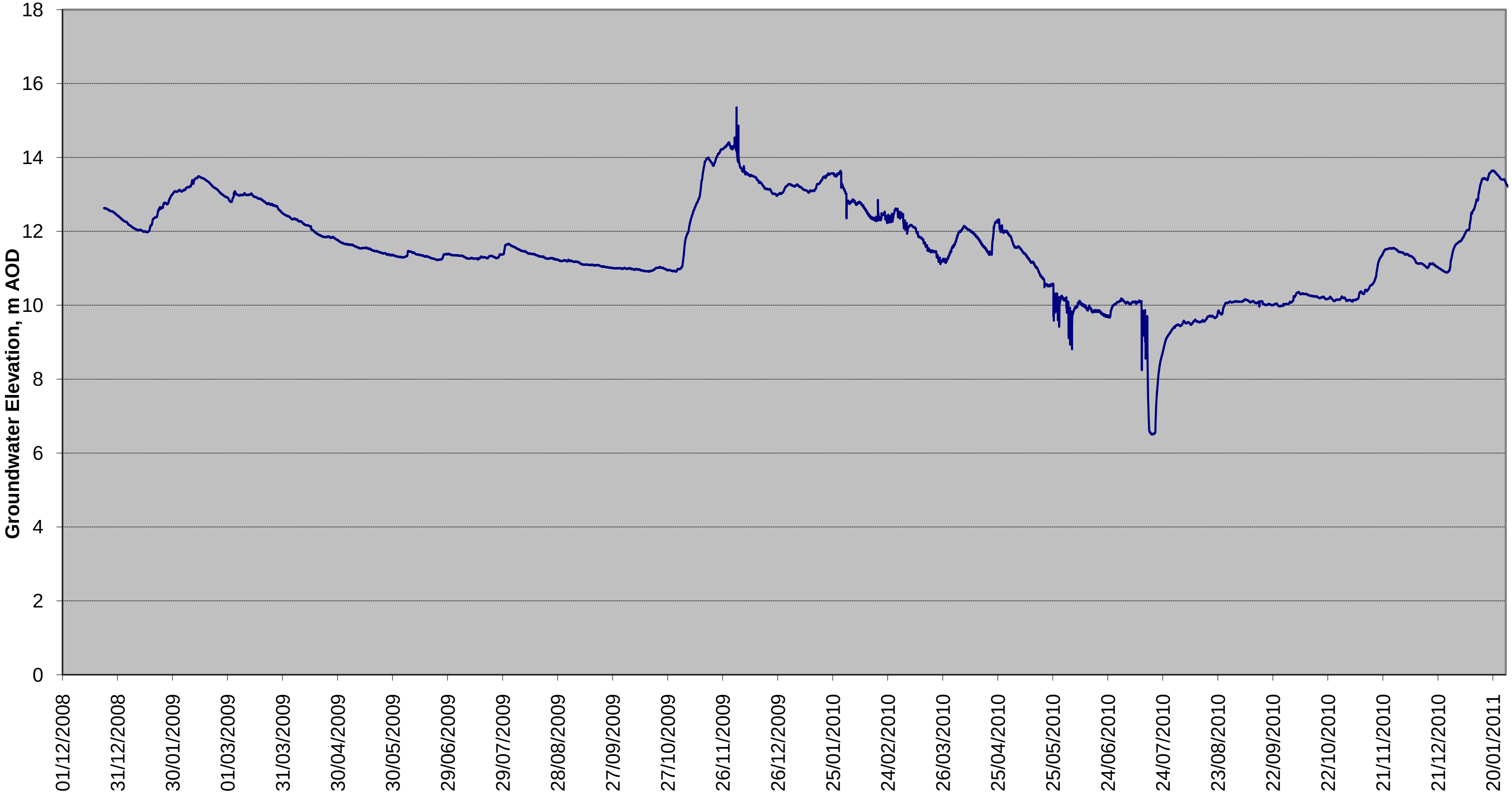


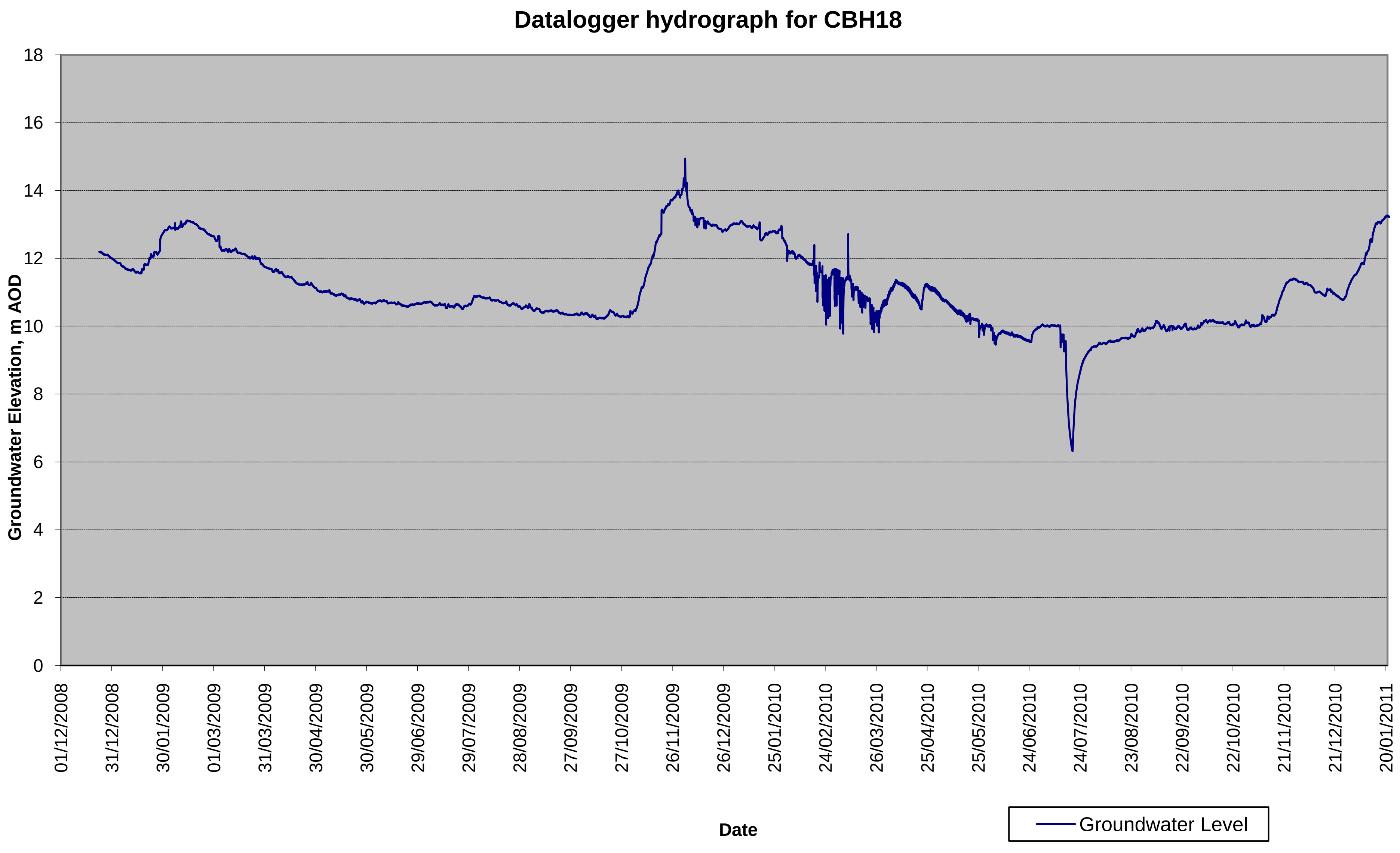

Datalogger hydrograph for CBH11
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level



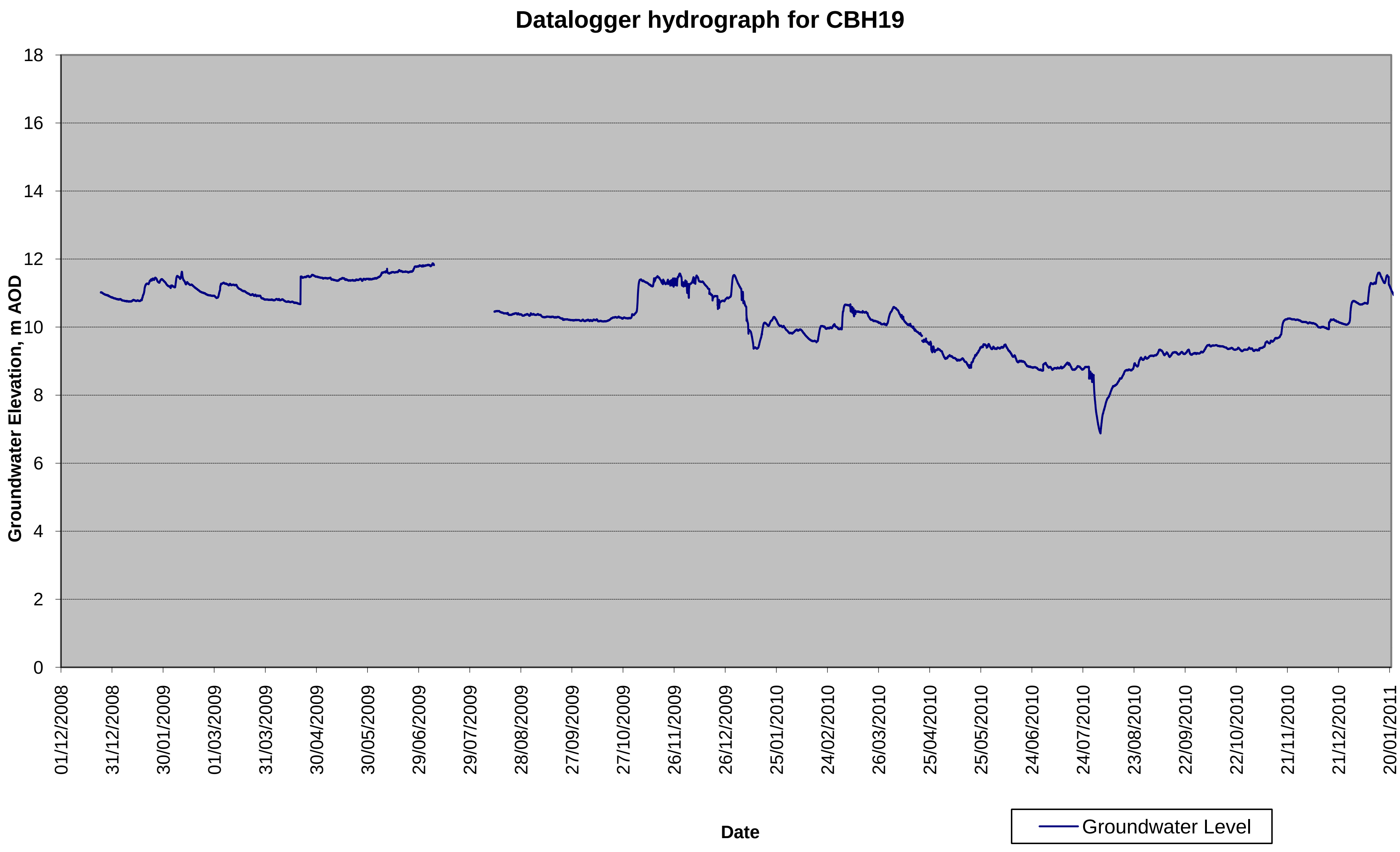
Datalogger hydrograph for CBH16
Groundwater Elevation, m AOD
16
11
6
1
-4
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

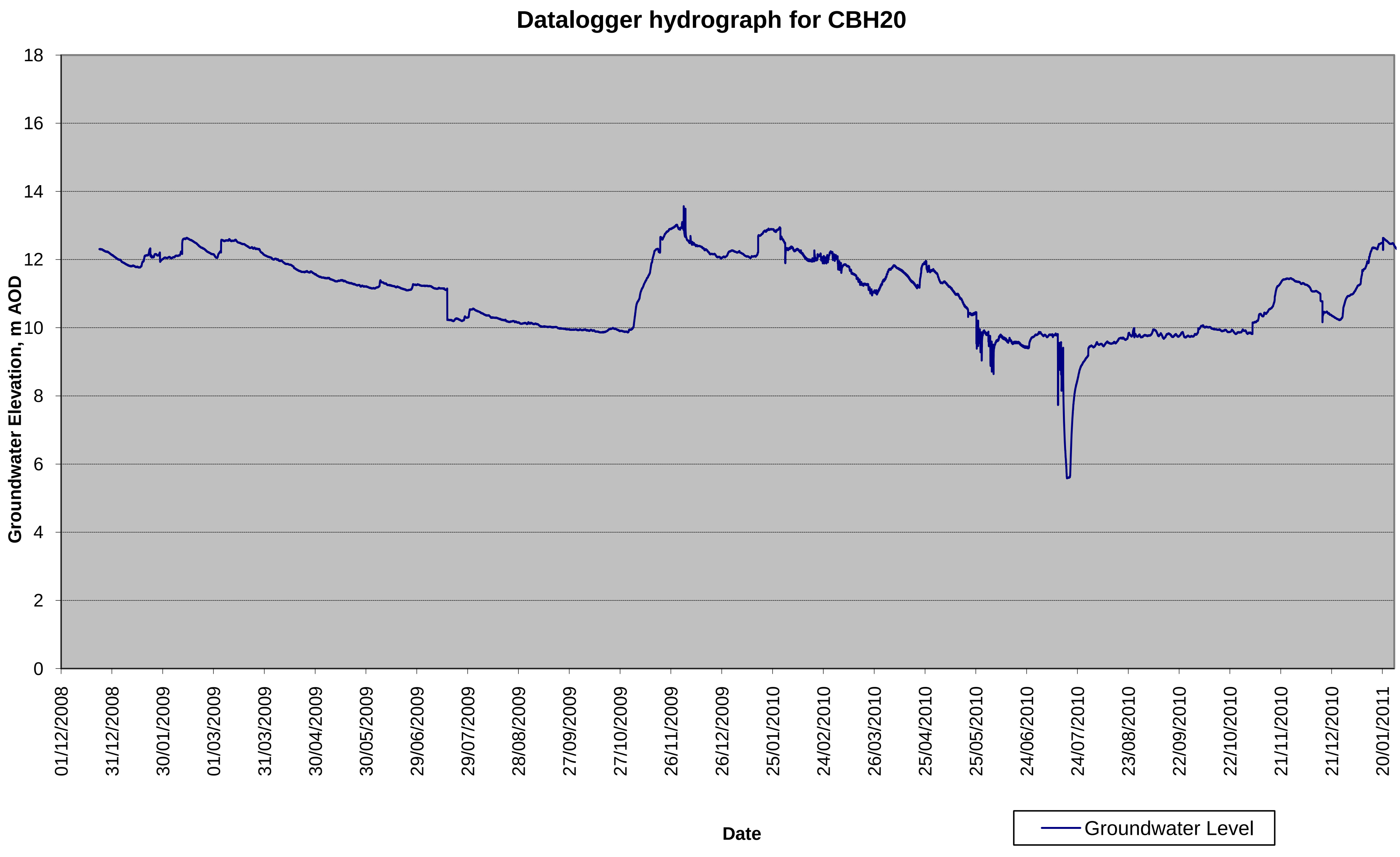
Datalogger hydrograph for CBH17



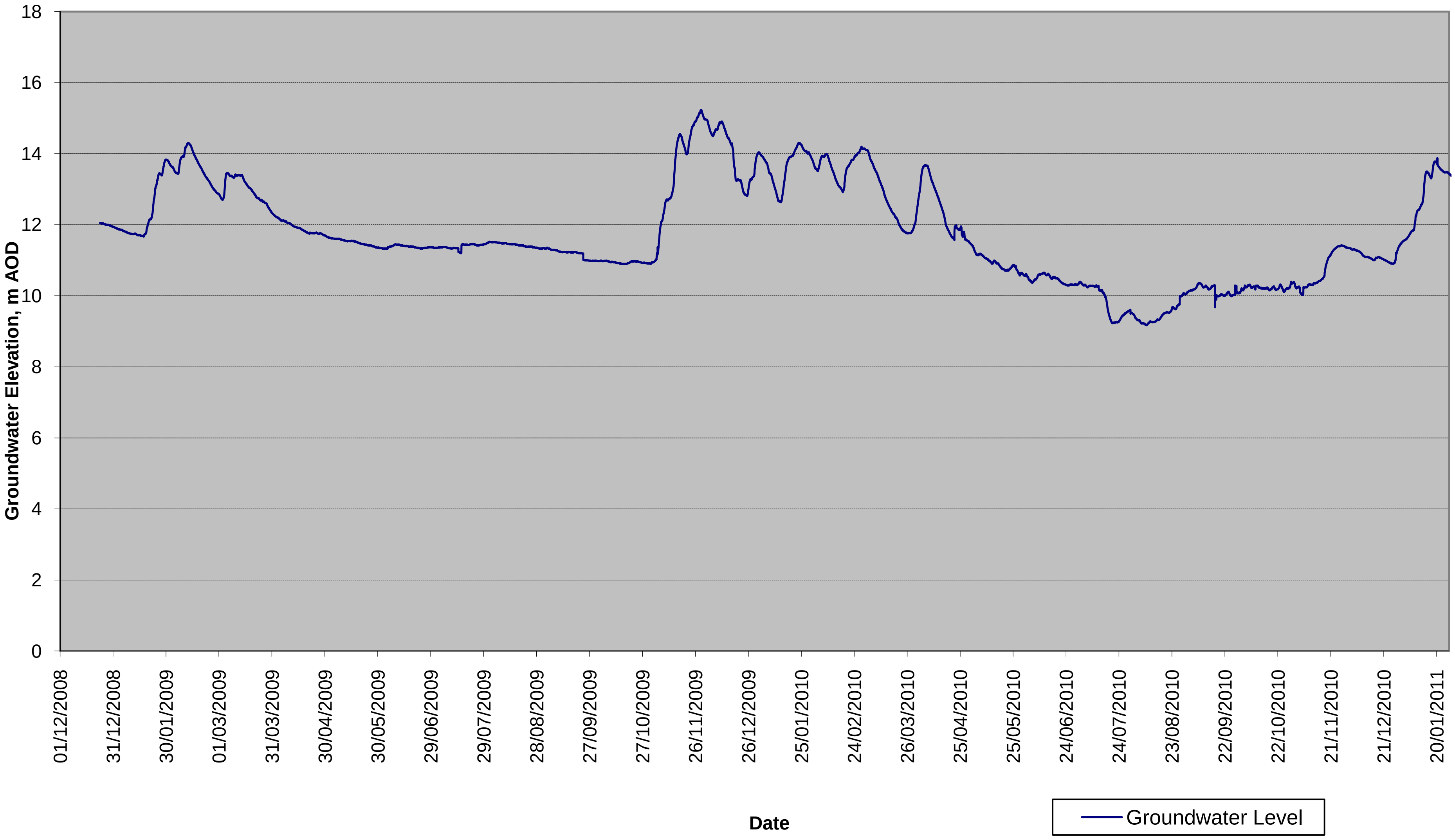


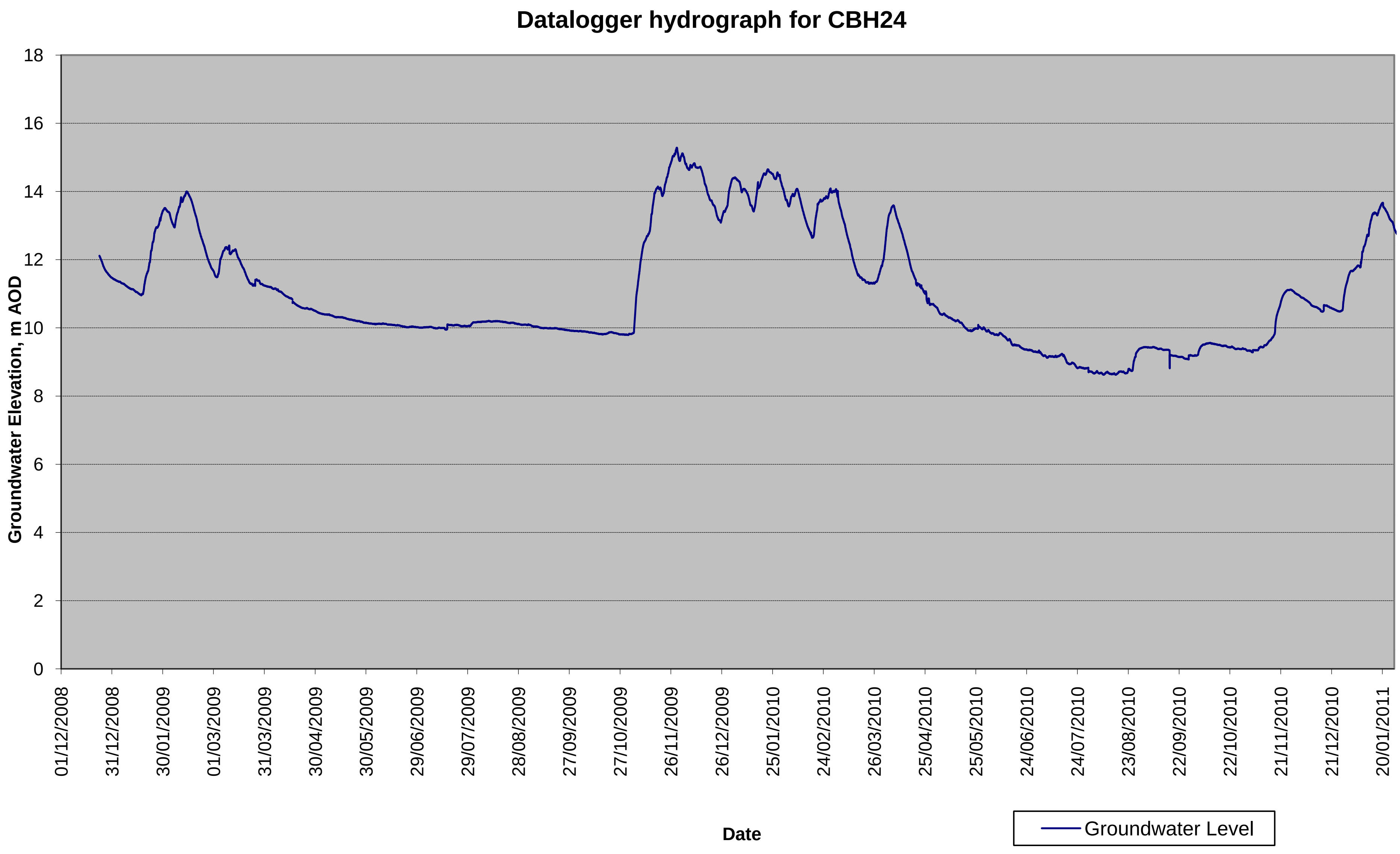
Datalogger hydrograph for CBH18
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

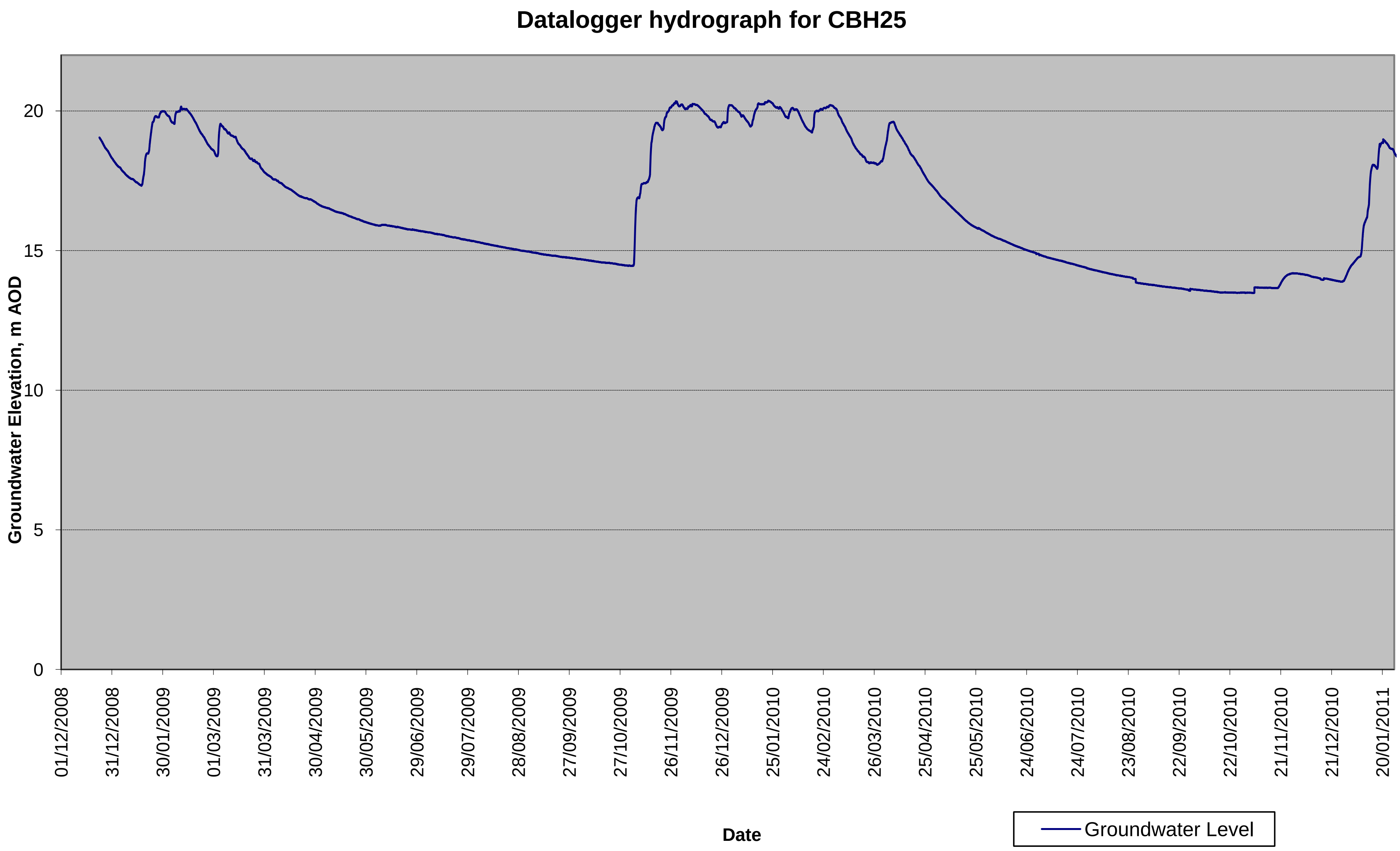

Datalogger hydrograph for CBH19
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level


Datalogger hydrograph for CBH20
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

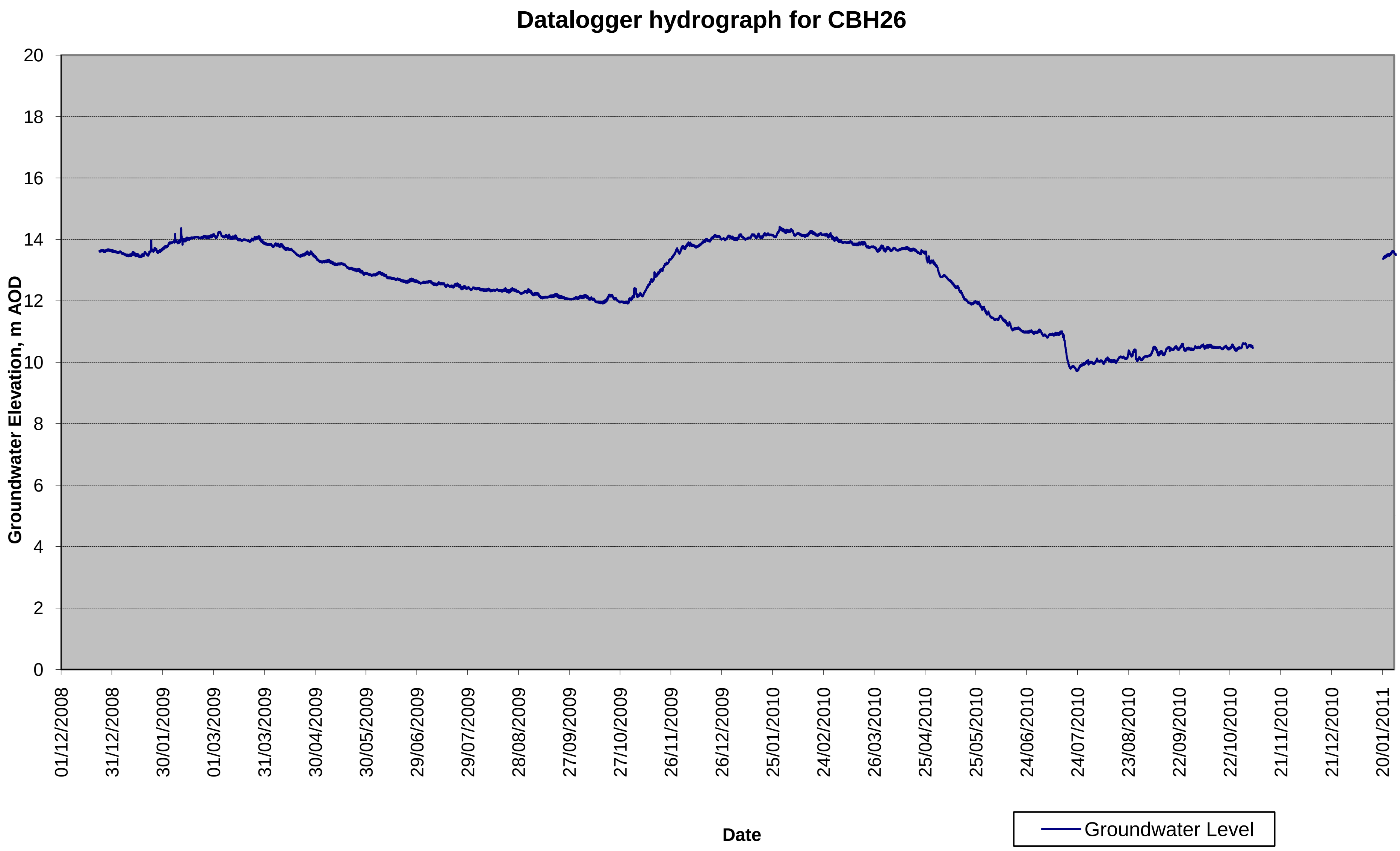
Datalogger hydrograph for CBH21

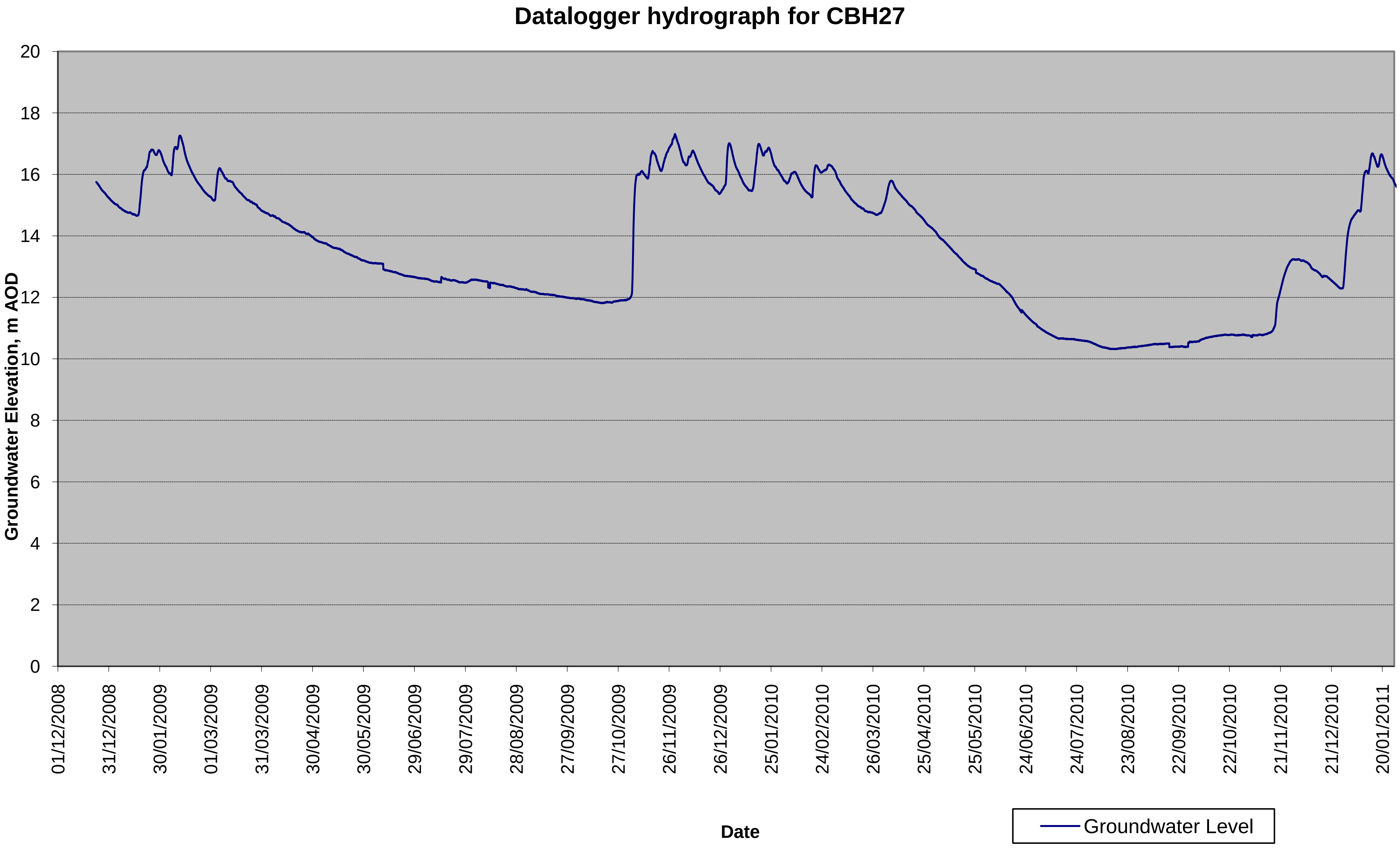



Datalogger hydrograph for CBH24
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

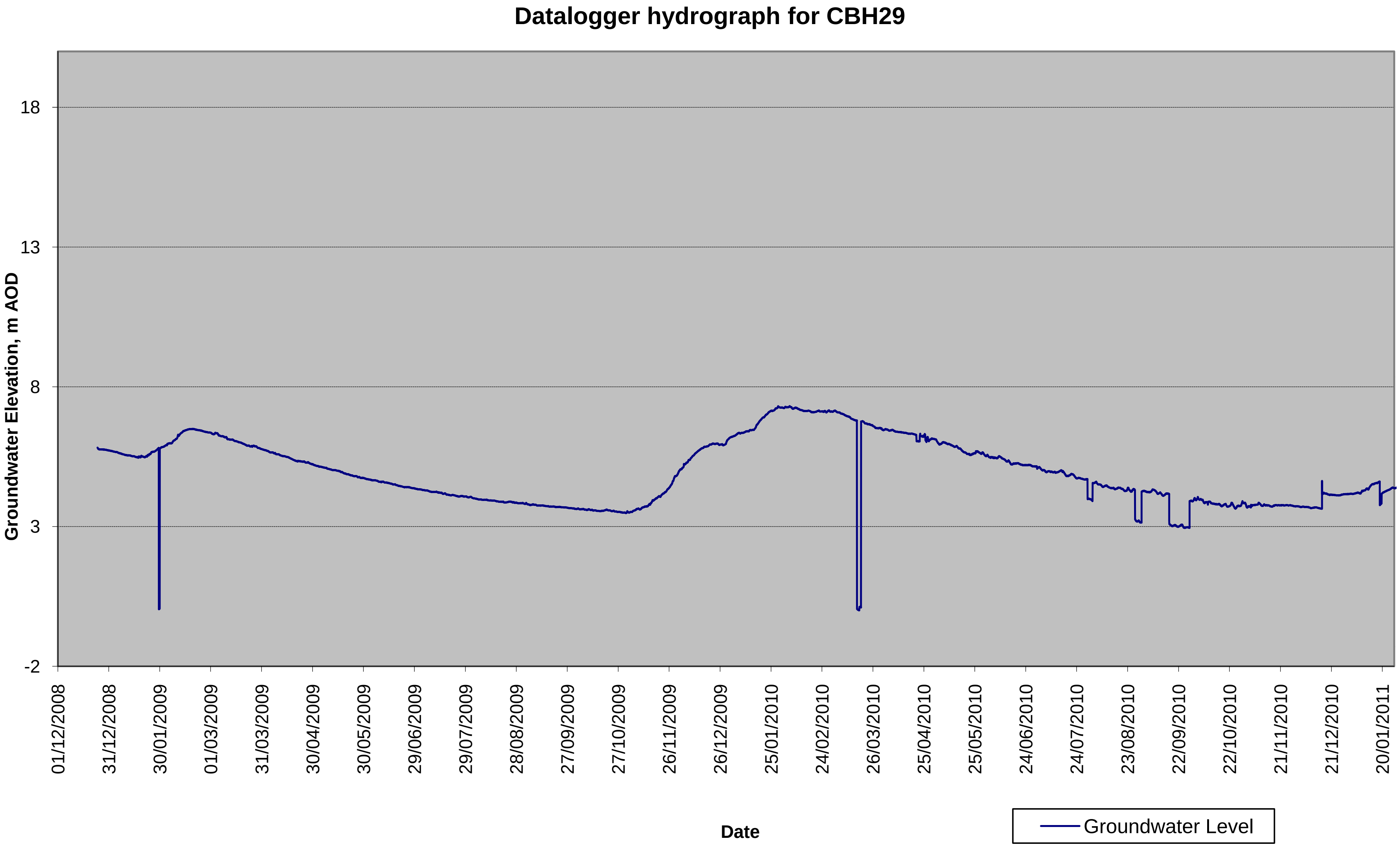


Datalogger hydrograph for CBH25
Groundwater Elevation, m AOD
0
5
10
15
20
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

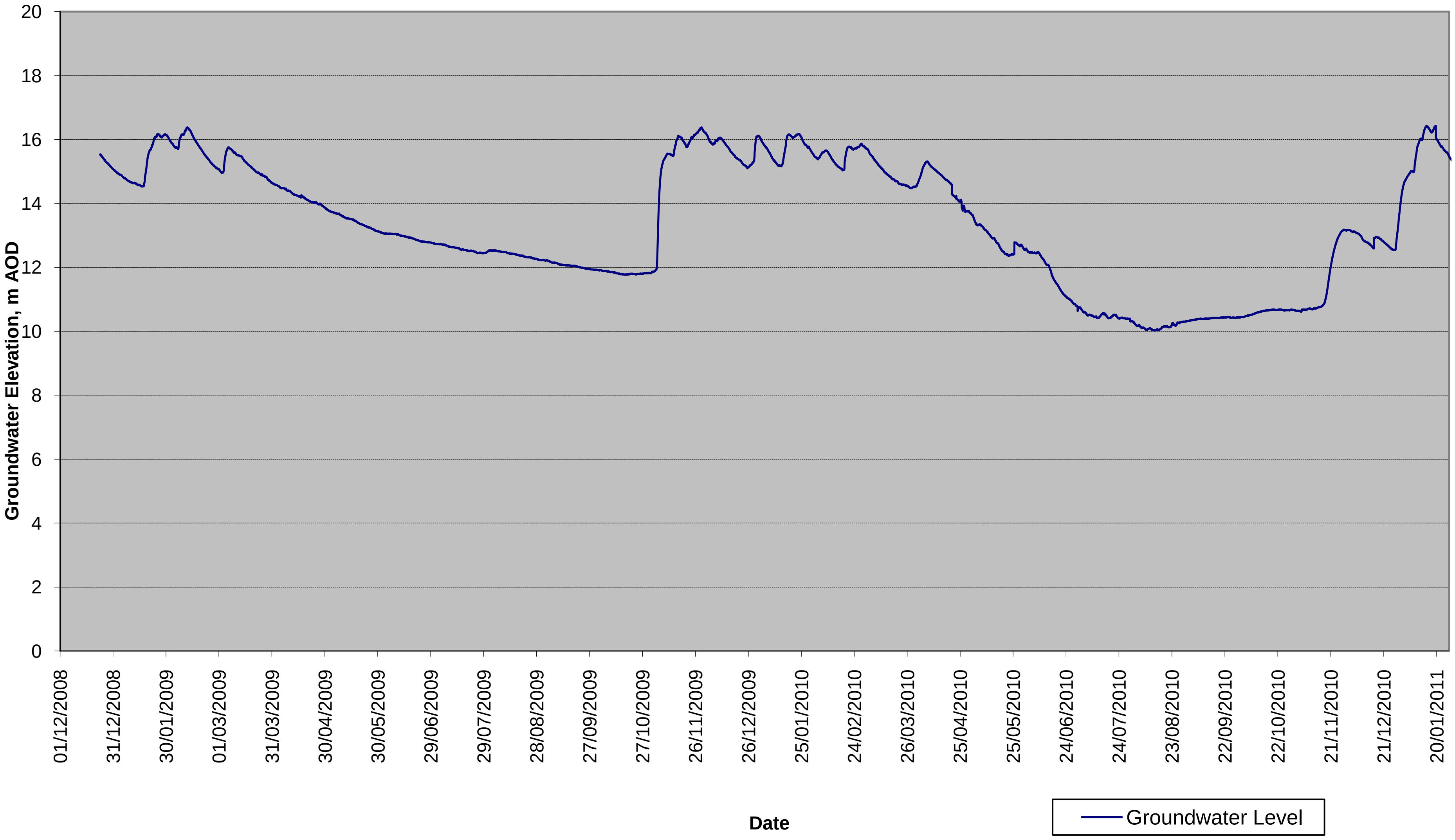

Datalogger hydrograph for CBH26
Groundwater Elevation, m AOD
20
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

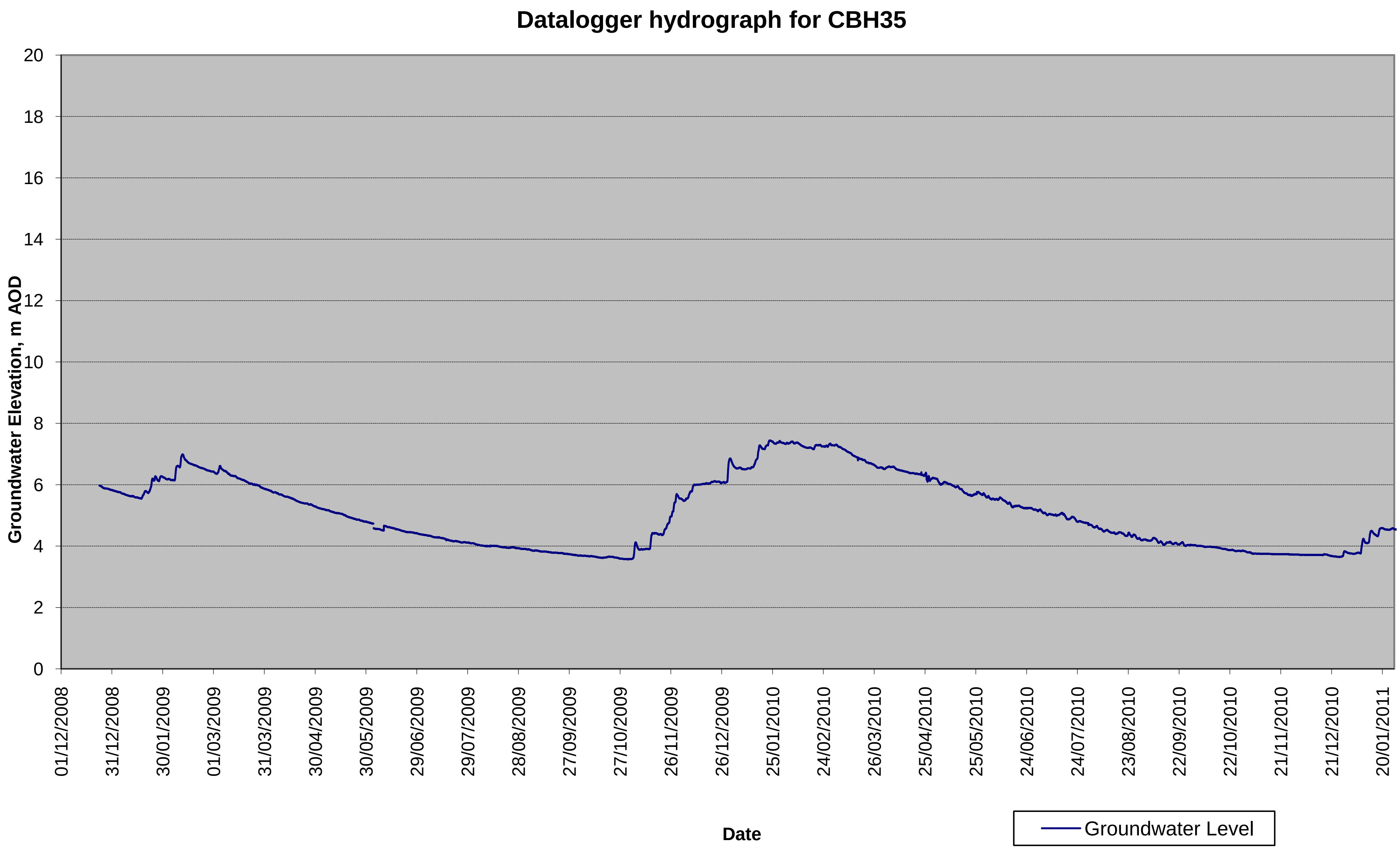


Datalogger hydrograph for CBH27
Groundwater Elevation, m AOD
20
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level


Datalogger hydrograph for CBH29
Groundwater Elevation, m AOD
18
13
8
3
-2
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

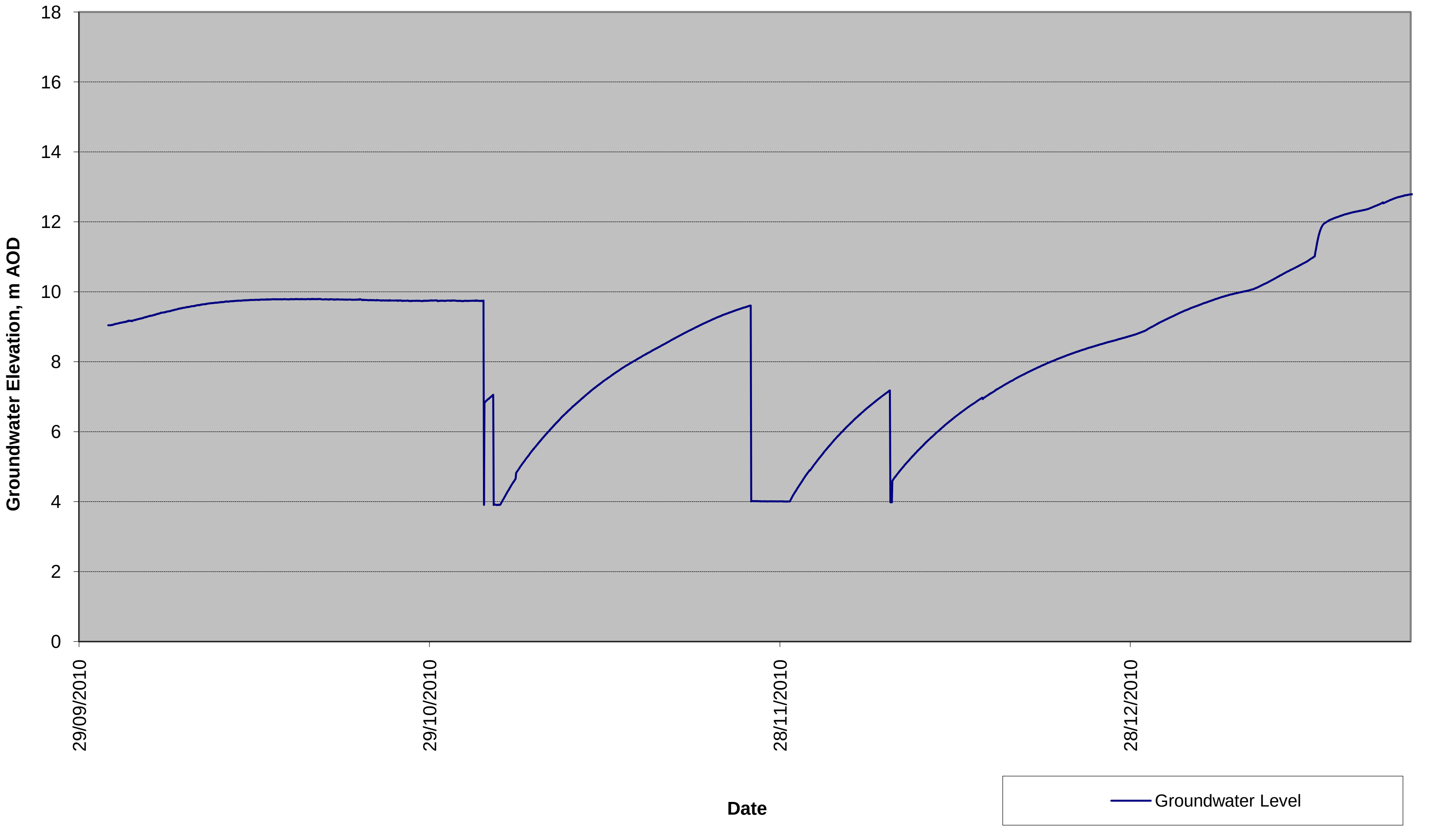
Datalogger hydrograph for CBH33

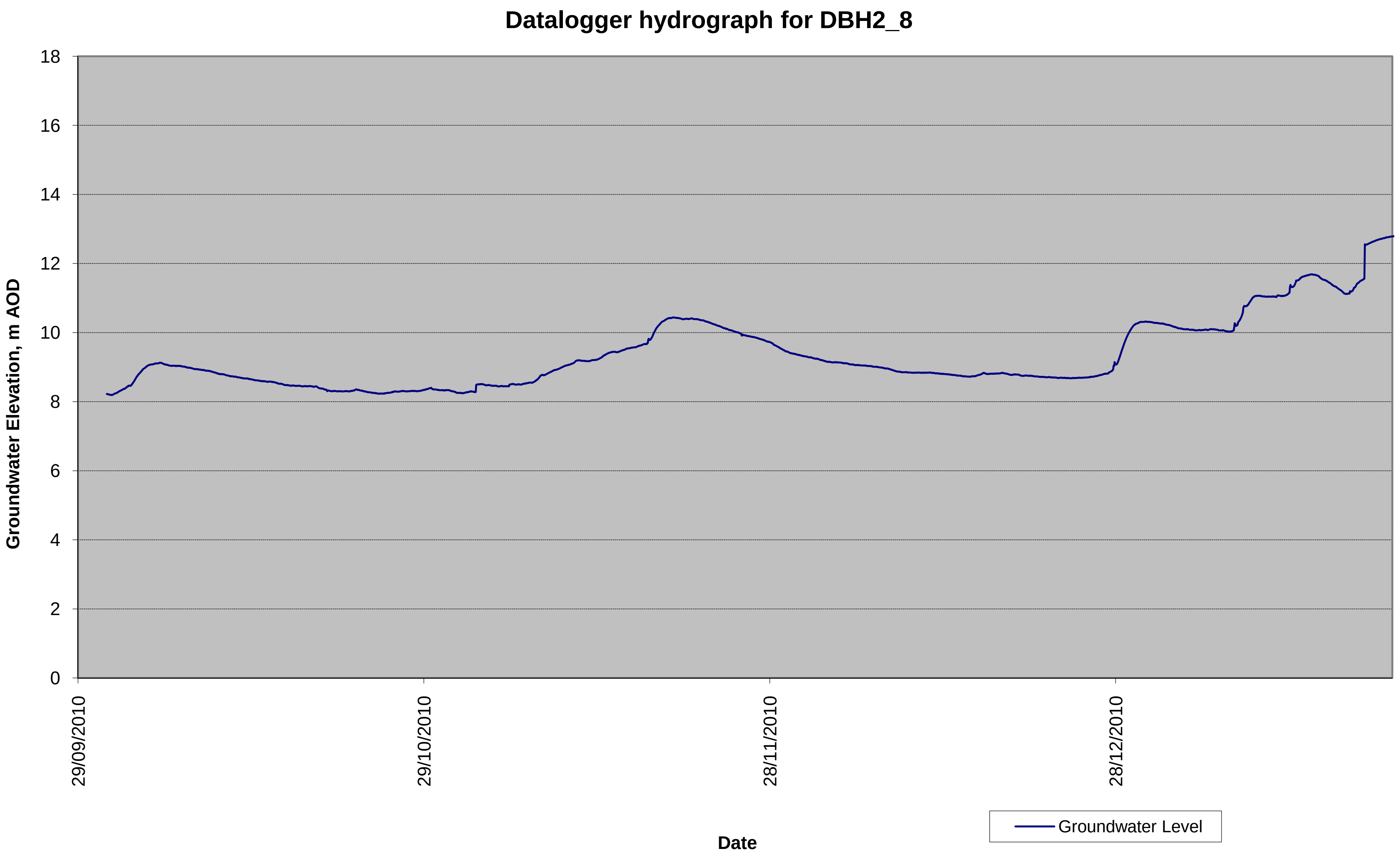


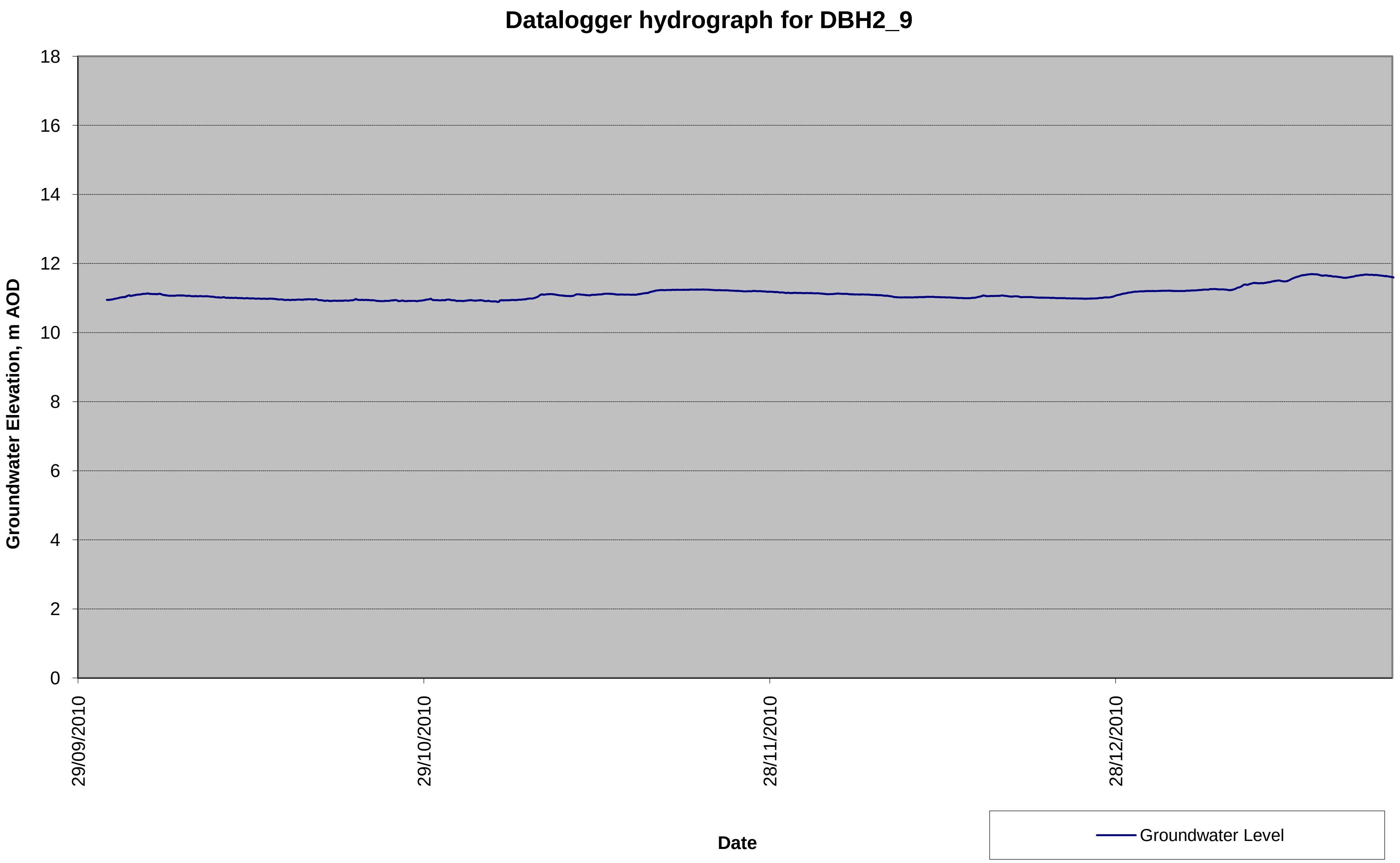


Datalogger hydrograph for CBH35
Groundwater Elevation, m AOD
20
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

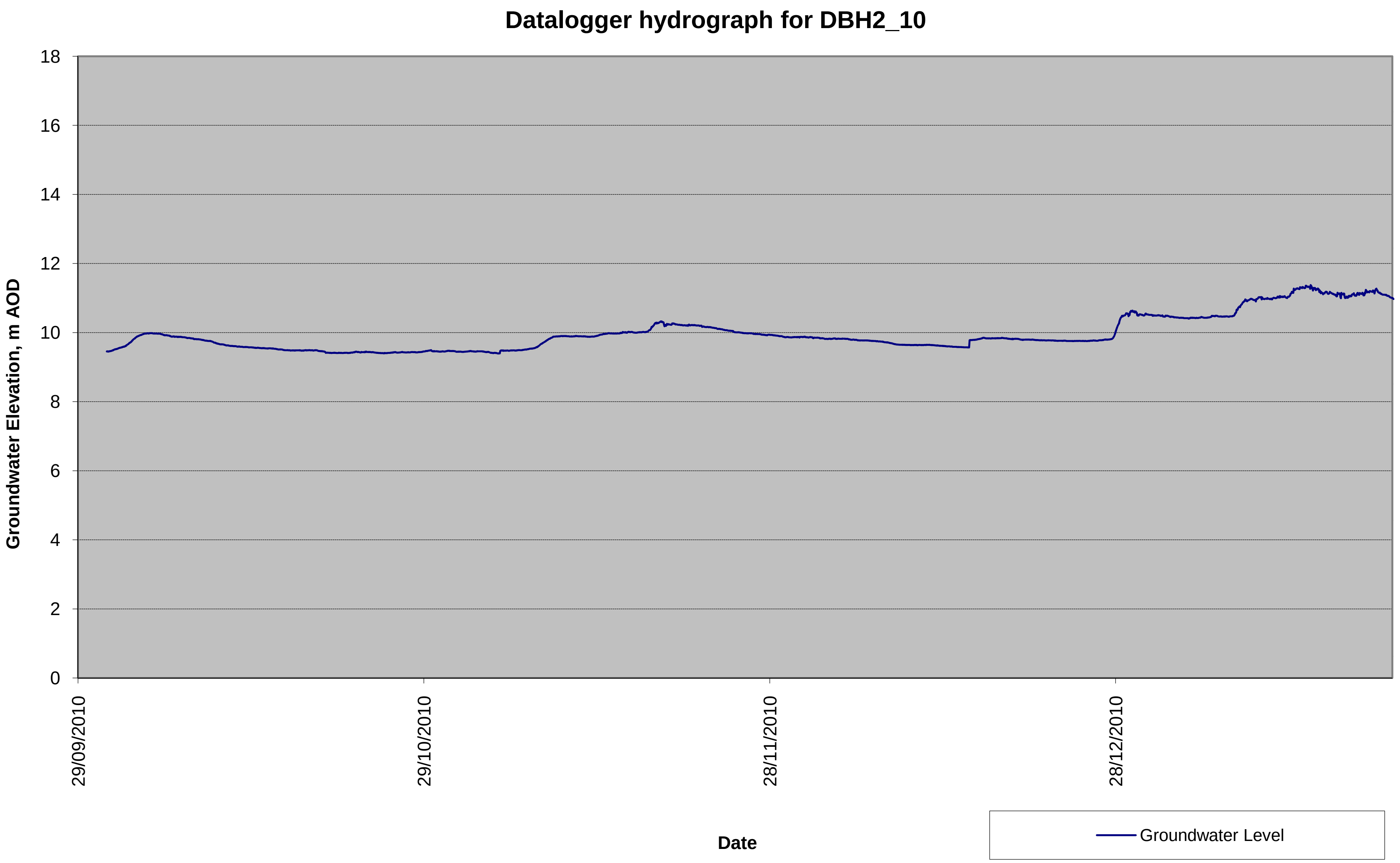
Datalogger hydrograph for DBH2_7



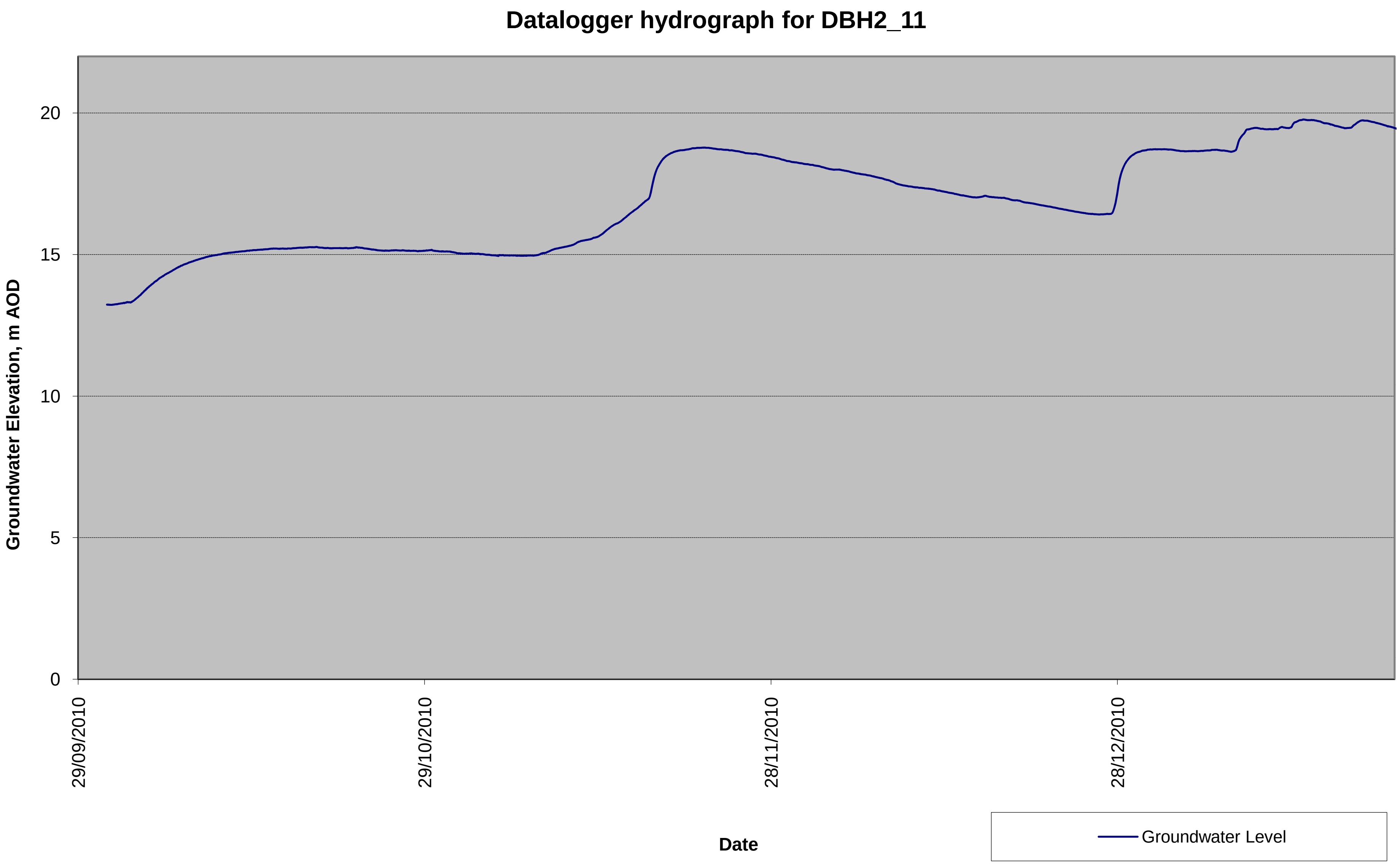

Datalogger hydrograph for DBH2_8
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

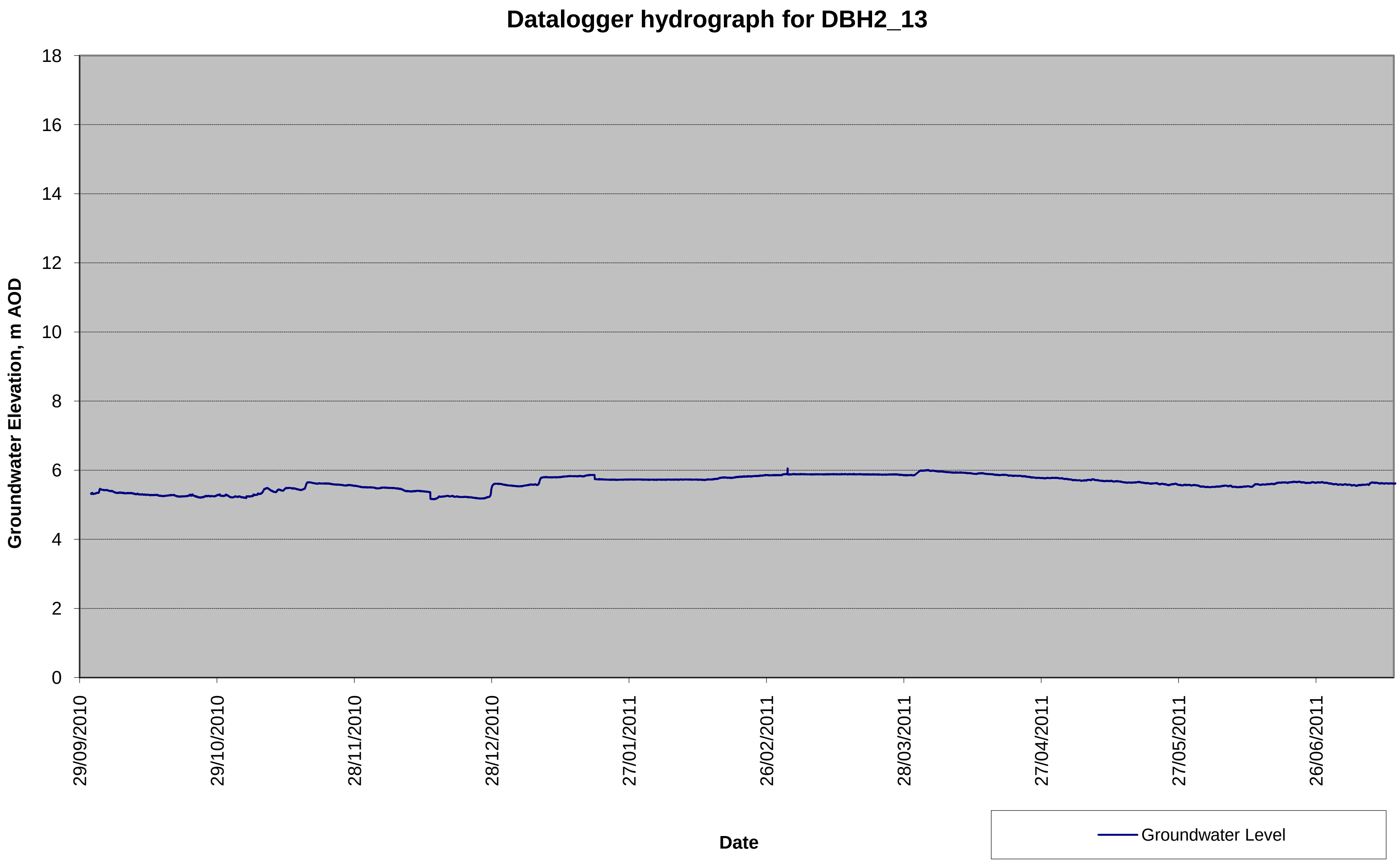


Datalogger hydrograph for DBH2_9
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

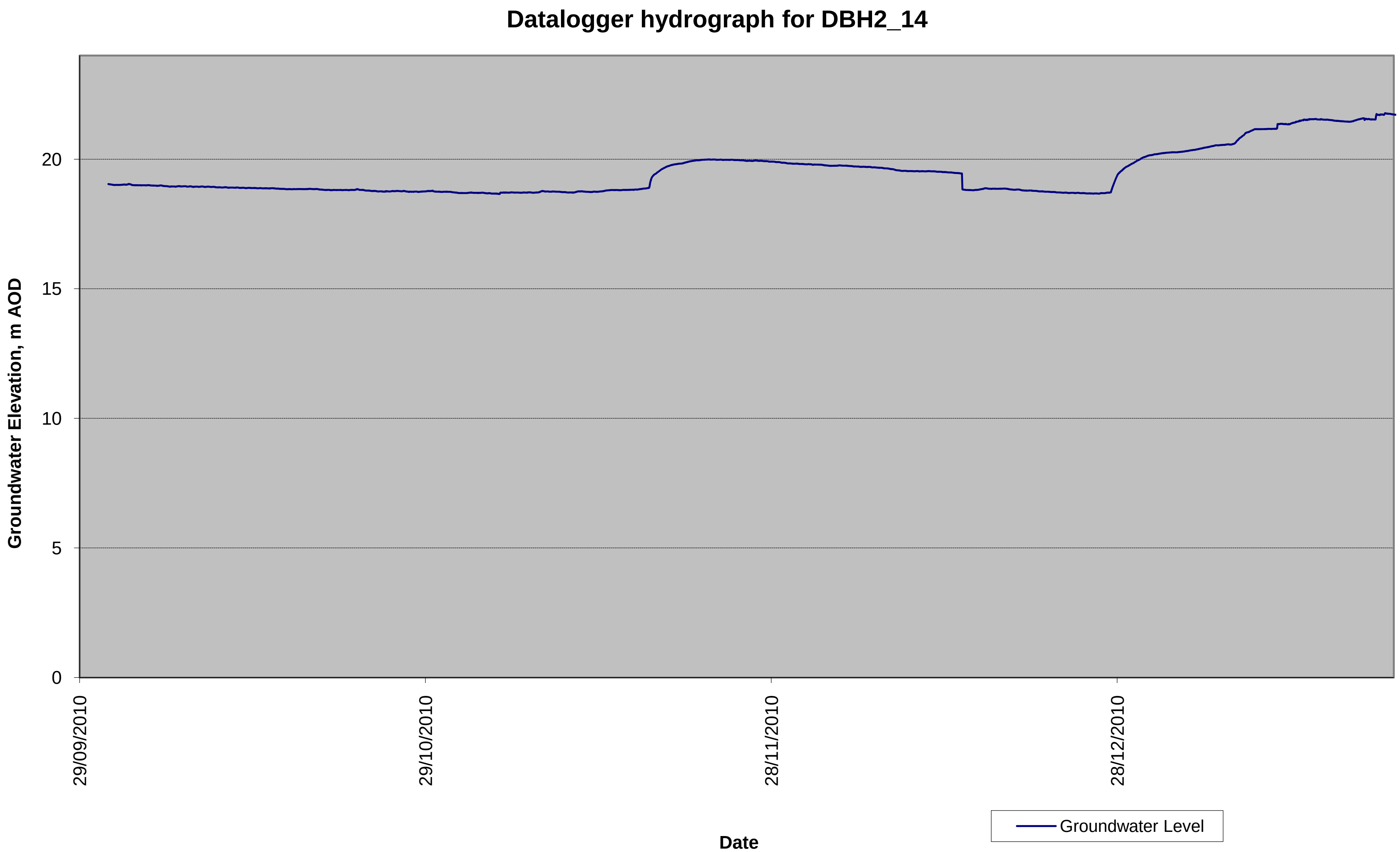


Datalogger hydrograph for DBH2_10
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

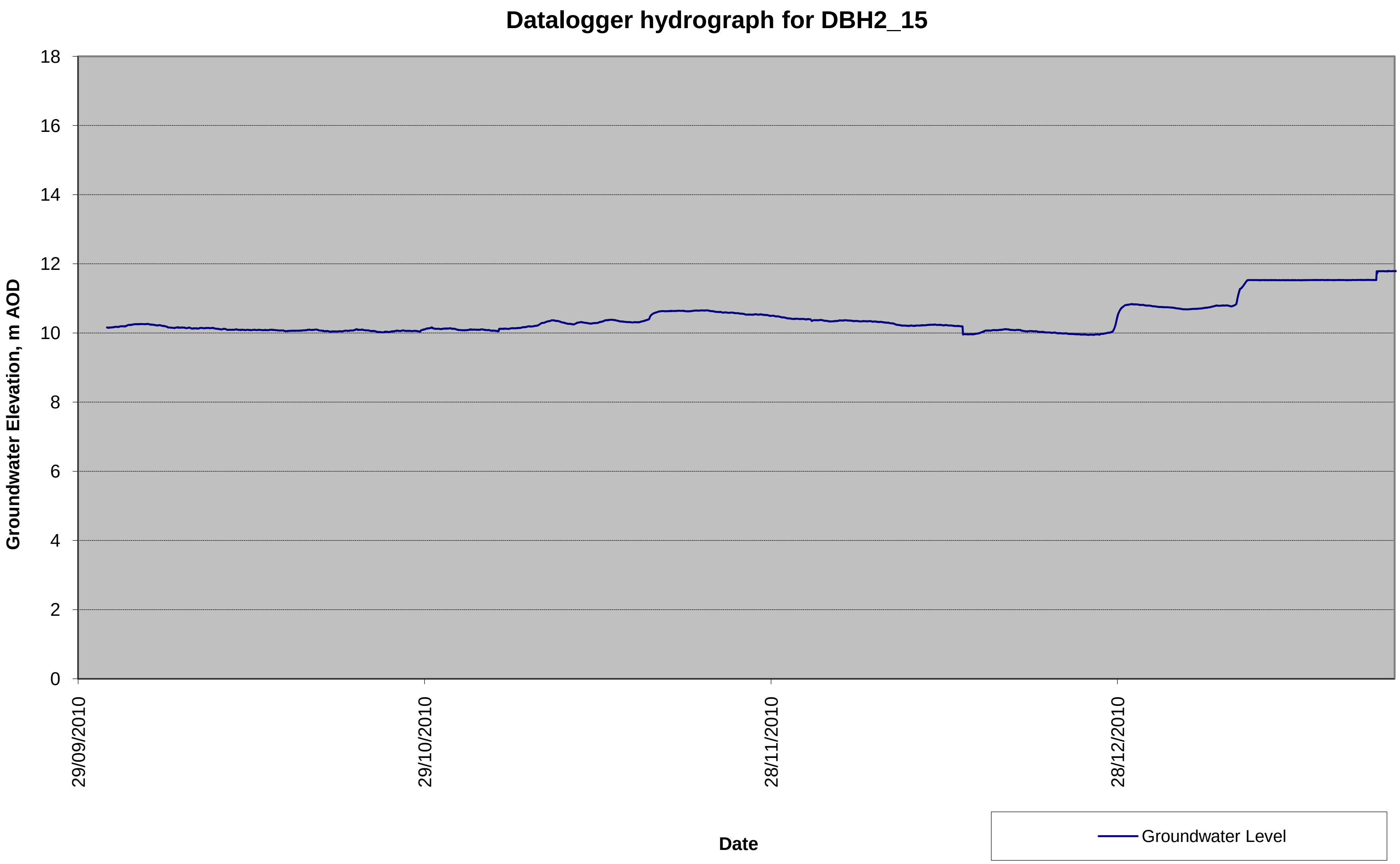

Datalogger hydrograph for DBH2_11
Groundwater Elevation, m AOD
0
5
10
15
20
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level



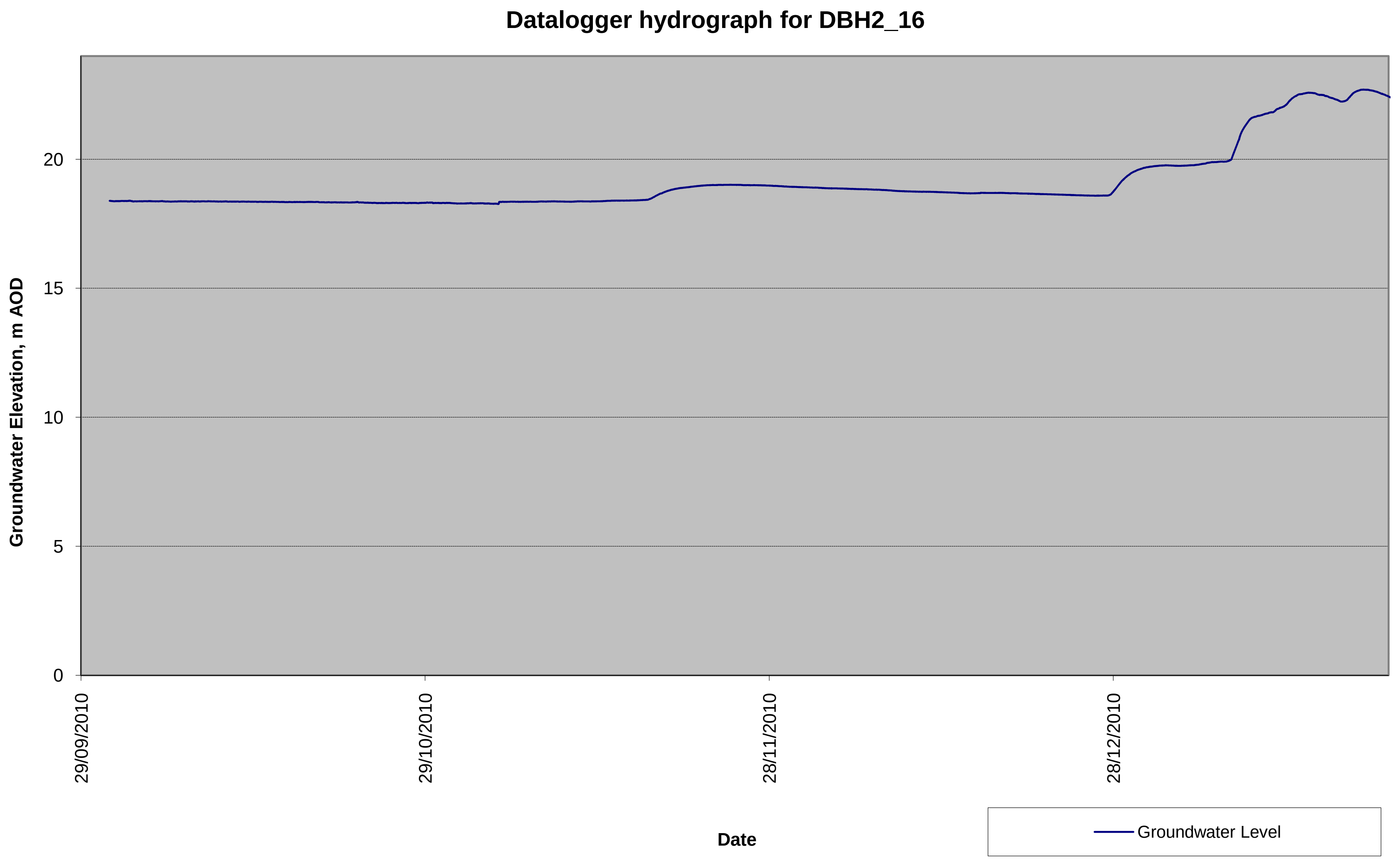
Datalogger hydrograph for DBH2_13
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
27/01/2011
26/02/2011
28/03/2011
27/04/2011
27/05/2011
26/06/2011
Date
Groundwater Level

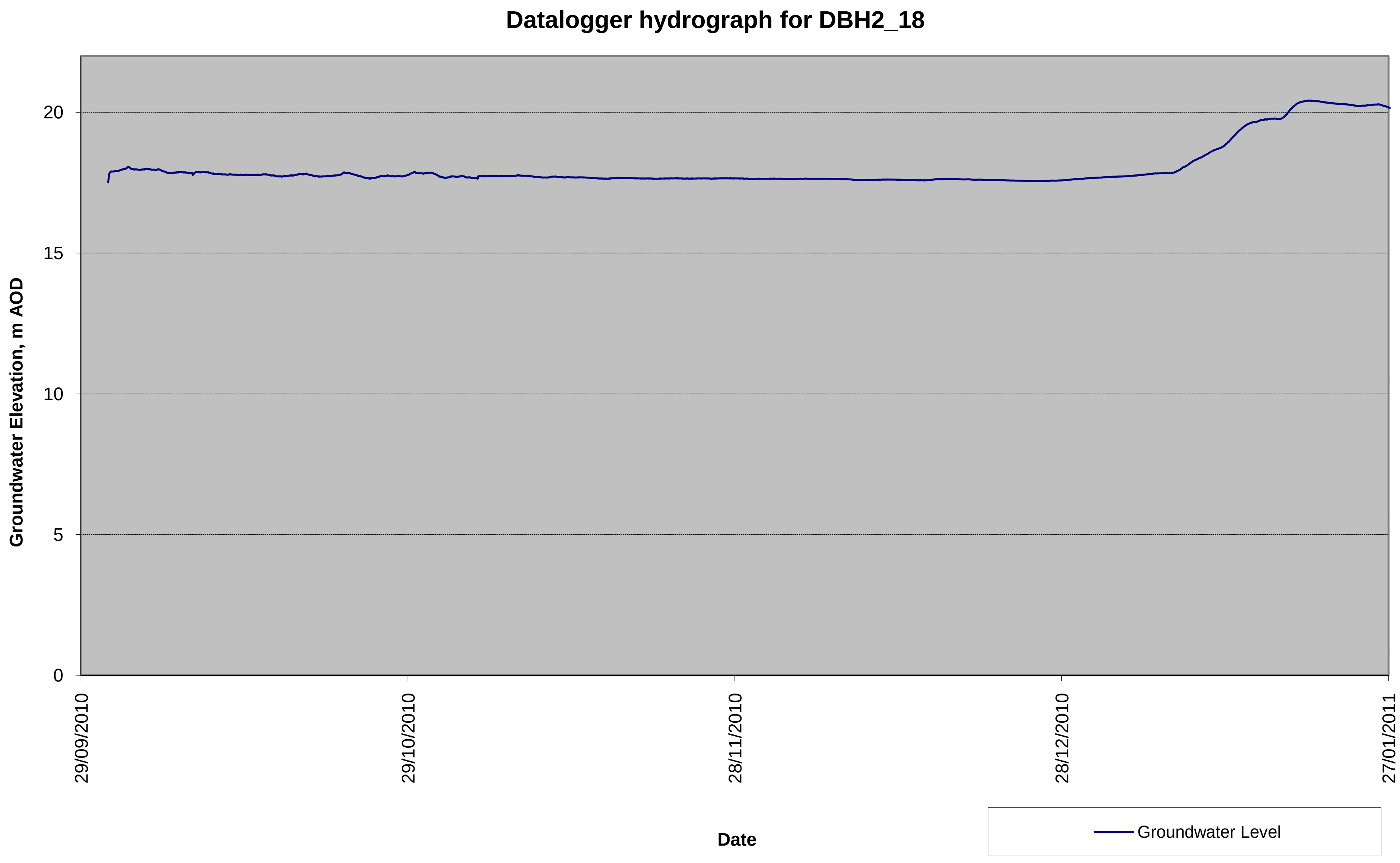


Datalogger hydrograph for DBH2_14
Groundwater Elevation, m AOD
0
5
10
15
20
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

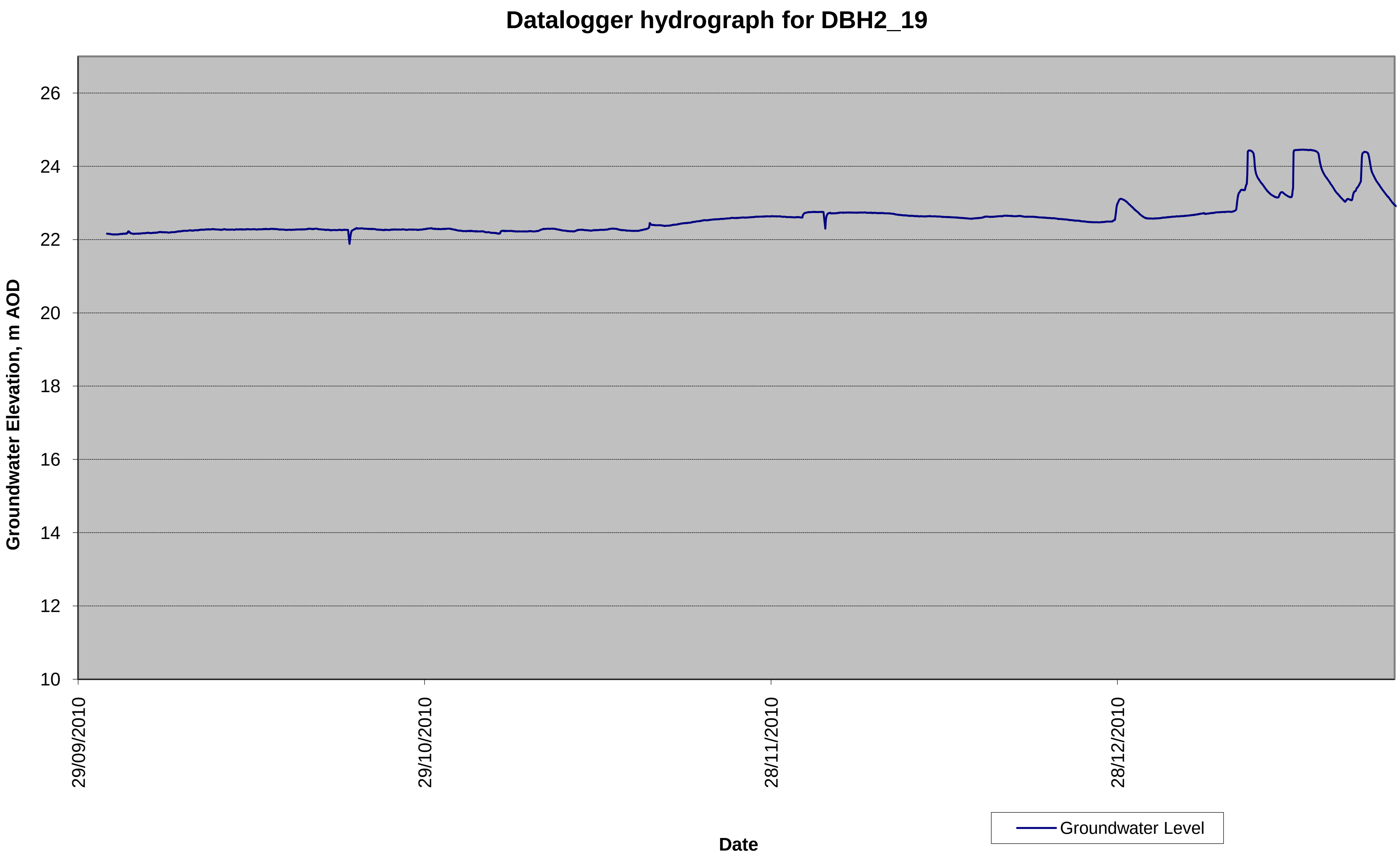


Datalogger hydrograph for DBH2_15
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

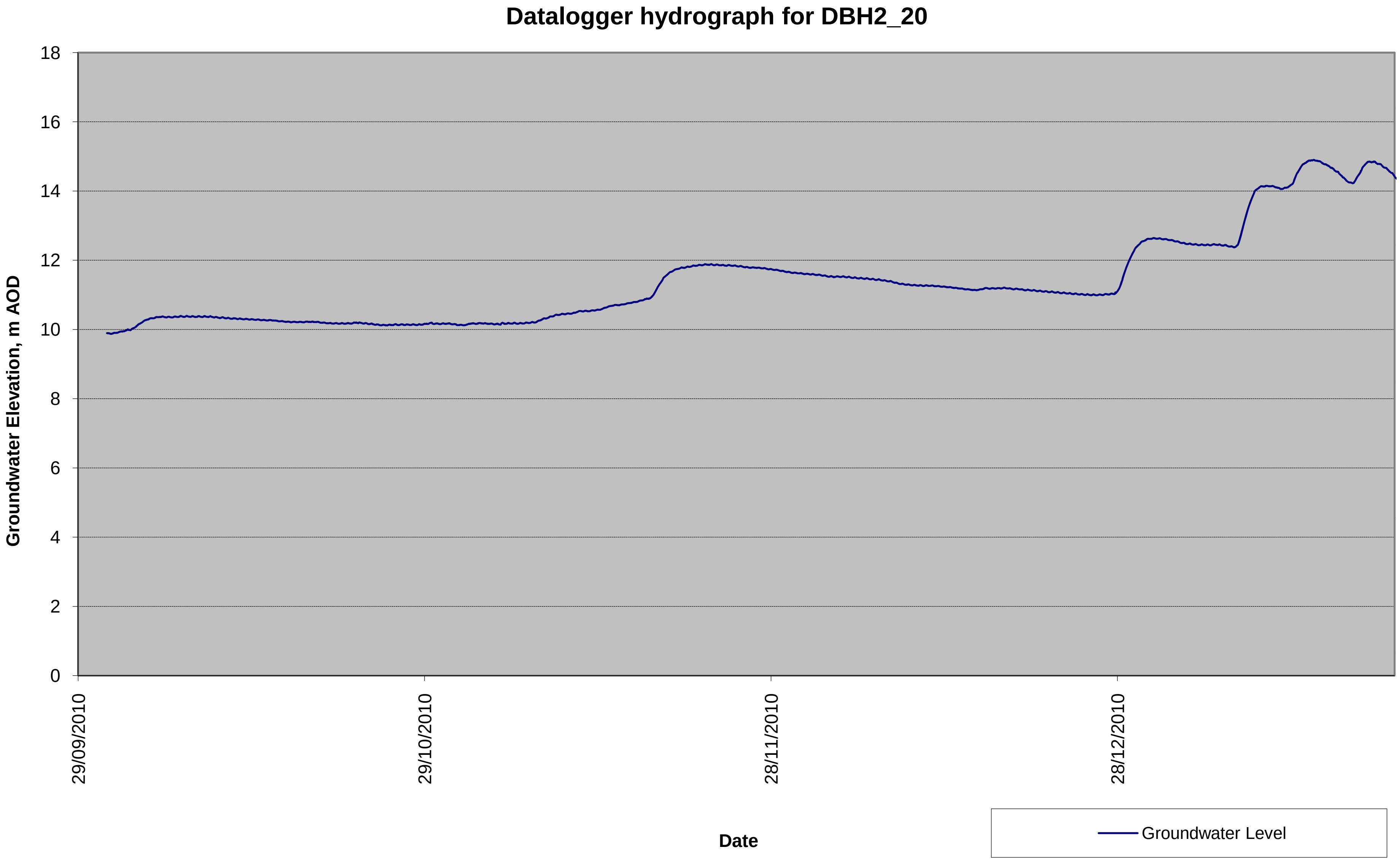

Datalogger hydrograph for DBH2_16
Groundwater Elevation, m AOD
0
5
10
15
20
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

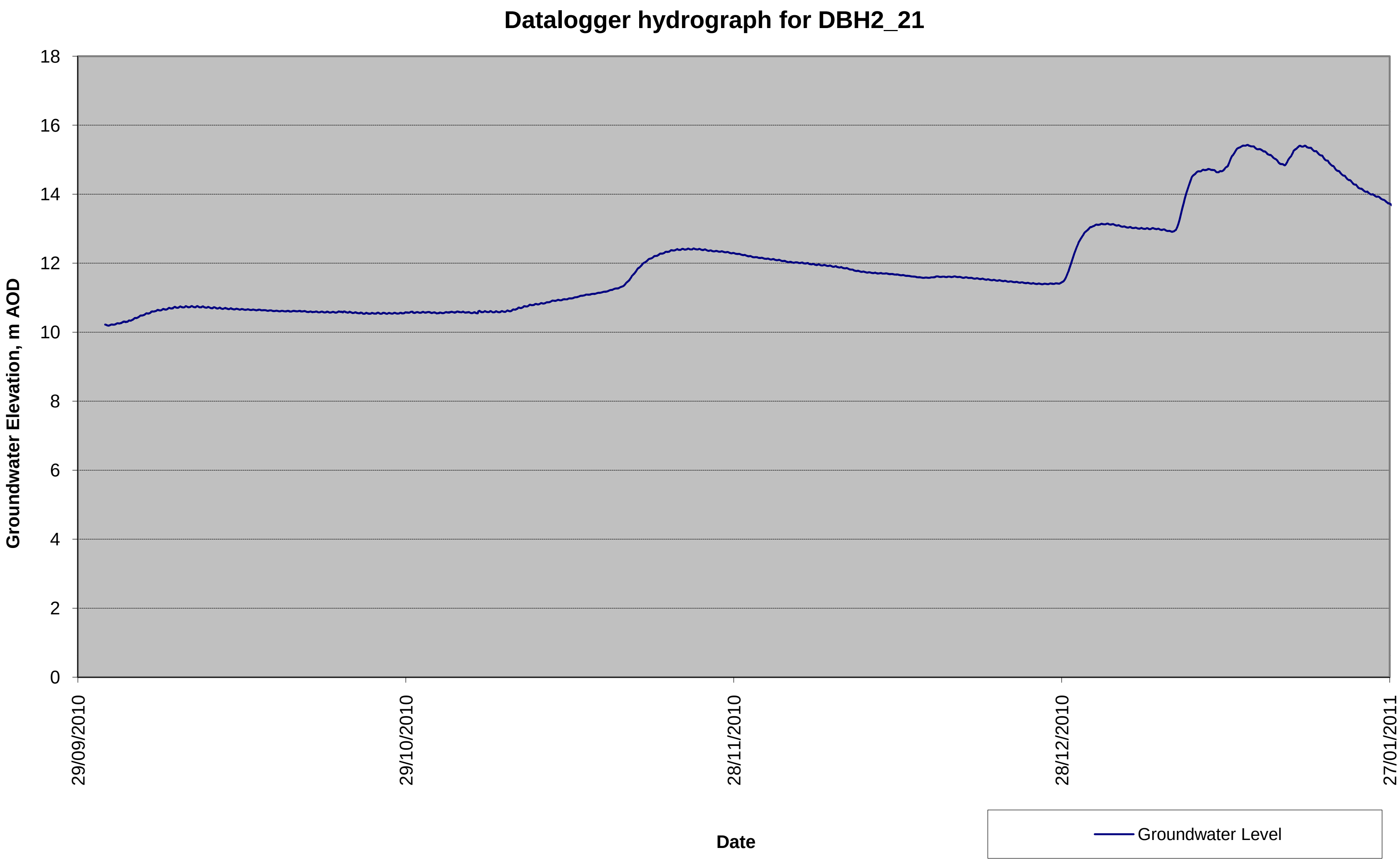


Datalogger hydrograph for DBH2_18
Groundwater Elevation, m AOD
0
5
10
15
20
29/09/2010
29/10/2010
28/11/2010
28/12/2010
27/01/2011
Date
Groundwater Level

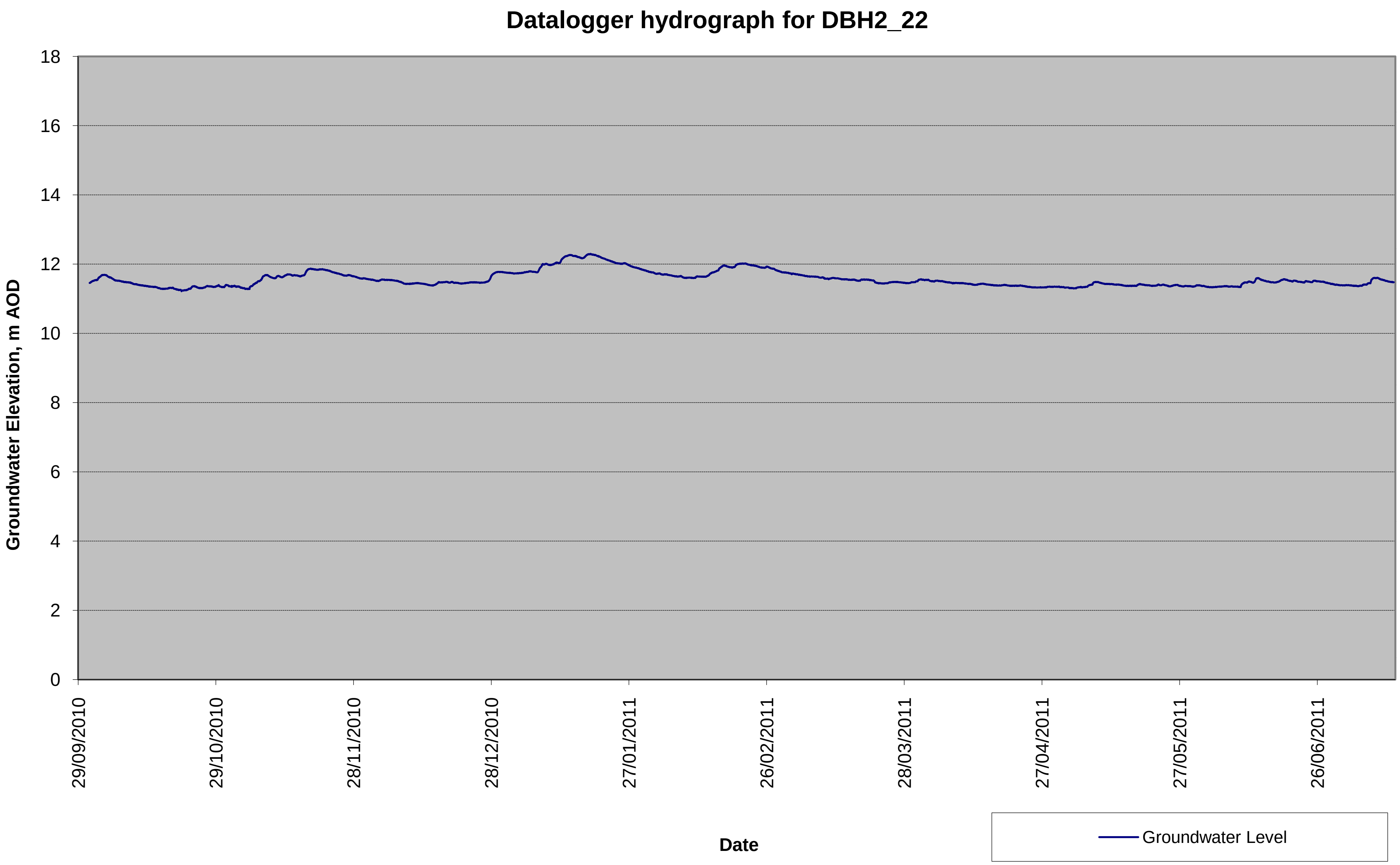


Datalogger hydrograph for DBH2_19
Groundwater Elevation, m AOD
26
24
22
20
18
16
14
12
10
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

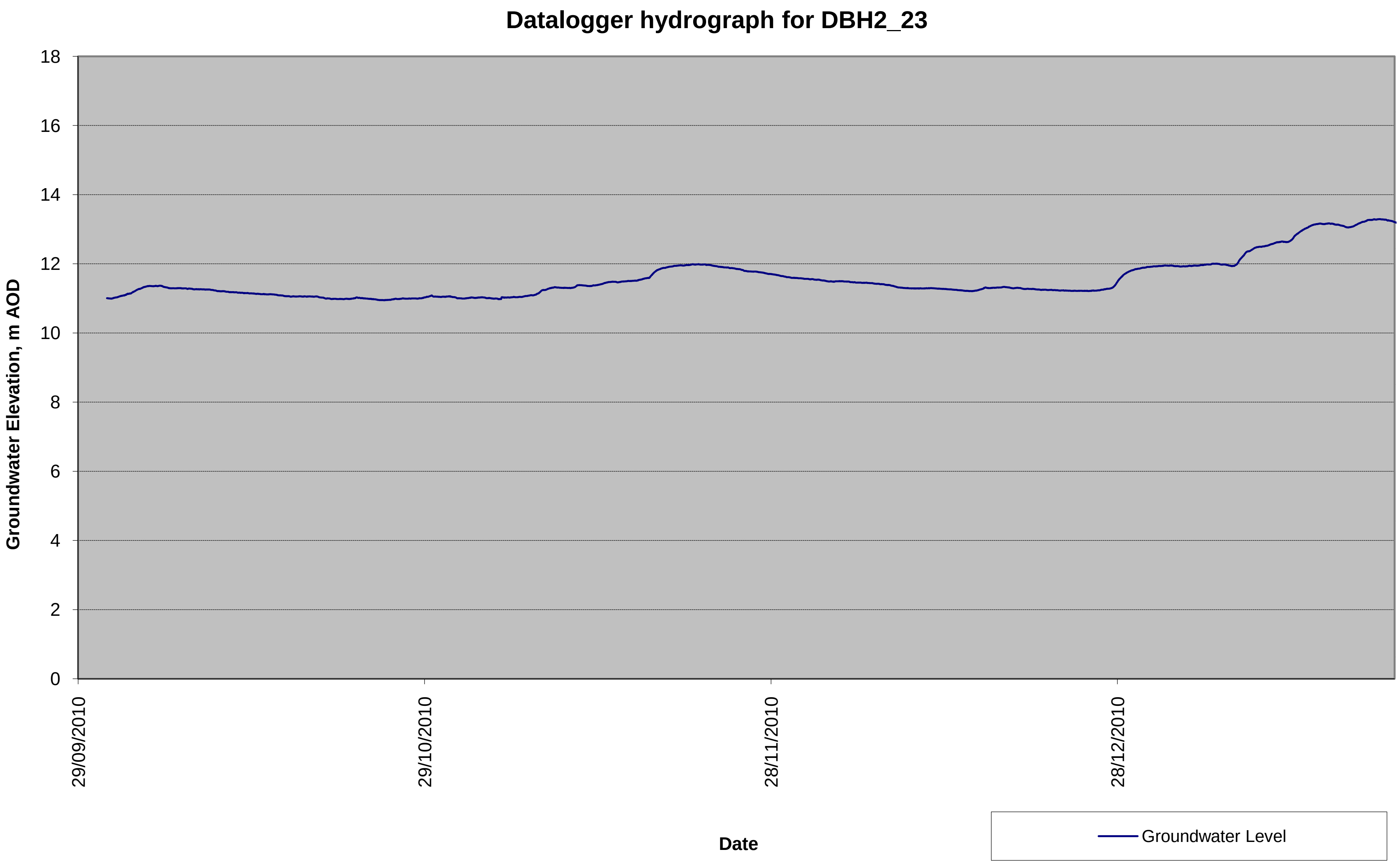

Datalogger hydrograph for DBH2_20
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level



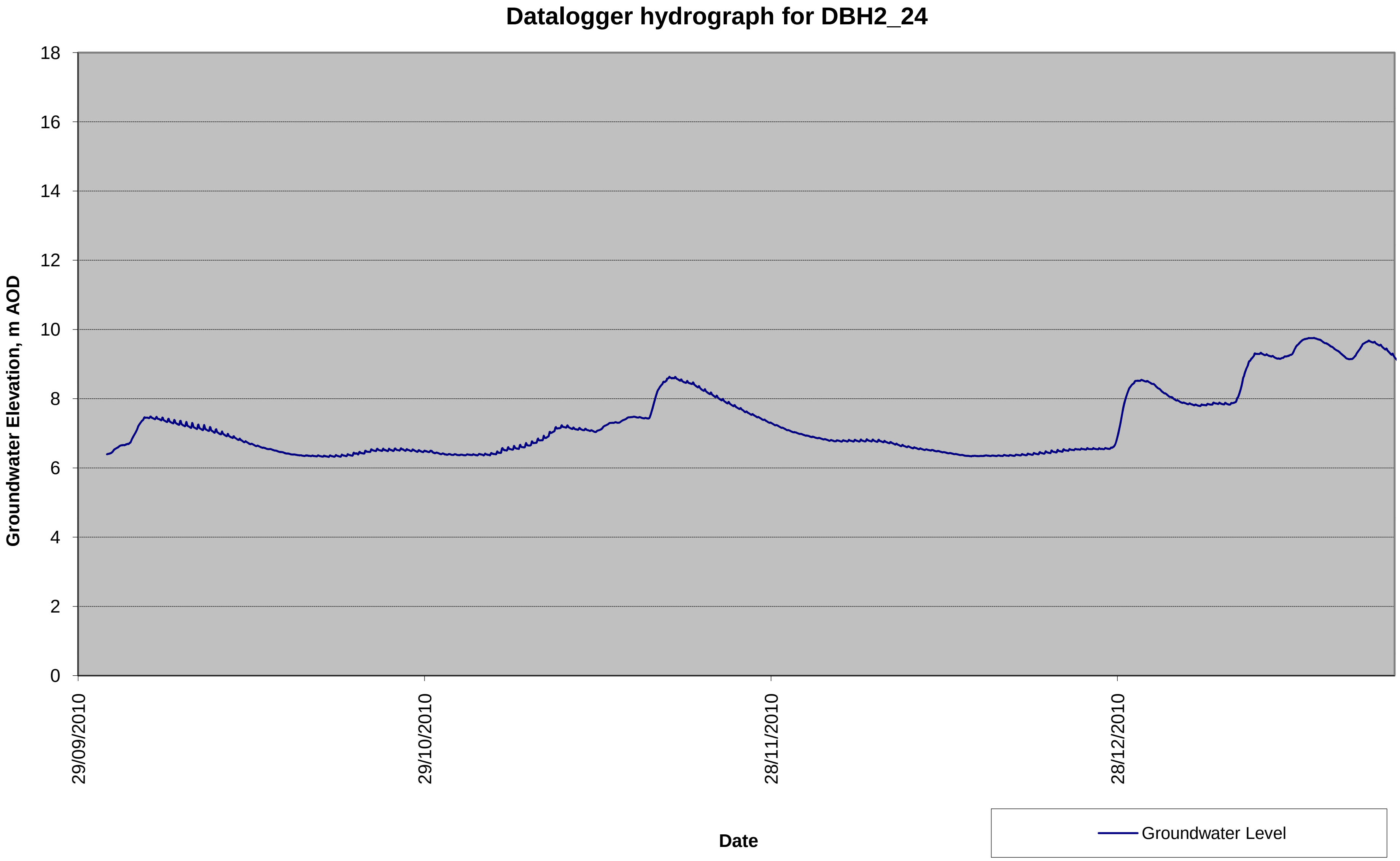
Datalogger hydrograph for DBH2_21
18
16
14
12
10
8
6
4
2
0
Groundwater Elevation, m AOD
29/09/2010
29/10/2010
28/11/2010
28/12/2010
27/01/2011
Date
Groundwater Level



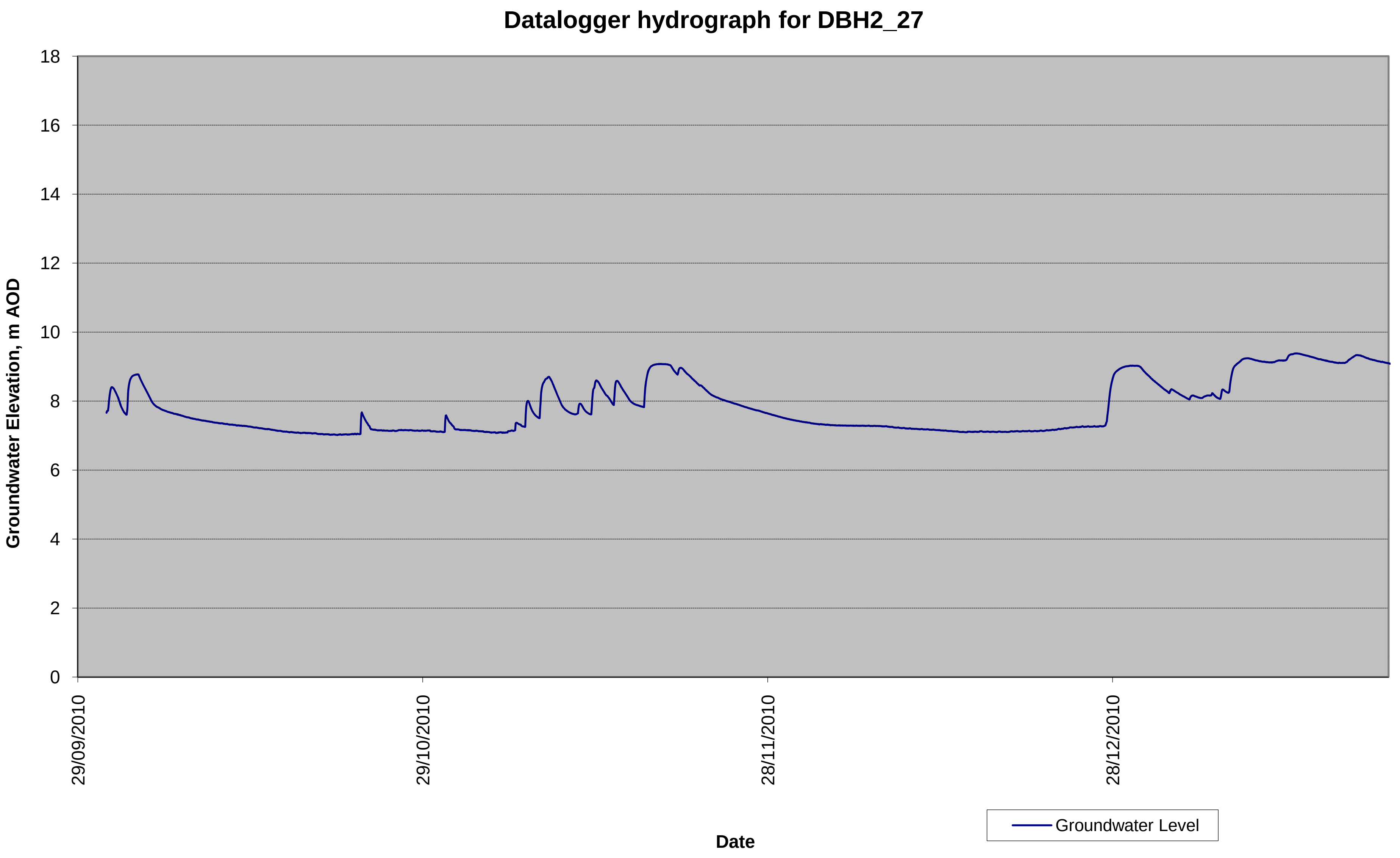
Datalogger hydrograph for DBH2_22
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
29/09/2010
29/10/2010
28/11/2010
28/12/2010
27/01/2011
26/02/2011
28/03/2011
27/04/2011
27/05/2011
26/06/2011
Date
Groundwater Level



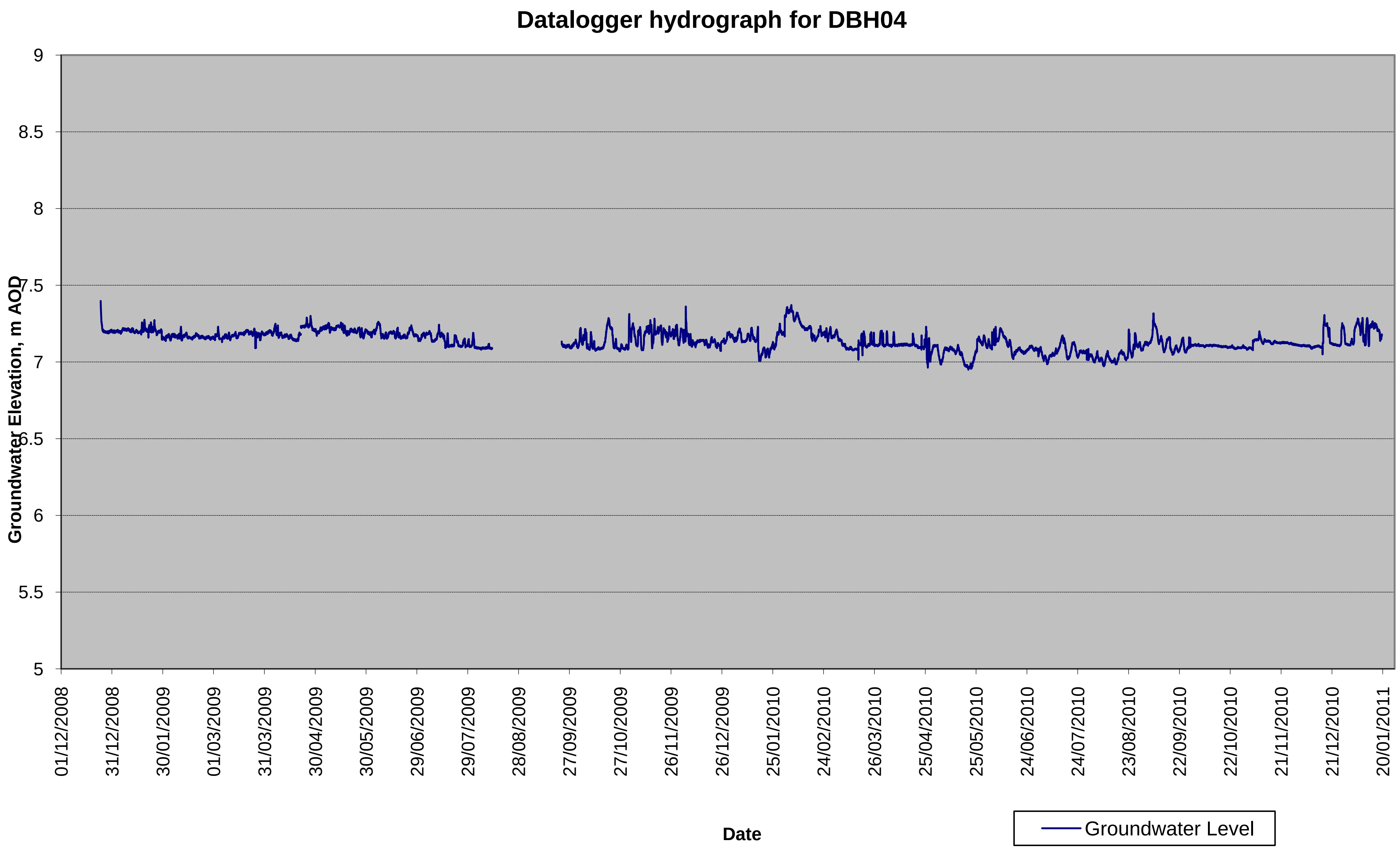
Datalogger hydrograph for DBH2_23
Groundwater Elevation, m AOD
18
16
14
12
10
8
6
4
2
0
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level



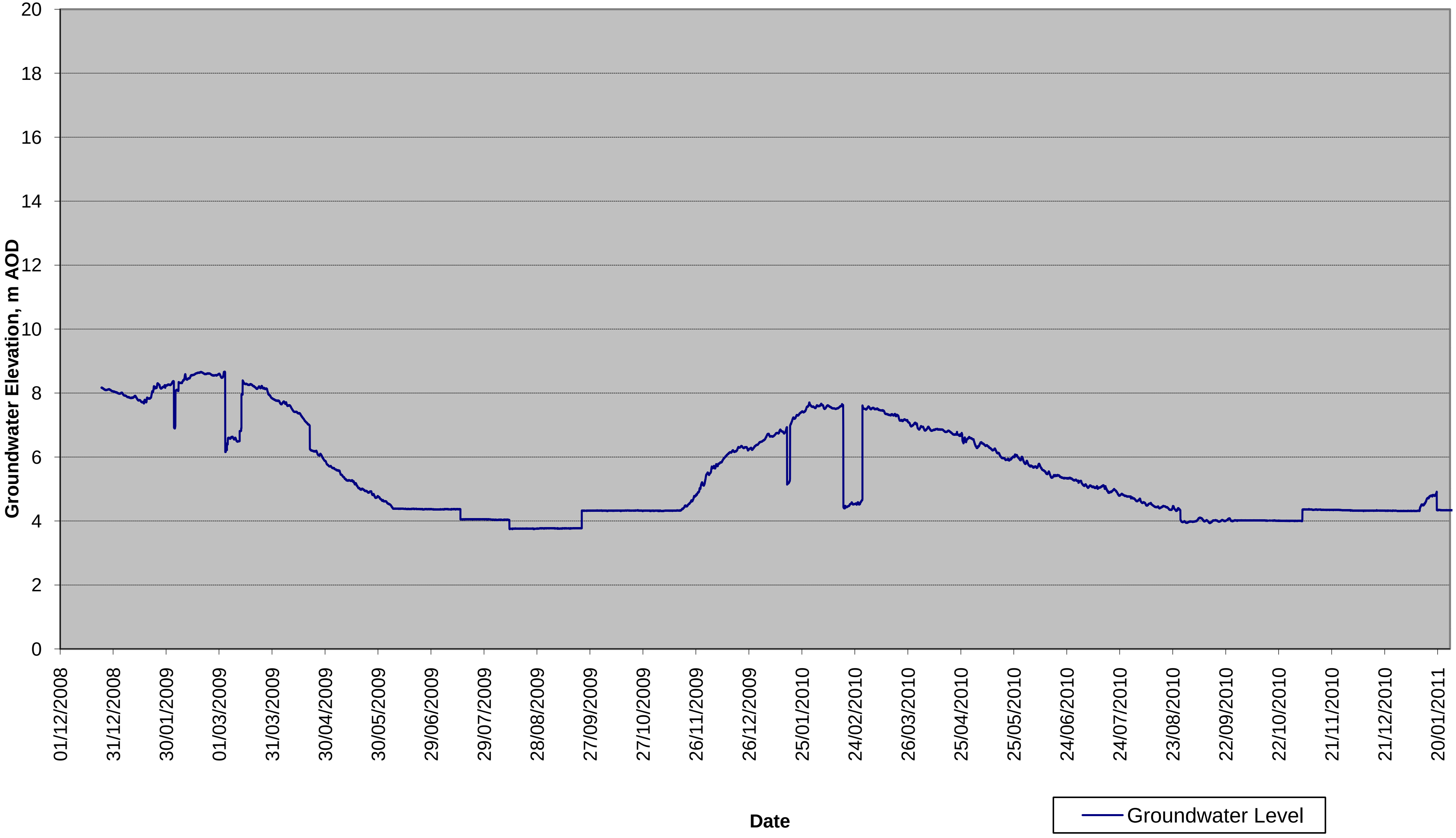
Datalogger hydrograph for DBH2_24
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level



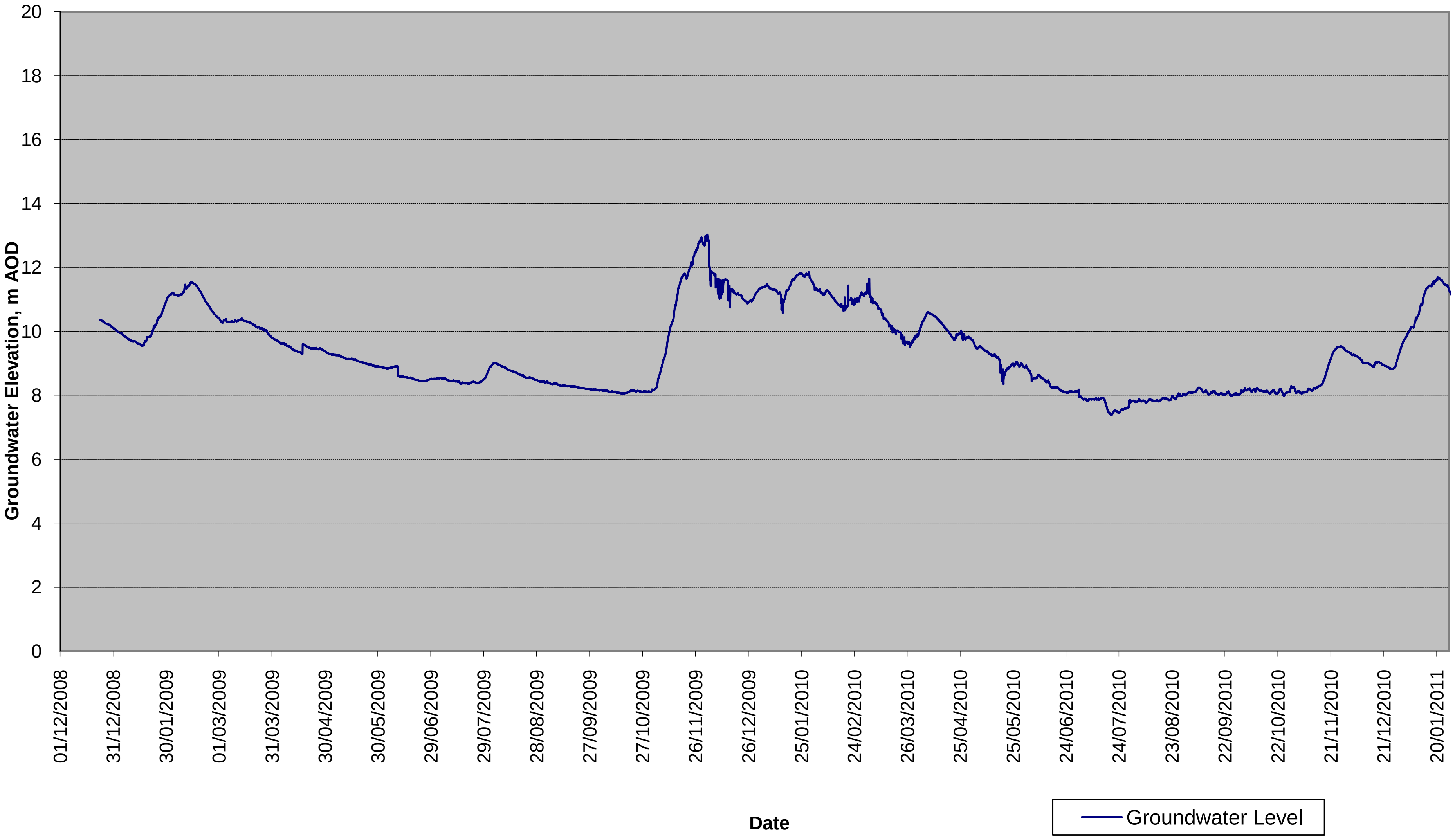
Datalogger hydrograph for DBH2_27
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
29/09/2010
29/10/2010
28/11/2010
28/12/2010
Date
Groundwater Level

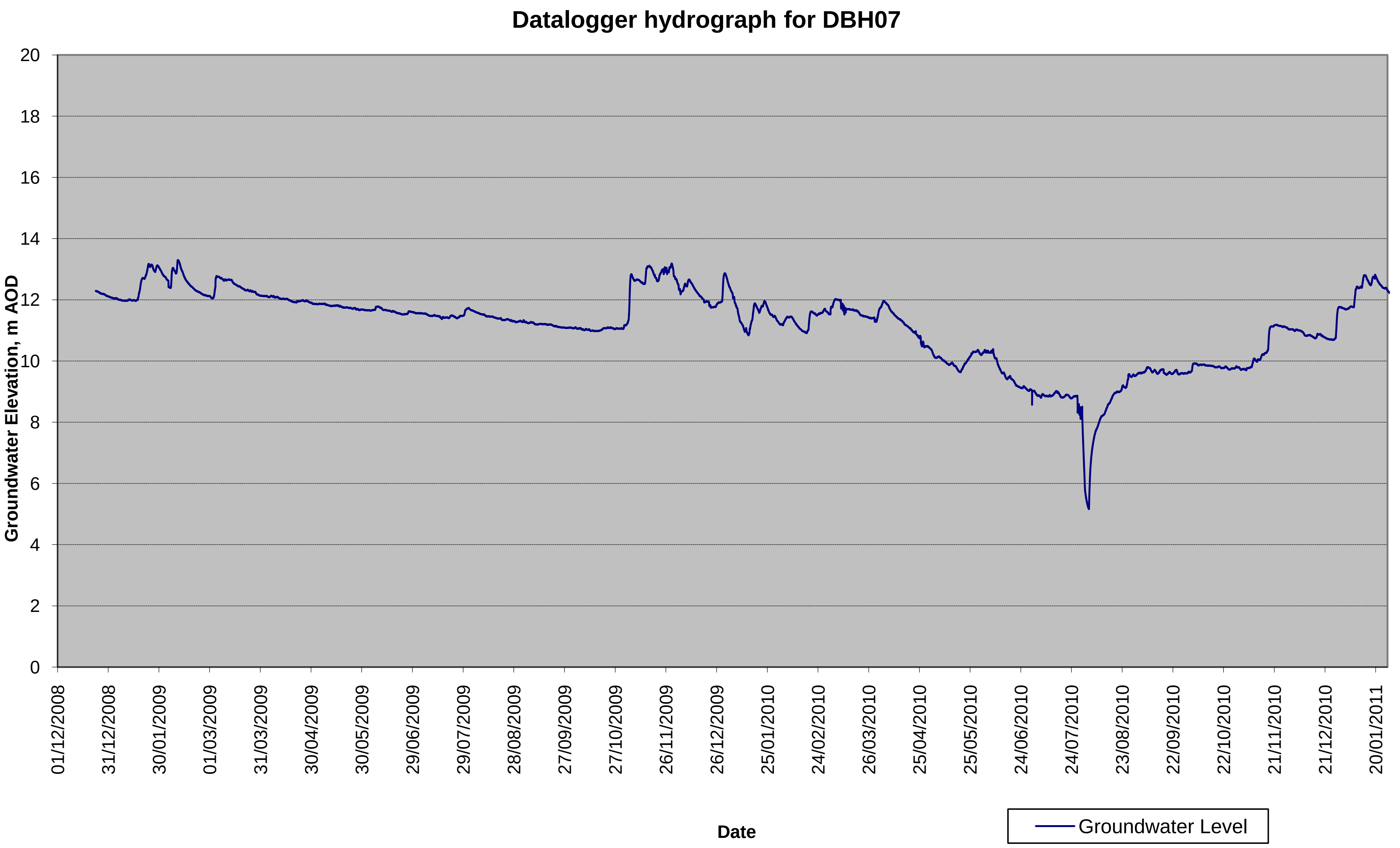

Datalogger hydrograph for DBH04
Groundwater Elevation, m AOD
9
8.5
8
7.5
7
6.5
6
5.5
5
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

Datalogger hydrograph for DBH05

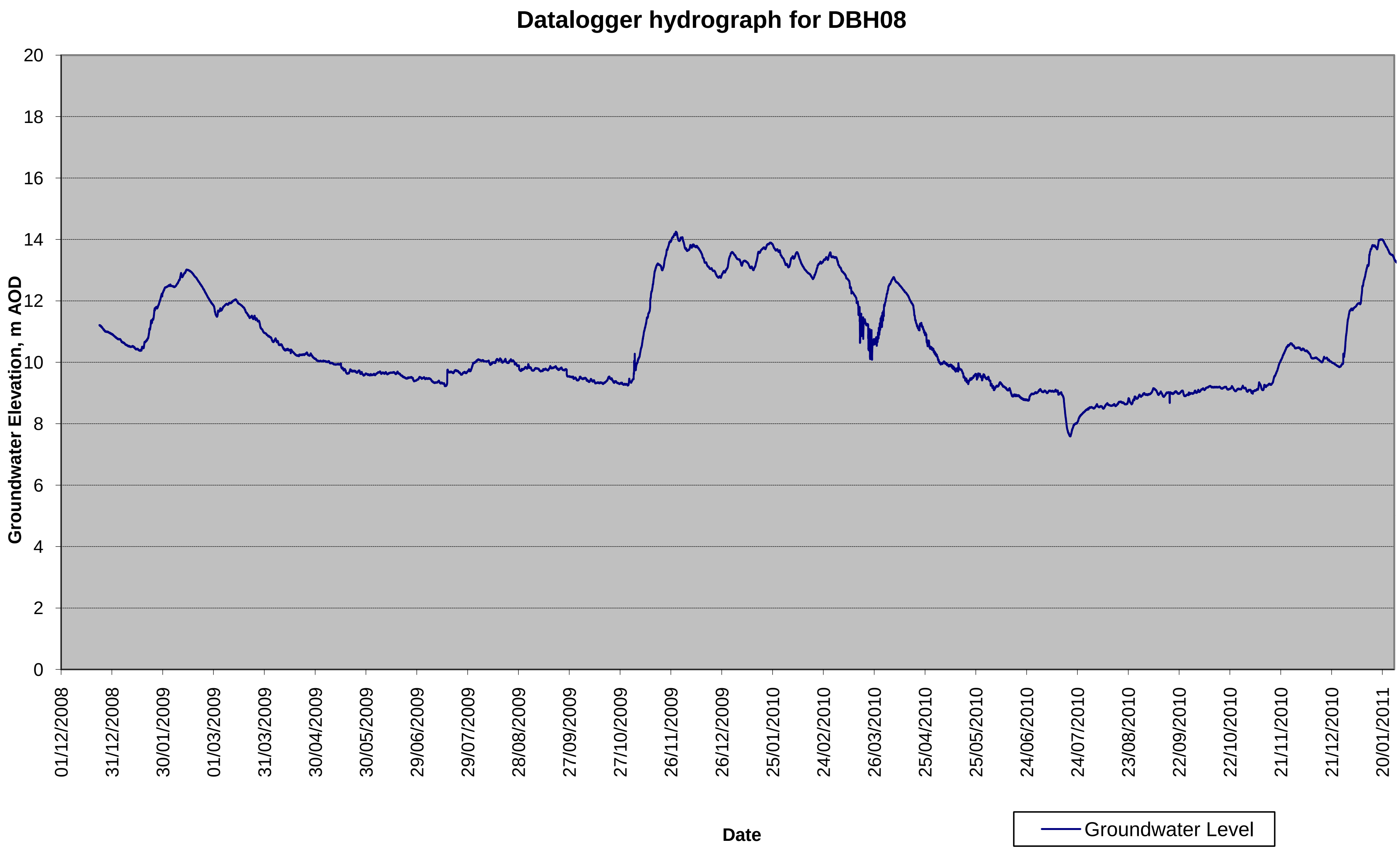


Datalogger hydrograph for DBH06

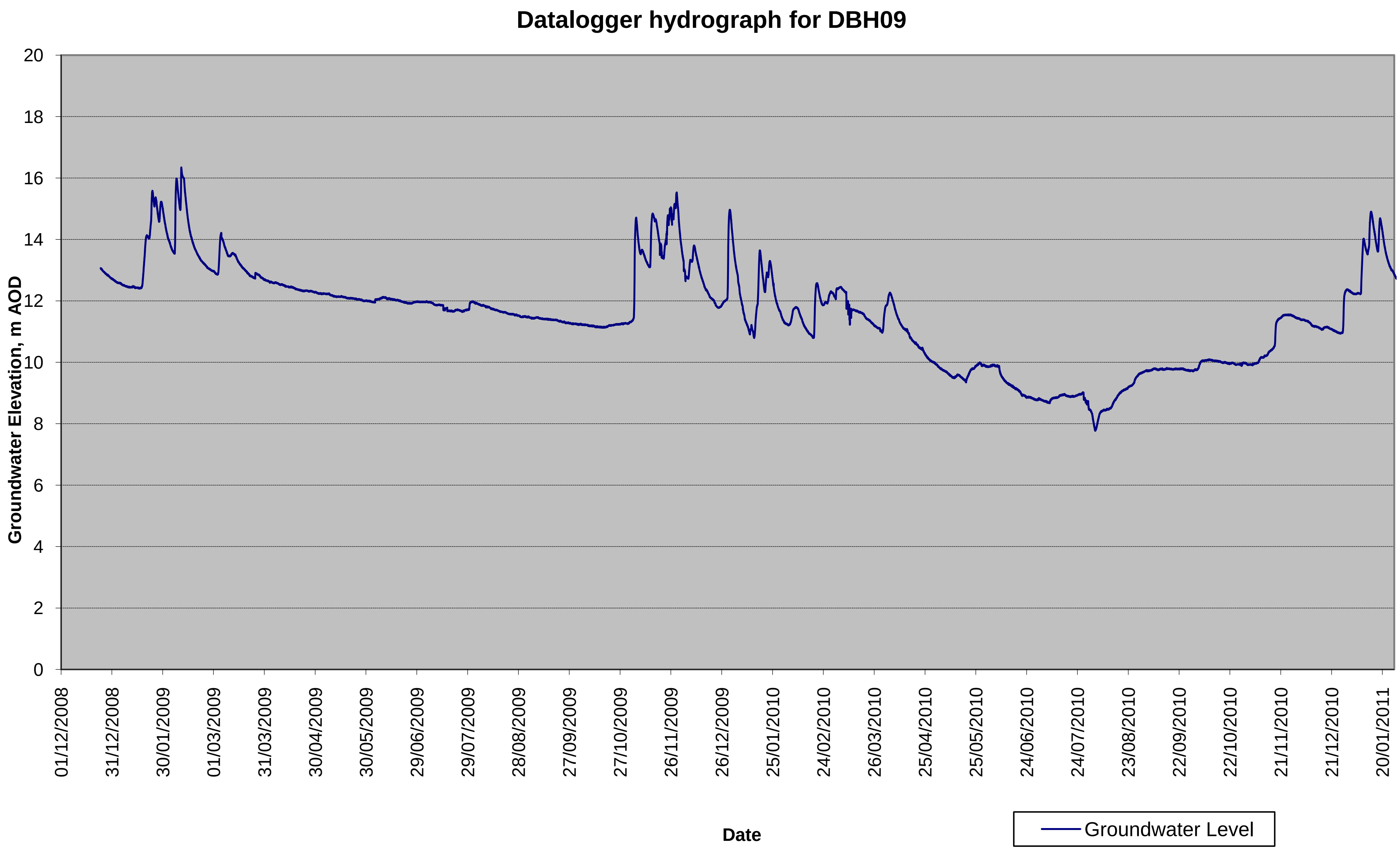




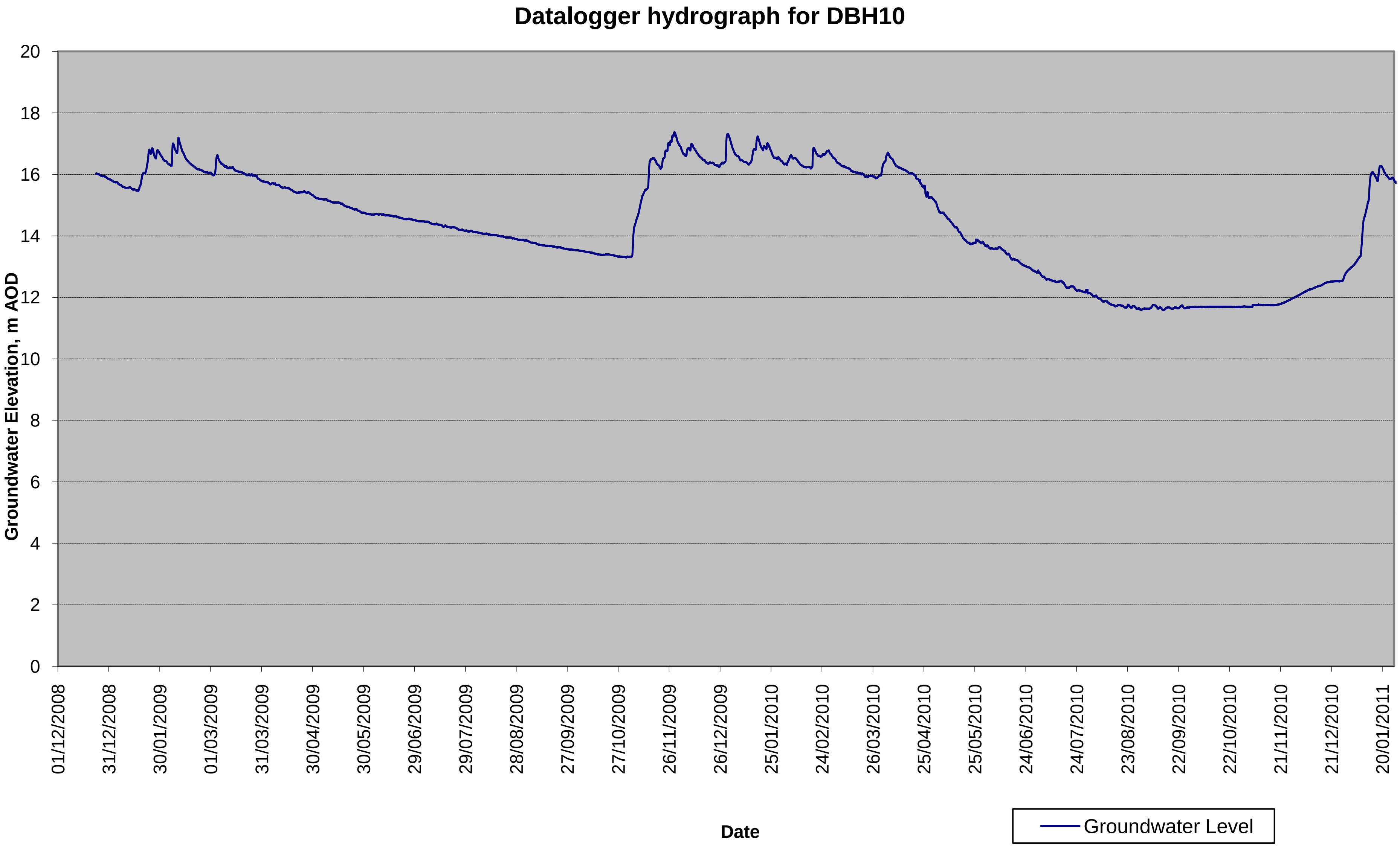
Datalogger hydrograph for DBH07
Groundwater Elevation, m AOD
20
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level



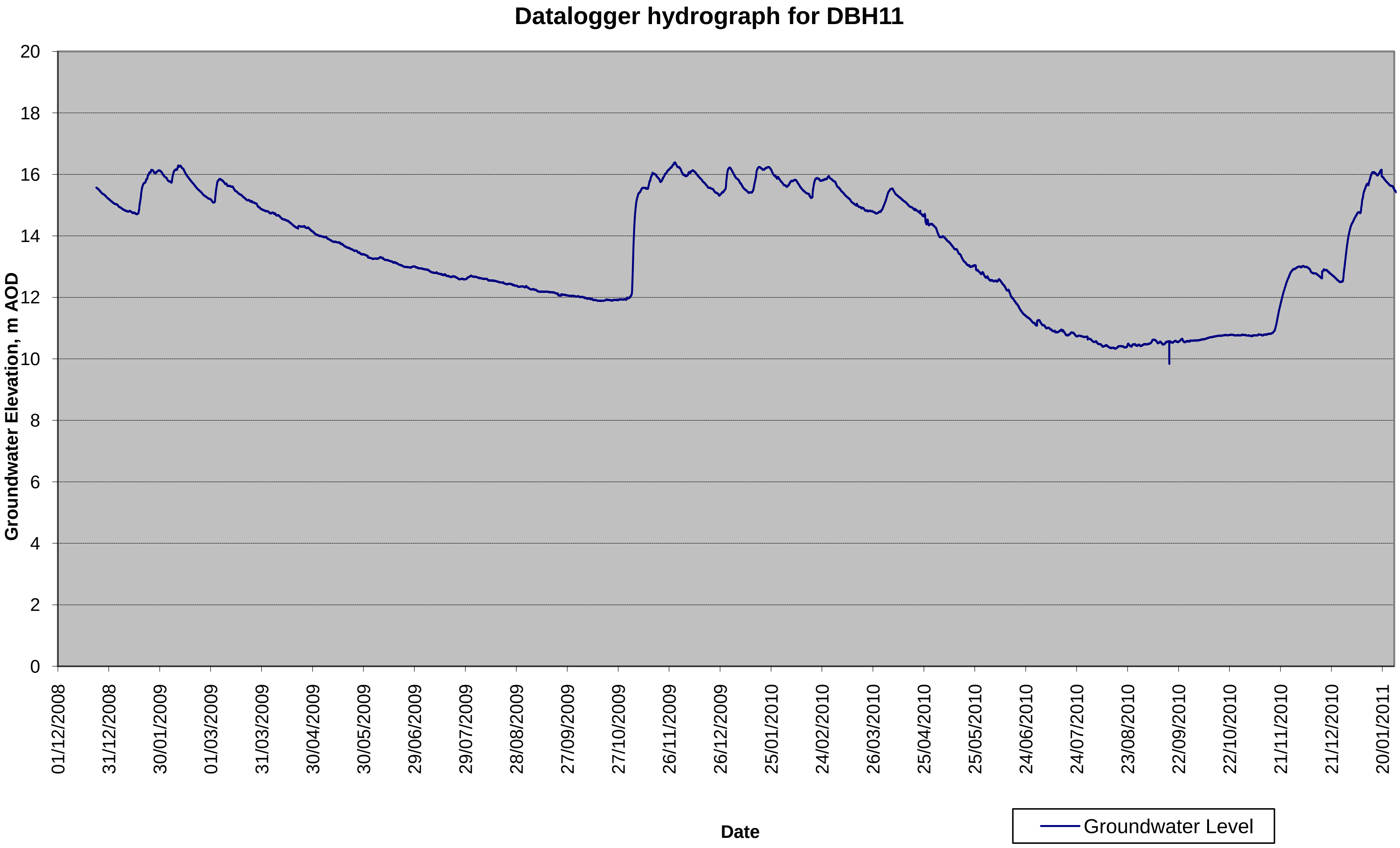
Datalogger hydrograph for DBH08
Groundwater Elevation, m AOD
20
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level



Datalogger hydrograph for DBH09
Groundwater Elevation, m AOD
0
2
4
6
8
10
12
14
16
18
20
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level


Datalogger hydrograph for DBH10
Groundwater Elevation, m AOD
20
18
16
14
12
10
8
6
4
2
0
01/12/2008
31/12/2008
30/01/2009
01/03/2009
31/03/2009
30/04/2009
30/05/2009
29/06/2009
29/07/2009
28/08/2009
27/09/2009
27/10/2009
26/11/2009
26/12/2009
25/01/2010
24/02/2010
26/03/2010
25/04/2010
25/05/2010
24/06/2010
24/07/2010
23/08/2010
22/09/2010
22/10/2010
21/11/2010
21/12/2010
20/01/2011
Date
Groundwater Level

Datalogger hydrograph for DBH11



APPENDIX 15D: METEOROLOGICAL OFFICE MOSES DATA

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Data from the Meteorological Office Surface Exchange System (MOSES) database

	PE_Grass	AE_Grass	PE_RLU	AE_RLU	EP_RLU	SMD_90	SMD_10	SMD_Med
total	576	505	546	460	376	22231	6191	13230

MONTHLY MEANS (1961-2001)			mm/d					
	PE_Grass	AE_Grass	PE_RLU	AE_RLU	EP_RLU	SMD_90	SMD_10	SMD_Med
Jan	0.22	0.22	0.27	0.24	1.92	25.42	0.10	4.37
Feb	0.46	0.45	0.48	0.45	2.08	27.62	0.21	4.70
Mar	0.98	0.96	0.93	0.89	1.71	34.37	0.08	6.88
Apr	1.83	1.76	1.73	1.61	1.32	47.62	2.16	17.94
May	2.72	2.48	2.58	2.28	0.89	67.82	13.69	40.03
Jun	3.23	2.75	3.09	2.54	0.60	87.13	32.96	62.98
Jul	3.18	2.58	3.05	2.37	0.44	98.56	46.86	76.86
Aug	2.70	2.21	2.44	1.86	0.41	98.65	46.01	76.77
Sep	1.74	1.51	1.57	1.30	0.46	89.32	35.35	65.81
Oct	0.82	0.77	0.77	0.71	0.63	65.50	13.06	38.70
Nov	0.35	0.34	0.36	0.34	0.95	44.96	2.79	17.67
Dec	0.19	0.19	0.24	0.21	1.23	35.36	0.43	8.91

MONTHLY MEANS (1961-2001)			mm/month						Brymore School rainfall 1962-1995	EP-SMD
	PE_Grass	AE_Grass	PE	AE	ffective precipitatic	SMD_90	SMD_10	SMD	Rainfall	(when EP>SMD)
Jan	6.96	6.90	8.25	7.53	59.66	25.42	0.10	4.37	82	55.29
Feb	13.05	12.84	13.55	12.63	58.90	27.62	0.21	4.70	59	54.20
Mar	30.36	29.84	28.88	27.67	52.91	34.37	0.08	6.88	60	46.04
Apr	54.96	52.67	51.76	48.28	39.63	47.62	2.16	17.94	50	21.68
May	84.26	76.84	79.83	70.54	27.66	67.82	13.69	40.03	56	0.00
Jun	96.76	82.44	92.64	76.32	18.09	87.13	32.96	62.98	49	0.00
Jul	98.65	79.86	94.45	73.56	13.59	98.56	46.86	76.86	48	0.00
Aug	83.84	68.43	75.66	57.67	12.70	98.65	46.01	76.77	58	0.00
Sep	52.26	45.32	47.20	39.05	13.78	89.32	35.35	65.81	67	0.00
Oct	25.52	23.88	23.92	21.97	19.39	65.50	13.06	38.70	71	0.00
Nov	10.37	10.12	10.83	10.21	28.62	44.96	2.79	17.67	77	10.95
Dec	6.04	5.97	7.34	6.64	38.16	35.36	0.43	8.91	82	29.25
Total	563.03	495.09	534.30	452.08	383.10				759.00	217.42

MONTHLY MEANS (1961-2001)

	PE	AE	Effective precipitation	SMD	Rainfall (Brymore School 1962-1995)
	mm/month	mm/month	mm/month	mm	mm/month
Jan	8.25	7.53	59.66	4.37	82
Feb	13.55	12.63	58.90	4.70	59
Mar	28.88	27.67	52.91	6.88	60
Apr	51.76	48.28	39.63	17.94	50
May	79.83	70.54	27.66	40.03	56
Jun	92.64	76.32	18.09	62.98	49
Jul	94.45	73.56	13.59	76.86	48
Aug	75.66	57.67	12.70	76.77	58
Sep	47.20	39.05	13.78	65.81	67
Oct	23.92	21.97	19.39	38.70	71
Nov	10.83	10.21	28.62	17.67	77
Dec	7.34	6.64	38.16	8.91	82
Total	534.30	452.08	383.10		759

Q1 runoff SAAR 752

	Zone								
	1	2	3	4	u/s GAS				
					1	2.33	5	30	100
m3/s	0.509	0.15	0.215	0.124	3.967	7.34	8.439	11.731	14.827
m3/d	43977.6	12960	18576	10713.6	342748.8				
area Ha	90.58	25.06	35.79	20.69					
area m2	439776000	129600000	185760000	107136000	29460000				
m/d	0.0001	0.0001	0.0001	0.0001	0.01163438				
mm/d	0.1	0.1	0.1	0.1	11.6343788				
mm/mth	3	3	3	3	349.031365				
mm/a	36.5	36.5	36.5	36.5	4246.54827		0.192392		

APPENDIX 15E: BASELINE – DETAILED NON-RADIOLOGICAL GROUNDWATER CHEMISTRY

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APPENDIX 15E: BASELINE – DETAILED NON-RADIOLOGICAL GROUNDWATER CHEMISTRY

15E.1 Built Development Area West (BDAW)

15E.1.1 AMEC have undertaken a groundwater quality monitoring programme on the BDAW. The monitoring programme comprised a total of five monitoring campaigns, in December 2008; and in January, March, April and June 2009. Technical reports detailing a summary of the findings from these five monitoring campaigns are included in the AMEC report (Ref. 15E.1)

15E.1.2 During each campaign pumped groundwater samples have been collected (following purging in accordance with standard procedures) from eleven borehole piezometers installed as part of the on-shore investigation undertaken for EDF by Structural Soils Ltd. The boreholes included in the groundwater quality programme are indicated on **Figure 15.12** and **Figure 15.13** in **Chapter 15, Volume 1**. Three of the piezometers (CBH11 - response zone in Blue Lias; and CBH16 and CBH29 - response zone in Blue Anchor Formation) were screened to allow sample recovery from the deep groundwater at depths ranging from 35m to 48mbgl, with the remaining eight piezometers being screened to sample the shallow Blue Lias groundwater (CBH20, CBH21, CBH24, CBH25, CBH27, CBH33, CBH35, DBH09 - response zones ranging between 3.5mbgl to 18.5mbgl). Of the shallow piezometers, CBH35 represents Mercia Mudstone formation water.

15E.1.3 General baseline groundwater chemistry is shown in **Table 15E.1**, and potential contaminants in **Table 15E.2**.

15E.1.4 Determinands were analysed by the following methods:

- probe (Field measurement);
- salinity;
- probe (laboratory measurement);
- electrical conductivity, pH;
- ICPMS (Inductively Coupled Plasma/Mass Spectrometry);
- Arsenic (As), Boron (B), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Lead (Pb), Nickel (Ni), Mercury (Hg), Vanadium (V), Zinc (Zn), Sodium (Na), Calcium (Ca), Magnesium (Mg), Potassium (K);
- calculation;
- Total Hardness as $CaCO_3$;
- titration;
- Bicarbonate (HCO_3);
- Ion chromatography;

- Chloride (Cl), Nitrite (NO2), Nitrate (NO3), Ammonium (NH4), Sulphate (SO4), Phosphate (PO4);
- colorimetry;
- Total Cyanide (CN);
- gravimetry;
- Total Suspended Solids;
- five day and reflux;
- Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD);
- GCFID (Gas Chromatography/Flame Ionisation Detector);
- Total Petroleum Hydrocarbons (TPH);
- GCMS (Gas Chromatography/Mass Spectrometry); and
- polyaromatic hydrocarbons (PAHs) and other hydrocarbons.

15E.1.5 The suite of baseline groundwater quality determinands above were selected to include a wide range of determinands and quality indicators frequently tested for in preliminary UK groundwater quality assessments, as well as a wide range of potential contaminants that are commonly associated with current and historical contaminative activities. The suite includes basic indicators of potential pollution e.g. ammonia, electrical conductivity, chloride, and BOD. Inorganic parameters such as nitrate, nitrite and phosphate have been included particularly given the current and historical agricultural use (i.e. to see if any impact to groundwater from the application of fertilisers may have occurred) and given that the area is within a Nitrate Vulnerable Zone. Electrical conductivity, chloride and sodium have also been included as these are key parameters which can help to evaluate the origins of more saline groundwaters. Other major anions and cations (e.g. sodium, chloride, calcium, magnesium, potassium, and sulphate) have been included as indicators of general groundwater quality but are also useful in helping to assess potential geological/geochemical impacts to groundwater (e.g. mineralisation/salinisation caused by mineral deposits in the bedrock).

15E.1.6 Ongoing results of groundwater quality monitoring campaigns have been presented regularly at meetings with stakeholders including the Environment Agency. These have allowed for discussion and raising of any areas of concern over the results and the interpretation put on them. In particular, soil and water quality data were presented to the Marine Authorities Liaison Group (MALG) meeting of 28 July 2009.

a) Tier 1 Groundwater Assessment Methodology - BDAW

15E.1.7 A Tier 1 groundwater risk assessment using the analytical results has been undertaken. Initial assessment involved the comparison of the groundwater concentration with relevant UK Drinking Water Standards (DWS) and the Marine and Freshwater Environmental Quality Standards (EQS). This is a standard practice in the UK whereby concentrations of determinands within the site groundwater are initially compared (conservatively) to accepted UK Drinking Water Standards. This is routinely carried out in Tier 1 groundwater quality assessments in the UK whether or not the groundwater in the area is – or has the potential to be

- used for drinking water purposes. In addition, the groundwaters have also been compared to marine and freshwater EQS values, as the hydrogeological conceptual model has indicated that groundwaters are likely to discharge to marine and/or fresh water on/off site.

15E.1.8 In December 2009, Directions were issued by the UK government to the Environment Agency which allowed revised water environmental quality standards developed by UKTAG (United Kingdom Technical Advisory Group) for the Water Framework Directive (WFD) to be implemented. The WFD EQS values adopted for Hinkley (and validated by EDF) are presented in **Table 15E.1** alongside previous standards (and in **Table 15E.4** for the BDAE and **Table 15E.6** for the SCPA).

b) Derivation of the Revised Screening Values

15E.1.9 To assess the risks to groundwater and surface waters at Hinkley in line with the requirements of the WFD, AMEC adopted the published Tier 1 screening values published by the UK Technical Advisory Group on the Water Framework Directive.

15E.1.10 AMEC have also conducted a review of the River Basin Management Plan for the South West to determine if any specific threshold values were published for the controlled water receptors identified in the Conceptual Site Model (i.e. groundwater in the Secondary A aquifer and the Hinkley Point C drainage ditch and Holford Stream surface water systems).

15E.1.11 The review of the water body status objectives set for the South West district indicated the following:

- The water body status objectives for the Secondary Aquifer in proximity to the study area confirmed that it is not located in a designated Groundwater Water Protection Area established under the Water Framework Directive. No threshold values for Groundwater Impacts on Surface Waters (Test 2 in Part 7 of the groundwater threshold values) have therefore been set for the underlying Secondary A aquifer underlying and in proximity to the study area.
- The on-site surface water receptors (Hinkley C drainage ditch and Holford Stream) have no water body status objectives set under the WFD and the River Basin Management Plan (Annex B) for the South West. However, as Holford Stream is a tributary of the Stogursey Brook (albeit the confluence located at a downstream location), which has water body status objectives itself, the EQS values (for water chemistry) for Stogursey Brook have been adopted and the EQS values for ‘good’ quality water have been applied.
- Water body status objectives for Stogursey Brook have been specified in the water body status objectives. The Stogursey Brook water body status is currently classified as an overall ‘Poor’ WFD standard with the objective of reaching ‘Good Ecological Status’ by 2015 for a select number of water chemistry parameters;
- Where applicable these have been used, together with the target status of ‘Good’ to define appropriate EQSs under the WFD for the assessment of risk from groundwaters to surface water receptors. In each case, the highest available status score has been chosen, given that the WFD dictates no deterioration of any component water quality parameter should occur.

15E.1.12 The WFD provides a range of EQS values which have to be adjusted to account for site specific conditions (e.g. hardness and alkalinity). The following provides discussion of where AMEC have specified site specific EQS values:

- The WFD EQSs for Total Ammonia and Biochemical Oxygen Demand (BOD) (Part 3 Physico-chemical Standards) have been based on the criteria for Type 7 surface water systems. The surface water receptors have been classified as Type 7 surface waters based on the calculated average alkalinity of the Hinkley C drainage ditch and Holford Stream watercourses being greater than 200mg/l (as CaCO3) and the study area altitude being less than 200mAOD in accordance with Part 2 Table 1 of the River Basin Districts Typology, Standards and Groundwater threshold values.
- The Freshwater EQS for copper has been based on freshwater controlled water receptors containing an annual mean carbonate (alkalinity) greater than 200mg/l CaCO3.
- The EQS for cadmium has been based on the receiving controlled waters being classed as class 5 based on the hardness value being greater than 200mg/l as CaCO3.
- The EQS for total zinc has been based on the corresponding value for controlled water receptors containing an annual mean hardness concentration of greater than 250mg/l CaCO3.

15E.1.13 As the study area lies outside a groundwater water protected area, there are no water body status objectives (for groundwater impacts on surface waters in accordance with part 7 of the WFD) specified for the aquifer underlying the study area. Therefore, in the absence of these values, the EQS values are based solely on the EQS values of ‘good’ standard for freshwater rivers (part 4 specific pollutants) and EQS values for priority substances for inland waters (Part 5 priority substances) in accordance with Test 2 detailed in the Groundwater Classification System and its Application in Regulation document.

15E.1.14 Based on the review of the water body status objectives specified in the River Basin Management Plan and the status of the controlled water receptors identified, all EQS values have been revised in line with the WFD where applicable (**Table 15E.2, Table 15E.4** and **Table 15E.6**), with the exception of the values specified for Groundwater Drinking Water in Test 4 and Test 5. The current UK Drinking Water Supply Regulations (2000) are retained as screening values to assess the risks to groundwater, and using the test 4 screening value where no current drinking water screening values are available.

15E.1.15 The main EQS values (for groundwater drinking water) are not adopted in total due to the study area not being located within a Groundwater Water Protected Area, for which these values apply; and that they are set at a percentile of the UK Drinking Water Supply Regulation Values which is not considered to be applicable to the environmental setting of the study area.

15E.1.16 All of the saltwater surface water EQS values specified in the Directions to assess the risks from potentially contaminated groundwater to saltwater receptors (Bridgwater Bay which has a water body status objective set for 2027 under the WFD) are adopted. These screening values are also appropriate as the Hinkley C drainage ditch (which is potentially in continuity with the groundwater in the study area) discharges directly into Bridgwater Bay.

15E.1.17 All of the freshwater / surface water EQS values specified in the River Basin Districts Typology, Standards and Groundwater Threshold Values to assess the potential risk posed to on-site surface water receptors from potentially contaminated groundwater are adopted. These EQS values have been based on the water body status objective for Stogursey Brook being 'good' status by 2015.

15E.1.18 For determinands where no EQS value (saltwater or freshwater) are set out in the Directions, AMEC has used the previous EQS values specified as screening criteria.

c) Groundwater Quality - BDAW

15E.1.19 **Table 15E.1** below presents a summary of the major ion chemistry on the BDAW.

Table 15E.1: Summary of Groundwater Major Ion Chemistry on Built Development Area West

Parameter	Range Detected in Shallow Groundwater	Range Detected in Deep Groundwater
Total Hardness (mg/l as $CaCO_3$)	320-511	1,836-11,211
pH Value (Units)	6.2-8.3	6.3-9.7
Electrical Conductivity (µS/cm)	793-2,410	4,050-162,700
Calcium (mg/l)	70.0-143.7	200.3-7,367
Magnesium (mg/l)	17.8-62.9	31.6-881.3
Sodium (mg/l)	22.5-151.2	112.0-56,239
Potassium (mg/l)	2.4-8.7	30.1-336.9
Ammonium (converted to NH_4-N) (mg/l)	<0.01-0.89	0.79-30.35
Chloride (mg/l)	13-141	571-72,315
Sulphate (mg/l)	16-156	<5-9,002
Bicarbonate (mg/l as $CaCO_3$)	194-353	20-591
Nitrate (mg/l)	<1-103	<1-290

15E.1.20 Shallow Groundwater is generally intended to mean groundwater present in the Secondary A Aquifer in the underlying Blue Lias Formation and Penarth Group strata which is usually < 20mbgl, although piezometers DBH2_7 and CBH2_55 have been installed as combined monitoring installations to target the deeper Blue Lias Formation.

15E.1.21 Deeper Groundwater is intended to mean groundwater present in the underlying Blue Anchor Formation of the Mercia Mudstone Group, which is generally >40mbgl.

15E.1.22 The pH of the groundwaters within the BDAW was found to be quite consistent throughout the monitoring campaign across the shallow piezometers. More variation was identified across the deep piezometers with one location (CBH16) showing lower pH levels (ranging from pH 6.3 to 6.5) and one location showing significantly higher pH levels (CBH29 ranging from pH 7.0 to 9.7). Groundwater in CBH16 has very high (non-sea water) salinity (see below) whilst CBH29 groundwater is very low in bicarbonate alkalinity and therefore has limited buffering capacity against pH changes.

15E.1.23 Relatively fresh groundwaters such as at CBH25 show values between 872 and 964µS/cm; the saline waters in CBH11 show values between 40,900 and 57,200µS/cm; and at CBH16 in the Blue Anchor formation with the very saline groundwater, values of over 150,000µS/cm are shown.

15E.1.24 In terms of general groundwater quality in the shallow Blue Lias groundwaters, CBH20 and CBH24 are the only ones that show signs of elevated concentrations of determinands related to sea water such as EC, chloride and sodium. Otherwise they represent typical hard calcium-bicarbonate type groundwaters.

15E.1.25 Highly saline groundwaters are found in the deep piezometers CBH11 and CBH16. CBH11 is nearest to the shoreline and at a similar distance to CBH24 and has chloride concentrations around 16,000mg/l and sodium around 12,000mg/l; at CBH16 chloride concentrations have reached around 70,000mg/l and sodium around 56,000mg/l (though not consistently).

15E.1.26 For context, an analysis of typical sea water is as follows (The Geochemistry of Natural Waters, 1997) (Ref. 15E.2). These concentrations are in mg/kg (to obtain values in mg/l it is necessary to multiply the values below by about 1.02-1.03).

- Na: 10,760 mg/kg;
- Cl: 19,350 mg/kg;
- Mg: 1,290 mg/kg;
- SO4: 2,710 mg/kg;
- K: 399 mg/kg;
- HCO3: 142 mg/kg; and
- Ca: 400 mg/kg (from http://www.lenntech.com/periodic/water/calcium/calcium-and-water.htm).

15E.1.27 Average values from sampling of estuary water at Hinkley (not done for all major ions) are 14,250mg/l for chloride, 8,500mg/l for sodium and 1,920mg/l for sulphate32. This is around 70-80% of the above typical sea water values (after conversion to mg/l) and reflects the estuarine rather than fully marine condition at Hinkley.

15E.1.28 At CBH11 chloride concentration is similar to a slightly diluted typical sea water, but sodium is higher and sulphate is very low. At CBH16 sulphate and potassium concentrations are similar to typical sea water but the chloride and sodium concentrations are much higher and calcium concentrations are also very high (up to 7,367mg/l). This latter is indicative of a formation mineral or interstitial groundwater origin (halite and gypsum/anhydrite) rather than modern sea water.

d) Potential Groundwater Contaminants - BDAW

15E.1.29 The samples collected during the monitoring campaigns have been analysed for potential non-radiological and radiological contaminants. A summary of the non-radiological analytical results is provided in **Table 15E.2**. Full non-radiological analytical results are included in Ref. 15E.1.

Table 15E.2: Summary of Non-Radiological Groundwater Analytical Results for Built Development Area West

Determinand	Units	DWS	WFD Screening Values		Range of Concentrations in 4 Deep Piezometers	Range of Concentrations in 20 Shallow Piezometers
			Saltwater EQS	Freshwater EQS		
Dissolved Arsenic*	(µg/l)	10[1] T	25[A 4 GC]	50[A 4 G15]	<1-6	<1-3
Dissolved Cadmium*	(µg/l)	-	0.2[A 4] / 1.5[MAC 4]	0.25[A(C5) 4] / 1.5[MAC 4]	<1-2	<1
Dissolved Chromium*	(µg/l)	50[1] T	15[2]AD	250[2]AD[#]	<1-12	<1-3
Dissolved Lead*	(µg/l)	25 [1]T	7.2[A4]	7.2[A4]	<1-8	<1
Dissolved Nickel*	(µg/l)	20[1] T	20[A4]	20[A 4]	<1-46	<1-16
Dissolved Copper*	(µg/l)	2000[1] T	5[A 4 GC]	28[A 4 G15#]	<1-137	<1-3
Dissolved Zinc*	(µg/l)	5000[5]T	40[A 4 GC]	-	<5-64	<5-12
Dissolved Mercury*	(µg/l)	1[1]T	0.05[A 4] / 0.07[MAC]	0.05[A 4] / 0.07[MAC]	<0.1-29.7	<0.1
Dissolved Boron	(µg/l)	1000[1] T	7,000[2]AT	2,000[2]AT	101-4420	<5-1887
Dissolved Iron	(µg/l)	200[1]T	1000[A 4 GC]	1000[A 4 G15]	<10-1375	<1-2218
Dissolved Vanadium	(µg/l)	-	100[2]AT	60[2]AT[#]	<5-8	<5
Total Zinc	(µg/l)	5000[5]	-	125 [4 AT#G15]	<5-102	<5-371
Total Cadmium	(µg/l)	5[1]	-	5[7]AT	<1-2	<1
Total Mercury	(µg/l)	1[1]	-	1[7]AT	<0.1-37.3	<0.1-4.9
Total Boron	(µg/l)	1000[1] T	7,000[2]AT	2,000[2]AT	663-4892	262-2390
Total Hardness	(mg/l as $CaCO_3$)				1880-18361	320-511
pH Value*	(Units)	6.5 -9.5[1]	6 – 8.5[4P95]	6[4P5 H] – 9[4P95 H]	6.3-9.7	6.2-8.3
Electrical Conductivity	(µS/cm)	2500[1]	-	-	4050-162700	793-2410
Sulphate*	(mg/l)	250[1]	-	400[3] A	<5-9002	16-156
Chloride	(mg/l)	250[1]	-	250[3] A	571-72315	13-287

Determinand	Units	DWS	WFD Screening Values		Range of Concentrations in 4 Deep Piezometers	Range of Concentrations in 20 Shallow Piezometers
			Saltwater EQS	Freshwater EQS		
Nitrate	(mg/l)	50[1]	-	-	<1-290	<1-103
Nitrite	(mg/l)	0.5[1]	-	-	<1	<1
Ammonium (NH4)	(mg/l)	0.5[1]	-	-	1.02-39.02	0.03-1.19
Ammonium (converted to NH4-N)	(mg/l)	0.29 [P DPA]	-	0.6 [4 P90 T7 G15]	0.89-30.35	<0.01-0.92
Unionised Ammonium (converted from NH4-N)	(mg/l)	-	0.021[A 4 GC]	-	0.001-0.979	<0.001-0.007
Phosphate	(mg/l)	-	-	-	<5	<5
Sodium	(mg/l)	200[1]	-	170A^	112-56239	22.5-408.8
Calcium	(mg/l)	250[9]	-	-	200.3-7367.0	70.0-143.7
Magnesium	(mg/l)	50[9]	-	-	31.6-881.3	17.7-62.9
Potassium	(mg/l)	12[9]	-	-	30.1-336.9	2.4-8.94
Suspended Solids	(mg/l)	-	-	25[8]	<5-1176	10-710
BOD	(mg/l)	-	-	5[4 (P 90) T7/G15]	<2-8.0	<2-7
COD	(mg/l)	-	-	-	<2-168.0	<2-165
Total Cyanide*	(µg/l)	50[1]	1[A4] / 5[P GC FCN]	1A / 5[4 P G15 FCN]	<5	<5-8
Bicarbonate	(mg/l as $CaCO_3$)	-	-	-	20-591	194-353
Total Petroleum Hydrocarbons*	(µg/l)	10[5]	-	50[6]	<10	<10 except one instance of 29 µg/l in CBH27
PAHs (speciated)	(µg/l)	0.1[1]^^	-	-	<0.01	<0.01
VOCs	(µg/l)	-	-	-	<1	<1

Notes:

All units as µg/l unless otherwise stated

The Water Supply (Water Quality) Regulations 2000

National Environmental Quality Standards (EQS) – For List II substances. Source DoE Circular 7/89. (Saltwater EQS = Saltwater concentration, Freshwater EQS = Freshwater Protection of other aquatic life - cyprinid fish).

Environment Agency Non-Statutory (Operational) Environmental Quality Standards. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis.

The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010

The Water Supply (Water Quality) Regulations 1989. N.B These Regulations were superseded by the 2000 regulations therefore there is currently no UK DWS for zinc and / or Total Petroleum Hydrocarbons.

The Surface Waters (Abstraction) for Drinking Water (Classification) Regulations 1996. DW1 treatment (i.e. simple physical treatment and disinfection) limit.

The Surface Waters (Dangerous Substances) (Classification) Regulations 1989

2006 / 44/ EC Fish Directive - Cyprinid Fish Guideline.

The Private Water Supply regulations 1992 N.B. These regulations were superseded by 2009 regulations therefore there is no current UK DWS for these determinands.

^ Guideline Value - Non statutory / proposed EQS, but EQS never adopted in UK.

DPA - River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 Part 7 Groundwater Threshold Values for Groundwater Drinking Water Protected Areas.

- no current threshold value available

 # - Corrected based on the reported average hardness value (399m /l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009.

C5 - Cadmium EQS based on class 5 hardness (>200mg/l $CaCO_3$), corrected based on the reported average hardness value (399mg /l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009.

D - Dissolved

T - Total

A - Annual average

P - 95-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 5% of the time or more).

P90 - 90-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 10% of the time or more).

P5 - 5-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is less than the standard for 5% of the time or more).

MAC Maximum Allowable Concentration

T7 - Type 7 surface water.

G15 - Threshold value based on 'good standard' to meet objective of WFD for Stogursey Brook to achieve good status by 2015.

GC - Threshold value based on 'good standard' for transitional and coastal waters to meet objective of WFD for Bridgewater Bay to achieve good ecological status by 2027 (no chemical criteria target thresholds specified).

FCN - Threshold value for free cyanide (as HCN)

H - River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 Threshold value for high standard.

$ No assessment criteria is currently available for dissolved boron and therefore the dissolved boron concentrations have been compared to total values.

** LOD   Exceedances of the annual average EQS have occurred due to the limit of detection (LOD) not being low enough. This is a consequence of applying new and lower EQS values to data obtained before the issue of these new, lower values. However, these ‘exceedances’ are not considered to be environmentally significant.*

DWS - Drinking Water Standard

F EQS – Freshwater Environmental Quality Standard (EQS)

i. Shallow Groundwater

15E.1.30 The groundwater results showed generally low concentrations of inorganic contaminants such as heavy metals and metalloids, below the relevant screening values (see **Table 15E.2**), across all shallow piezometers, with the exception of some isolated exceedences of specific contaminants, with subsequent monitoring having identified the return of concentrations to below the relevant screening values. Isolated elevated concentrations of dissolved and total boron and/or slightly elevated ammonium have been identified in one or two of the boreholes.

15E.1.31 Concentrations of nitrates in shallow groundwater are slightly above normal background and indicate a slight existing impact, most probably associated with application of nitrogenous fertilisers or ploughing of organic-rich soils, historical and/or current agricultural fertiliser application on and off site. However, nitrate concentrations in excess of the DWS (50mg/l) were only exceeded at one location (CBH35).

15E.1.32 Concentrations of organic contaminants, i.e. Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPHs) and Volatile Organic Carbons (VOCs) were below the limit of detection and below the relevant screening values across all shallow groundwater locations, with the exception of an elevated TPH concentration identified in one shallow piezometer (CBH27, 29µg/l) located on the western boundary of the BDAW during the first monitoring campaign. However, all subsequent campaigns have recorded concentrations below the limits of detection (<10µg/l).

15E.1.33 Concentrations of suspended solids regularly exceeded the screening criteria.

ii. Deep Groundwater

15E.1.34 Elevated concentrations of several heavy metals and metalloids have been identified in the deeper groundwaters in boreholes CBH16 and CBH11 which are located in the central eastern and northern areas of the BDAW, respectively. The concentrations of some of these (e.g. boron, copper, nickel, iron, mercury and zinc) have frequently exceeded Tier 1 groundwater and surface quality standards. Elevated concentrations of ammonium were also present within the deeper groundwaters.

15E.1.35 The source of these elevated contaminant concentrations is believed to be from the leaching of minerals and pockets of naturally occurring organic matter within the Blue Anchor Formation bedrock.

15E.1.36 Concentrations of organic contaminants, i.e. PAHs, TPHs and VOCs were all below the limit of detection and respective groundwater and surface water quality standards.

15E.1.37 Concentrations of suspended solids regularly exceeded the screening criteria.

e) Summary for BDAW

i. Shallow Groundwater

15E.1.38 The shallow groundwaters across the BDAW show very little evidence of any contamination by non radiological contaminants, with the exception of very isolated and occasional occurrences of certain heavy metals, ammonia and nitrate. However these are considered to be naturally elevated and not the result of anthropogenic (man-made) contamination. The concentrations of suspended solids regularly exceed the surface water environmental quality standard, although this is only of environmental significance if, during construction dewatering, water containing suspended solids is discharged to a surface water receptor. (Further assessment of the potential impacts from dewatered groundwater discharged to surface water receptors is contained in **Chapter 14** of this volume).

15E.1.39 Slightly elevated, and (in the case of CBH35) elevated nitrate concentrations are present in the shallow groundwater on the BDAW. In all cases (with the exception of CBH35) these are below the recognised environmental screening criterion of 50mg/l. The source of these slightly elevated and elevated nitrate concentrations is likely to be application of nitrogenous fertilisers or ploughing of organic-rich soils. The Hinkley Point area is a designated Nitrate Vulnerable Zone, which means that from an environmental impact assessment point of view, the groundwaters and surface waters in the area are sensitive to activities during the construction and operation of the proposed development that could give rise to nitrate pollution.

ii. Deep Groundwater

15E.1.40 The deep groundwaters have been found to contain elevated concentrations of several heavy metals, metalloids, ammonium and suspended solids. However these are considered to be naturally elevated and not the result of anthropogenic (man-made) contamination.

15E.1.41 Given the depth of the deeper groundwater (i.e. >30m bgl), the environmental significance of these elevated concentrations is very low as they are not generally in any direct contact with potential receptors. The fact that the deeper groundwater already has naturally elevated baseline concentrations of certain contaminants, means that they are less sensitive to activities during the construction and operation of the proposed development that may give rise to pollution or contamination. As a result of the elevated heavy metals and ammonia (and elevated salt and mineral content), these deeper groundwaters are unlikely to be used for possible potable or industrial waters (e.g. cooling). The resource potential of the deeper groundwaters is therefore considered to be very low.

15E.2 Built Development Area East (BDAE)

15E.2.1 The desk based assessment detailed in **Chapter 14** of this volume has identified a number of historical and current potentially contaminative activities (e.g. spoil deposition, waste management, construction and fabrication areas, former sewage treatment works, fuel storage tanks, and the adjacent Hinkley Point A power station complex) both on and off the BDAE.

15E.2.2 An extensive programme of groundwater quality monitoring (similar in size and scope to that conducted on the BDAW above) has been undertaken on the BDAE which has included the sampling of twenty one piezometers (nineteen monitoring 'shallow' groundwater and two monitoring 'deep' groundwater) across the BDAE to establish the baseline groundwater quality on the site. Groundwater samples have been collected from all twenty one piezometers on three occasions. Thirteen of the twenty one piezometers have been sampled on four occasions (eight of the piezometers were either not installed or developed at the time of the first partial monitoring round in June 2010, which is why some piezometers have three sets of data only). The groundwater samples have been screened for a wide variety of non radiological and radiological contaminants based on the historical land use. Locations of the BDAE groundwater monitoring piezometers are shown on **Figure 15.15**.

15E.2.3 Four of the piezometers (DBH2_10, DBH2_21, DBH2_22 and DBH2_27) have been installed along the eastern boundary of the BDAE to monitor for potential cross boundary groundwater contaminant migration from the adjacent HPA power station complex.

15E.2.4 As with the BDAW above, for monitoring and assessment purposes, the groundwater on the BDAE has been divided into 'shallow' and 'deep' groundwater. The 'shallow' groundwater includes the Secondary A Aquifer in the underlying Blue Lias Formation and Penarth Group strata. The majority of the response zones monitoring the 'shallow' groundwater are installed between depths of 1 – 15mbgl, however, DBH2_7 and CBH2_55 are installed slightly deeper in the Blue Lias at 25-33mbgl and 22-24mbgl, respectively. DBH2_7 and CBH2_55 have been installed as combined monitoring installations to target the deeper Blue Lias to see if there are any differences in groundwater chemistry with depth in the Blue Lias.

15E.2.5 The 'deep' groundwater includes the unproductive strata in the underlying Blue Anchor Formation of the Mercia Mudstone Group. The piezometers (CBH2_53 and CBH2_54) have been installed to target the 'deeper' groundwater in the Blue Anchor Formation. A detailed rationale for the groundwater monitoring strategy on the BDAE is provided in AMEC Report (Ref. 15E.3)

15E.2.6 The results of the non radiological data are summarised in **Table 15E.3** (Groundwater Major Ion Chemistry on the BDAE) and **Table 15E.4** (Summary of Non-Radiological Groundwater Analytical Results for the BDAE) and discussed below. For a more detailed assessment and discussion of the non radiological and radiological groundwater quality data, the reader is referred to the AMEC report. (Ref. 15E.4)

a) Tier 1 Groundwater Assessment Methodology - BDAE

15E.2.7 This is described under BDAW groundwater quality section above.

15E.2.8 **Table 15E.3** below presents a summary of the general and major ion chemistry on the BDAE.

Table 15E.3: Groundwater Major Ion Chemistry on the BDAE

Parameter	Range Detected in Shallow Groundwater	Range Detected in Deep Groundwater
Total Hardness (mg/l as $CaCO_3$)	178-1377	106-12,408
pH Value (Units)	6.8-12.9	6.9-12.5
Electrical Conductivity (µS/cm)	739-18,200	1,256-125,600
Calcium (mg/l)	36.4-404.5	36.2-3866.0
Magnesium (mg/l)	0.2-151.7	1.1-669.9
Sodium (mg/l)	29.9-3,985.0	120.8-42,990.0
Potassium (mg/l)	2.8-351.4	15.4-240.1
Ammonium (as NH_4) (mg/l)	<0.01-2.53	0.62-14.16
Chloride (mg/l)	33-5,156	9-64,253
Sulphate (mg/l)	4-803	29-3359
Bicarbonate (mg/l as $CaCO_3$)	<5-2800	<20-230
Nitrate (mg/l)	<1-30	<1-4

Shallow Groundwater is generally intended to mean groundwater present in the Secondary A Aquifer in the underlying Blue Lias Formation and Penarth Group strata which is usually < 20m bgl, although piezometers DBH2_7 and CBH2_55 have been installed as combined monitoring installations to target the deeper Blue Lias Formation.

Deeper Groundwater is intended to mean groundwater present in the underlying Blue Anchor Formation of the Mercia Mudstone Group, which is generally >40m bgl.

i. Shallow Groundwater

15E.2.9 The concentrations of sulphate in the shallow groundwater are generally low and below respective Tier 1 screening criteria. The exceptions are slightly elevated to elevated concentrations of sulphate which have been identified in all campaigns for DBH2_8 (289 – 347mg/l), DBH2_23 (549 – 803mg/l), NBH01 (453 – 550mg/l) and NBH04 (444 – 679mg/l Campaigns 1, 3 and 4). All of these piezometers are situated in the north western area of the BDAE down gradient of the existing mound and in the area of the former NDA spoil disposal area.

15E.2.10 The shallow piezometers recorded concentrations of calcium and potassium generally below the Tier 1 screening criteria over the four campaigns. Exceptions to this were noted for potassium in piezometers DBH2_7, DBH2_8, DBH2_9, DBH2_27 and CBH2_55, and for calcium in DBH2_9, DBH2_20, DBH2_23 and DBH2_26. Again, many of these piezometers are in the northern area of the BDAE, either downgradient of the existing mound or in the former NDA spoil disposal area. The highest concentrations of calcium and potassium were noted in DBH2_9 which is situated in the south western corner of the existing spoil mound.

15E.2.11 Elevated concentrations of magnesium have been recorded on at least one occasion in twelve of the nineteen ‘shallow’ piezometers. Most of these piezometers are located in the northern part of the BDAE. The highest concentrations of magnesium were noted in piezometers NBH01, NBH04, and DBH2_23, which are located in the northern area of the BDAE, downgradient of the existing mound and / or in the former NDA spoil disposal area. Of note, is the very low magnesium concentrations and elevated pH in DBH2_9 (this being despite the fact that DBH2_9 had the highest relative concentrations of calcium and potassium). Concentrations of magnesium in the deep groundwater in CBH2_54 and CBH2_53 at 41mbgl (see below) are much lower than the shallow groundwater. This could indicate that the source of the groundwater contamination in DBH2_9 could be from reworked deep historical excavation material placed within this area of the mound.

15E.2.12 The concentrations of sodium and chloride in the shallow groundwater on the BDAE are generally low and below the Tier 1 screening criteria. However, exceedances of the Tier 1 screening criteria for sodium and/or chloride were recorded in DBH2_7, DBH2_9, DBH2_24, DBH2_27, CBH2_30 and CBH2_55. Five of these piezometers are located in the northern part of the BDAE and one (DBH2_9) is located in the south western mound area.

15E.2.13 Sodium and chloride concentrations in the shallow piezometers varied with depth in the Blue Lias groundwater. The highest concentrations of sodium and chloride were recorded in DBH2_7 and CBH2_55 which target the deeper groundwater in the Blue Lias.

15E.2.14 The three piezometers located adjacent to the coastline (DBH2_24, DBH2_26, and CBH2_57) did not record elevated concentrations of sodium and/or chloride, or only marginal exceedances, indicating no or very limited saline intrusion.

ii. Deep Groundwater

15E.2.15 Very high concentrations of sulphate, exceeding the Tier 1 screening values have only been consistently recorded in CBH2_53. Slightly elevated sulphate concentration (712mg/l) was also recorded at CBH2_54 in the second campaign.

15E.2.16 The concentrations of the major ions (calcium, magnesium and potassium) recorded in the deep groundwater varied significantly between the two deep piezometers. The highest concentrations of these determinands were consistently recorded above the Tier 1 screening values at CBH2_53 in the three campaigns (in samples taken from 48m and 53mbgl). In contrast, the range in values for the major ions at CBH2_54 was much lower although the Tier 1 screening criteria for potassium was exceeded in the three campaigns.

15E.2.17 Very high concentrations of sodium (37,000 – 42,990mg/l) and chloride (40,812 – 64,253mg/l) were present in the deep piezometer CBH2_53 which were significantly higher than the shallow piezometers. Elevated, but much lower concentrations of sodium and chloride were noted in CBH2_54. The concentrations of sodium and chloride recorded were recorded in exceedence of the Tier 1 Screening Criteria (DWS and Freshwater EQS) at CBH2_53 for all three campaigns but only at CBH2_54 on the second campaign and fourth campaign.

15E.2.18 The very high concentrations of sodium and chloride (well in excess of typical sea water concentrations – see above), as well as the Cl:SO4 ratio being around 20 (as opposed to around 7 in seawater) suggest that the source of the hypersalinity at the base of CBH2_53 is a formation mineral source. Halite (NaCl), gypsum and anhydrite were visually identified within the Blue Anchor Formation on the Structural Soils Limited borehole log for CBH2_53, suggesting that the source of the hyper salinisation and mineralisation in CBH2_53 is a principal formation mineral source. These findings are similar to those for the BDAW.

b) Summary for BDAE

15E.2.19 The general and major ion analysis and interpretation demonstrates that there are clear differences between the shallow (generally the Blue Lias groundwater) and the deeper (Blue Anchor Formation) groundwaters on the Built Development Area East which is similar to that found on the Built Development Area West. Slightly elevated concentrations of several major ions were noted in several of the piezometers downgradient of current and historical potential sources such as the existing spoil mound and the former NDA temporary spoil storage area and general Made Ground in the former fabrication area. Groundwater in the deeper the Blue Lias (as represented by piezometers DBH2_7 and CBH2_55) shows higher concentrations of sodium and chloride relative to the shallower Blue Lias groundwater and demonstrates increasing salinity with depth.

15E.2.20 The deeper groundwaters (generally in the Blue Anchor formation) are noted to contain very high concentrations of salts and minerals. These are considered in the most part to result from naturally present minerals in the bedrock formation with which the groundwaters are in contact.

15E.2.21 The samples collected during the monitoring campaigns have been analysed for potential non-radiological and radiological contaminants. A summary of the non-radiological analytical results is provided in **Table 15E.4**. Full non-radiological analytical results are included in the Summary of Groundwater Quality Report (Ref. 15E.5).

Table 15E.4: Summary of Non-Radiological Groundwater Analytical Results for the BDAE

Determinand	Units	DWS	WFD Screening Values		Range of Concentrations in Deep Piezometers	Range of Concentrations in Shallow Piezometers
			Saltwater EQS	Freshwater EQS		
Dissolved Arsenic*	(µg/l)	10[1] T	25[A 4 GC]	50[A 4 G15]	<1 – 8	<1 - 27
Dissolved Cadmium*	(µg/l)	-	0.2[A 4] / 1.5 [MAC 4]	0.25[A(C5) 4] / 1.5 [MAC 4]	<0.1 – 2.5	<0.1
Dissolved Chromium*	(µg/l)	50[1] T	15[2]AD	250[2]AD[#]	<1 - 10	<1 – 5.2
Dissolved Lead*	(µg/l)	25 [1]T	7.2[A4]	7.2[A4]	<1 - 3	<1
Dissolved Nickel*	(µg/l)	20[1] T	20[A4]	20[A 4]	<1 - 56	<1 - 8
Dissolved Copper*	(µg/l)	2000[1] T	5[A 4 GC]	28[A 4 G15#]	<1 - 6	<1 - 8
Dissolved Zinc*	(µg/l)	5000[5]T	40[A 4 GC]	-	6 - 59	<5 - 85
Dissolved Mercury*	(µg/l)	1[1]T	0.05[A 4] / 0.07 [MAC]	0.05[A 4] / 0.07 [MAC]	<0.05 – 0.68	<0.05 – 0.18
Dissolved Boron[$]	(µg/l)	1000[1] T	7,000[2]AT	2,000[2]AT	22 - 3753	15 - 3165
Dissolved Iron	(µg/l)	200[1]T	1000[A 4 GC]	1000[A 4 G15]	<10 - 289	<10 - 611
Dissolved Vanadium	(µg/l)	-	100[2]AT	60[2]AT[#]	<5 - 4	<5 - 8
Total Zinc	(µg/l)	5000[5]	-	125 [4 AT#G15]	37 - 120	<5 - 135
Total Cadmium	(µg/l)	5[1]	-	5[7]AT	<1 – 3.1	<0.1 – 2.4
Total Mercury	(µg/l)	1[1]	-	1[7]AT	<0.05 – 0.91	<0.05 – 7.82
Total Boron	(µg/l)	1000[1] T	7,000[2]AT	2,000[2]AT	45 - 4153	35 - 4196
Total Hardness	(mg/l as $CaCO_3$)				106 - 12408	178 - 1377
pH Value*	(Units)	6.5 -9.5[1]	6 – 8.5[4P95]	6[4P5 H] – 9[4P95 H]	6.9 - 12.5	6.8 - 12.9
Electrical Conductivity	(µS/cm)	2500[1]	-	-	1256 - 125600	739 - 18200
Sulphate*	(mg/l)	250[1]	-	400[3] A	29 - 3359	4 - 803

Determinand	Units	DWS	WFD Screening Values		Range of Concentrations in Deep Piezometers	Range of Concentrations in Shallow Piezometers
			Saltwater EQS	Freshwater EQS		
Chloride	(mg/l)	250[1]	-	250[3] A	9-64,253	33 - 5156
Nitrate	(mg/l)	50[1]	-	-	<1 - 4	<1 - 30
Nitrite	(mg/l)	0.5[1]	-	-	<0.02	<0.02 – 0.22
Ammonium (NH4)	(mg/l)	0.5[1]	-	-	0.62 – 14.16	<0.01 – 2.53
Total Ammonia (as N)	(mg/l)	0.29 [P DPA]	-	0.6 [4 P90 T7 G15]	<0.01 - 3.84	<0.001-2.30
Unionised Ammonium (converted from NH4-N)	(mg/l)	-	0.021[A 4 GC]	-	0.002 – 2.987	<0.0001 – 1.792
Phosphate	(mg/l)	-	-	-	<5	<5 - 9
Sodium	(mg/l)	200[1]	-	170A^	120.8 - 42990.0	29.9 - 3985.0
Calcium	(mg/l)	250[9]	-	-	36.2 - 3866.0	36.4 - 404.5
Magnesium	(mg/l)	50[9]	-	-	1.1 - 669.9	0.2 - 151.7
Potassium	(mg/l)	12[9]	-	-	15.4 - 240.1	2.8 - 351.4
Suspended Solids	(mg/l)	-	-	25[8]	8 - 1040	<5 - 1744
BOD	(mg/l)	-	-	5[4 (P 90) T7/G15]	<2 - 8	<2 - 14
COD	(mg/l)	-	-	-	<2 - 3493	<2 - 109
Total Cyanide*	(µg/l)	50[1]	1[A4] / 5[P GC FCN]	1A / 5[4 P G15 FCN]	<1 - 6	<1 - 22
Bicarbonate	(mg/l as $CaCO_3$)	-	-	-	<20-230	<5 - 2800
Total Petroleum Hydrocarbons*	(µg/l)	10[5]	-	50[6]	<10	<10 - 124
PAHs (speciated)	(µg/l)	0.1[1]^^	-	-	<0.002	<0.01
VOCs	(µg/l)	-	-	-	<1	<1 - 12

Notes:

All units as µg/l unless otherwise stated

The Water Supply (Water Quality) Regulations 2000

National Environmental Quality Standards (EQS) – For List II substances. Source DoE Circular 7/89. (Saltwater EQS = Saltwater concentration, Freshwater EQS = Freshwater Protection of other aquatic life - cyprinid fish).

Environment Agency Non-Statutory (Operational) Environmental Quality Standards. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis.

The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010

The Water Supply (Water Quality) Regulations 1989. N.B These Regulations were superseded by the 2000 regulations therefore there is currently no UK DWS for zinc and / or Total Petroleum Hydrocarbons.

The Surface Waters (Abstraction) for Drinking Water (Classification) Regulations 1996. DW1 treatment (i.e. simple physical treatment and disinfection) limit.

The Surface Waters (Dangerous Substances) (Classification) Regulations 1989

2006 / 44/ EC Fish Directive - Cyprinid Fish Guideline.

The Private Water Supply regulations 1992 N.B. These regulations were superseded by 2009 regulations therefore there is no current UK DWS for these determinands.

^ Guideline Value - Non statutory / proposed EQS, but EQS never adopted in UK.

DPA - River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 Part 7 Groundwater Threshold Values for Groundwater Drinking Water Protected Areas.

- no current threshold value available

 # - Corrected based on the reported average hardness value (399m /l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009.

C5 - Cadmium EQS based on class 5 hardness (>200mg/l $CaCO_3$), corrected based on the reported average hardness value (399mg /l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009.

D - Dissolved

T - Total

A - Annual average

P - 95-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 5% of the time or more).

P90 - 90-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 10% of the time or more).

P5 - 5-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is less than the standard for 5% of the time or more).

MAC Maximum Allowable Concentration

T7 - Type 7 surface water.

G15 - Threshold value based on 'good standard' to meet objective of WFD for Stogursey Brook to achieve good status by 2015.

GC - Threshold value based on 'good standard' for transitional and coastal waters to meet objective of WFD for Bridgewater Bay to achieve good ecological status by 2027 (no chemical criteria target thresholds specified).

FCN - Threshold value for free cyanide (as HCN)

H - River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 Threshold value for high standard.

$ No assessment criteria is currently available for dissolved boron and therefore the dissolved boron concentrations have been compared to total values.

** LOD Exceedances of the annual average EQS have occurred due to the limit of detection (LOD) not being low enough. This is a consequence of applying new and lower EQS values to data obtained before the issue of these new, lower values. However, these 'exceedances' are not considered to be environmentally significant.*

DWS - Drinking Water Standard

F EQS – Freshwater Environmental Quality Standard (EQS)

n/s = not sampled as piezometers not installed, developed and / or stabilised at the time of sampling

c) Tier 1 Groundwater Risk Assessment - BDAE

i. Shallow Groundwater

15E.2.22 The following provides a summary of the analytical data based on information presented in **Table 15E.4** and describes the main parameters of interest observed in the groundwater sampled from the 'shallow' groundwater piezometers on the BDAE.

ii. Metals and Metalloids

15E.2.23 Concentrations of metals and metalloids are generally very low and in most cases are below the Tier 1 screening criteria. Occasional, slight exceedances of some total and/or dissolved metals (e.g. arsenic, chromium, lead, copper, mercury and zinc) have been noted. Exceedances of total metals are probably also related to the high concentrations of suspended solids frequently noted in the groundwater samples and are a reflection of the difficultly of obtaining groundwater samples from piezometers with low suspended solids contents in certain geological formations even where the piezometers have been fully developed and professionally and properly installed and constructed (as is the case at Hinkley). The true quality of the groundwater is expected to be much better than indicated by some of the total metal results i.e. is likely to be more representative of the dissolved metal concentration results. The concentrations of elevated contaminants where they occur are typically only 1 – 3 times the conservative Tier 1 screening criteria concentrations and as such are not considered to be significant or of concern. In addition, elevated concentrations of total and / or dissolved boron and total iron in excess of the Tier 1 screening criteria have been noted more consistently in a number of the piezometers (e.g. DBH2_7, DBH2_8, DBH2_27, CBH2_30, CBH2_55, NBH01 and NBH03) mainly located in the northern part of the BDAE. Again, where the exceedances occur, they are generally only 1 – 3 times the conservative screening criteria and, as such, are not considered to be significant or of concern.

iii. Ammonia, Ammonium, Nitrite, Nitrate

15E.2.24 Most concentrations of ammonium and total ammonia recorded in the shallow piezometers were low and below the Tier 1 screening values. A number of exceedances of the DWS for ammonium were recorded in piezometers DBH2_7, DBH2_8, DBH2_9, DBH2_22, DBH2_24, DBH2_27, CBH2_30, CBH2_55, NBH01 and NBH03, most of which are located in the northern area of the BDAE, down gradient of the existing spoil mound or in the former NDA spoil disposal area. In some cases, the exceedances have been isolated, however, consistently slightly elevated ammonium concentrations have been noted in DBH2_9, DBH2_22, DBH2_27 and NBH03. The highest relative concentrations have been noted in DBH2_9 and DBH2_27, which are located within and downgradient of the mound area, respectively. However, concentrations, where slightly elevated are generally only 1 - 3 times the conservative Tier 1 screening criteria concentrations and are therefore not considered to be significant or of concern. The one exception to this, is DBH2_9 where, due to the very high pH, the proportion of the more aquatically toxic unionised ammonia (estimated by calculation) is higher and is calculated to be present in concentrations of up to 85 times the salt water EQS of 0.021mg/l.

15E.2.25 Concentrations of nitrate (as NO3) and nitrite (as NO2) in shallow groundwater have been consistently low in the range <1 – 30mg/l and <0.02-0.22mg/l respectively and below the DWS value of 50mg/l. Occasionally, slightly elevated (10 – 30mg/l) concentrations of nitrate have been detected, but as these are below the Tier 1 screening criteria these are not of concern.

iv. pH Value

15E.2.26 The pH values recorded in the shallow groundwater are typically neutral to slightly alkaline in the range of pH 6.8 (DBH2_20) to pH 8.4 (DBH2_7). However, elevated alkaline pH values in the range 12.0 to 12.9 have been consistently recorded in DBH2_9 which exceeded the DWS, freshwater and saltwater EQS values. The high laboratory pH measurements for DBH2_9 have been corroborated by in-situ field readings. DBH2_9 is located in the south western corner of the existing mound feature. One possible explanation for this unusually high pH could be the presence of alkaline anthropogenic materials (e.g. concrete, plaster, mortar etc) in the Made Ground in the mound. A further possible explanation for the high pH in DBH2_9 could be due to leaching from deep rock spoil materials (similar in geochemistry to the Blue Anchor formation noted at depth within CBH2_54*) that may have been historically deposited in the spoil mound in the locality of DBH2_9. (*Groundwater in the deep borehole CBH2_54 also has very high pH, but this is believed to be due to reactions with minerals in the bedrock and natural deeper groundwater geochemistry and not in any way related to the elevated pH in DBH2_9).

v. Electrical Conductivity Values

15E.2.27 Electrical conductivity values in the shallow piezometers generally range from 700 - 2,000µS/cm and have remained reasonably consistent for each of the four groundwater monitoring campaigns. Elevated conductivity values (i.e. above 2500µS/cm) have been recorded in DBH2_7, DBH2_9, DBH2_27, CBH2_30 and CBH2_55. All of these piezometers are in the northern area of the BDAE, down-gradient of the mound and / or in the former NDA spoil disposal area. The highest electrical conductivity values were noted in DBH2_7 and CBH2_55 (deeper Blue Lias groundwater) where the conductivities range from 5600 to 18,200µS/cm and 3,870 to 14,270µS/cm respectively and in DBH2_9 (2,340 to 9,780µS/cm). The elevated laboratory conductivities have been corroborated by in-situ measurements / depth profiling, which demonstrates a definite increase in electrical conductivity with depth in the Blue Lias aquifer. The slightly elevated electrical conductivity in DBH2_9 is likely to be related to leaching of salts and minerals form the anthropogenic Made Ground and / or natural reworked materials within this area of the mound.

vi. BOD and COD

15E.2.28 Slightly elevated concentrations of BOD (5 - 14mg/l), above the freshwater EQS value, have been recorded in most of the shallow piezometers on at least one occasion, although most BOD concentrations recorded in Campaigns 3 and 4 were generally below the limit of detection. Most of the exceedances are marginally above the Freshwater EQS, although a higher BOD values of 12 and 14mg/l was recorded in DBH2_9 and CBH2_56 in the third campaign. The elevated concentrations of BOD are generally only 1 - 3 times the conservative Tier 1 screening value and therefore are not considered to be significant or of concern.

vii. Suspended Solids

15E.2.29 The concentrations of suspended solids in the shallow groundwater ranged from <5 – 1,744mg/l and regularly exceed the Tier 1 screening criteria (25mg/l) in the all of the piezometers on the BDAE (with the exception of DBH2_8). The concentrations of suspended solids varied significantly across the BDAE and during different sampling rounds for the same piezometer.

viii. Organic Determinands (TPH, VOC, PAHs and PCB Congeners)

15E.2.30 The data from the groundwater monitoring campaigns indicates that there is no evidence of significant organic contamination (with respect to petroleum hydrocarbons, PCBs, PAHs and VOCs) in the shallow groundwater on the BDAE. Slightly elevated concentrations of benzene (6µg/l) and trichloroethylene (12µg/l) were recorded in DBH2_7 and NBH04 during the second campaign, but analyses during the first, third and fourth visits found the concentrations were <1µg/l. This would indicate that the initial positive result was a one off occurrence. The concentrations are not considered to be significant or of concern.

ix. CBH2_56 and CBH2_57

15E.2.31 During site investigations, a localised area of hydrocarbon impacted soil, associated with an historical fuel storage tank, was discovered around a trial pit (TE418) in the north eastern area of the BDAE. A number of additional trial pits were excavated around the area to delineate the vertical and lateral extent of the soil contamination. The trial pits indicated that the hydrocarbons were primarily associated with a thin layer of made ground at approximately 0.6-0.8mbgl, covering an area of approximately 100m^2. In addition, groundwater monitoring well CBH2_56 was installed immediately downgradient of the impacted area to determine see if there was any evidence of deeper vertical migration, or groundwater contamination. As an additional measure, piezometer CBH2_57 was installed a greater distance downgradient (approximately 40m to the north east) to determine if hydrocarbons were present in groundwater downgradient of the impacted soils.

15E.2.32 During the drilling of CBH2_56, a slight hydrocarbon odour was noted between 0.75mbgl and 0.80mbgl, increasing to a strong diesel hydrocarbon odour and observations of globules of viscous dark brown free product between 0.80mbgl and 1.50mbgl. Rotary coring flush from 1.6mbgl to 2.8mbgl was noted to have an associated layer of free phase product with a strong hydrocarbon odour. A slight to strong hydrocarbon odour and sheen on arisings was noted to 4.5mbgl (within the weathered Lias deposits), with staining between 2.8 - 3.0mbgl. No evidence of flush water contamination was reported during drilling arising from greater than 4.5mbgl and no contamination was evident within the core below that depth.

15E.2.33 During the drilling of CBH2_57, a slight hydrocarbon sheen was witnessed on flush water at 6.0mbgl, with an associated slight hydrocarbon odour from clay arisings when broken open; these appeared to have different visual and olfactory characteristics to the hydrocarbons observed within the shallow Made Ground within TE418 and within the Made Ground and shallow weathered Lias in CBH2_56. A faint hydrocarbon odour was also noted by the driller between 6.25 and 6.36mbgl. Clayey mudstone and clay partings arising from between 12.36 and 12.5mbgl, and at 15.0mbgl and 18.0mbgl were noted to have a very faint hydrocarbon odour. No other evidence of hydrocarbon contamination was witnessed in CBH2_57.

15E.2.34 Soil samples from CBH2_56 and CBH2_57 were submitted for detailed forensic hydrocarbon analysis at Jones Environmental Laboratories. The analysis indicated that the low levels of hydrocarbon detected in CBH2_56 were derived from biodegraded heavy fuel oil (i.e. an historic anthropogenic source) that was very similar to the source in TE418. The EPH fingerprint analysis for samples from CBH2_57 also indicated the hydrocarbon was from an historic anthropogenic source (a gas oil type middle distillates in the carbon range nC8-C28) but was of a different source and fingerprint to that in TE418 and CBH2_56.

15E.2.35 During subsequent groundwater monitoring, visual evidence of slight hydrocarbon contamination was observed in one piezometer (CBH2_56) which was described as a ‘rainbow’ sheen. However, analyses of the groundwater samples have not detected any elevated dissolved phase hydrocarbon contaminations in either CBH2_56 or CBH2_57. Therefore, it is concluded that the hydrocarbon impact noted in the soils the vicinity of TE418 has not resulted in significant groundwater contamination.

d) Tier 1 Screening Values - BDAE

i. Shallow Groundwater

15E.2.36 The greatest number of exceedances of the inorganic and metal and metalloid Tier 1 screening values for the shallow groundwater has occurred in the piezometers located in the northern part of the BDAE which are either down gradient of the existing spoil mound or in the former NDA spoil disposal area. These include piezometers, DBH2_7, DBH2_8, DBH2_9, DBH2_23, DBH2_27, CBH2_30, CBH2_55, NBH01 and NBH03. This would indicate that some slight inorganic and metal and metalloid contamination (principally total and dissolved boron and iron) has occurred in the northern BDAE down gradient of the existing mound and in the area of the former NDA spoil area.

15E.2.37 The presence of slightly elevated concentrations of inorganic determinands (e.g. sulphate, chloride, sodium, potassium, calcium, magnesium, pH and ammonium etc) is often associated with the storage and disposal of inert spoil materials such as construction and demolition wastes and excavated natural rock and subsoils and general made and disturbed ground. These types of materials present in the existing mound, the former NDA spoil area and the Made Ground present over much of the north eastern area of the BDAE.

15E.2.38 In order to help highlight the slight increase in certain major ions (e.g. Na, Cl, SO4, K, Ca, Mg and NH4) and metal and metalloid concentrations (e.g. B, Fe) that have been noted in some piezometers in the northern area of the BDAE which are down gradient of likely source features (e.g. the existing spoil mound, former NDA spoil disposal area and Made Ground in the former fabrication area) The Table in **Appendix 15D** presents a summary of the data ranges, means and number of exceedances of Tier 1 screening criteria for these piezometers against data for piezometers on the BDAE which are hydraulic gradient of these features (i.e. background relative to these sources) and also, for comparison, data from piezometers on the adjacent BDAW land which has no such sources (i.e. is considered to be representative of greenfield/natural background concentrations for the Hinkley Point Area).

15E.2.39 Comparison of the data ranges, means and number of Tier 1 exceedances for the piezometers down gradient of the these likely source features against the upgradient piezometers on the BDAE and natural background piezometers on the BDAW, generally shows higher concentrations and greater number of exceedances for most of these major ions and metals/metalloids, demonstrating that a slight impact has occurred from these determinands to the shallow groundwater in some areas of the BDAE which are down gradient of these likely source features.

15E.2.40 It should be stressed that the slightly elevated concentrations are not considered to be significant or of concern, particularly when the low the very low sensitivity and value of the groundwater in the Blue Lias on site is taken into account. Also, given that groundwater flow is towards the north-north-east (i.e. towards the Bristol Channel) it will ultimately discharge into the Bristol Channel, which will already have naturally high concentrations of most of these inorganic determinants as well as enormous dilution potential (see AMEC report34). There are no other surface water receptors downgradient of the BDAE meaning that the Bristol Channel is the only potential surface water receptor.

15E.2.41 The response zone of the monitoring installations in DBH2_7 and CBH2_55 were positioned within the deeper interbedded limestone and mudstones of the Blue Lias Formation. The conductivity values and concentrations of sodium and chloride recorded in these piezometers were much higher than those typically recorded in the shallower Blue Lias groundwater. Concentrations of total arsenic, total and dissolved boron, total and dissolved iron also tended to be more elevated in these slightly deeper piezometers. This finding is consistent with that found on the BDAW.

ii. Deep Groundwater

iii. Metals and Metalloids

15E.2.42 Elevated concentrations of several metals and metalloids (e.g. total and dissolved nickel, total and dissolved boron and total iron) in excess of the Tier 1 screening criteria have been consistently detected in CBH2_53. In addition, elevated concentrations of dissolved cadmium, chromium, copper, mercury and zinc have been occasionally noted in CBH2_53 and isolated elevated concentrations of total arsenic and total lead during second campaign. Elevated total and dissolved boron on the first campaign and dissolved iron on the second campaign were detected in CBH2_54. A comparison of the concentrations of metals and metalloids recorded shows that they vary in the two deep piezometers. A majority of the highest concentrations of metals were recorded in CBH2_53 which is the shallower of the deep boreholes.

15E.2.43 Again, where the exceedances have occurred, they are generally only 1 - 3 times the conservative Tier 1 screening criteria, therefore are not considered to be significant or of concern.

iv. Ammonia, Ammonium, Nitrite, Nitrate

15E.2.44 Slightly elevated to elevated concentrations of ammonium, which exceeded the Tier 1 screening criteria, have been consistently recorded in both deep piezometers. The concentrations of ammonium recorded in CBH2_53 ranged from 0.62 to 14.16mg/l and from 1.80 to 3.85mg/l in CBH2_54. The concentrations are generally 1 – 30 times the DWS and Freshwater EQS and are therefore more significant than in the shallow aquifer. Furthermore, due to the very high pH noted in CBH2_54 (see below) the concentrations of unionised ammonia (estimated by calculation) are 66 – 142 times the conservative saltwater EQS for unionised ammonia of 0.021mg/l.

15E.2.45 The concentrations of nitrate recorded in the deep piezometers are generally similar to the shallow piezometers. Concentrations of nitrate and nitrite in the deep groundwater are consistently low in the range <1–4mg/l and <0.02mg/l respectively and are below the Tier 1 screening criteria.

v. pH Value

15E.2.46 Piezometer CBH2_53 has shown neutral pH values (ranging between pH 6.9 and 7.7 units) in comparison to the groundwater in CBH2_54 which has been consistently alkaline pH (11.7 – 12.5 units). The reason for the unusually high pH is CBH2_54 is most likely to be associated with the bedrock / deep groundwater geochemistry and may be associated with the known presence of gypsum and anhydrite nodules in the Blue Anchor formation at depth.

vi. Electrical Conductivity Values

15E.2.47 Very high electrical conductivities (88,200 -125,600µS/cm) were noted in CBH2_53 at 48m and 53m depth. However, interestingly, in situ conductivity profiling across the response zone in CBH2_53, supported by sampling and laboratory testing has demonstrated a wide variation in the electrical conductivity with depth across the response zone. The lowest value (1,821µS/cm) was noted at the top of the response zone (41mbgl) and the highest values (125,600 and 122,000µS/cm) in the middle (48m) and bottom (53m) of the response zone.

15E.2.48 Electrical conductivities in CBH2_54 were also elevated (4,780 – 7,620µS/cm) on two out of the three sampling occasions, but much less so than in CBH2_53 at 48 and 53mbgl

vii. BOD and COD

15E.2.49 BOD concentrations remained generally below the limit of detection over the two campaigns, with an exceedance of the Freshwater EQS value recorded in CBH2_54 and CBH2_53 (53 m) during the second campaign (both 8ug/l). In contrast, COD concentrations were elevated in CBH2_53 (165 – 3,494*mg/l) but not particularly in CBH2_54 (<2 – 29mg/l). *The value of 3,494mg/l is considered to be a spurious result.

viii. Suspended Solids

15E.2.50 The concentrations of suspended solids in the deep groundwater ranged from 8 – 1,040mg/l and regularly exceed the Tier 1 screening criteria (25mg/l) in both

CBH2_53 and CBH2_54. The concentrations of suspended solids varied significantly during different sampling rounds for the same piezometer.

ix. Organic Determinants (TPH, VOC, PAHs and PCB Congeners)

15E.2.51 A slightly elevated concentration of benzene at CBH2_54 (4µg/l) and CBH2_53 (53m, 2ug/l) exceeded the Tier 1 screening criteria in the second campaign. These concentrations on subsequent monitoring rounds was <1µg/l. These initial slightly elevated results are considered to be a one off results. As the concentrations were only 2-4 times the DWS, it is not considered to be significant or of concern. No other organic contaminants (i.e. TPH, VOCs, PAHs or PCBs) were present in any of the samples above the limit of detection.

x. Piezometer CBH2_54

15E.2.52 Low amounts of a light non aqueous phase liquid (LNAPL) free phase hydrocarbon product described as a thick, viscous brown oil were noted in piezometer CBH2_54 (**Figure 15.15**) by Structural Soils Limited following drilling works but prior to installation and development. Monitoring of the groundwater in this piezometer with an oil/water interface meter did not record any detectable thickness of free product, however the oil was recovered as tiny globules and streaks on the dip tape or bailer when monitored. A small amount (2ml) of the oil was recovered in May 2010 and sent to The Environmental Laboratory (Elab) for analysis. Elab's assessment and interpretation of the oil was that it was a weathered (degraded) diesel with some trace amounts of a heavier oil (>C28), which was considered likely to be lube oil. Elab aged the product at approximately 3.5 years.

15E.2.53 Piezometer CBH2_54 is a deep rotary cored borehole which was drilled to 90mbgl. No visual or olfactory evidence of hydrocarbon was noted on the borehole log. The borehole was temporarily cased to 20mbgl and shallow aquifer protection measures (as agreed with the Environment Agency) were installed during drilling to prevent any potential near surface contamination migrating downwards into the aquifer.

15E.2.54 Several rounds of 'grab samples' using dedicated hydrocarbon sampling bailers were undertaken on the non installed and developed well. The initial samples taken from just below the surface of the water column (typically approximately 4.40mbgl) in the borehole did not record any evidence of dissolved phase hydrocarbons in excess of the laboratory detection limits, however, subsequent samples taken from deeper down in the piezometer (at approximately 20mbgl i.e. just below the casing) did detect elevated concentrations of dissolved phase hydrocarbons in excess of Tier 1 screening criteria'.

15E.2.55 A series of trial pits and one window sample were excavated in close proximity around borehole CBH2_54 to see if there may be a near surface source of hydrocarbon in the area, field observations and laboratory analysis did not identify a shallow source of hydrocarbons within the made round in the immediate vicinity of CBH2-54. An additional piezometer (CBH2_55) has been drilled in close proximity to CBH2_54 to a depth of 27.60mbgl. No visual evidence of hydrocarbon was noted, however a strong hydrocarbon odour was noted in a thin band of clay at 23.1mbgl. CBH2_55 was installed with a response zone between 22.00-24.00mbgl targeting the deeper weathered clay horizon with the hydrocarbon odours. No LNAPL/free phase product has been found in CBH2_55.

15E.2.56 CBH2_54 was scheduled to be a deep monitoring piezometer and as such has been installed with a response zone from 80–90mbgl. Since the piezometer has been installed and developed, the free phase product previously present in CBH2_54 has not been noted. Furthermore, no detectable dissolved phase hydrocarbon contamination has been noted in CBH2_54 with the exception of the one sample which recorded 4µg/l of benzene on one occasion.

15E.2.57 GC-MS chromatograms of the sample of oil analysed by Elab were sent to Jones Environmental Ltd, who are a laboratory who specialise in detailed oil and hydrocarbon analysis and source identification and characterisation. Jones Environmental re-interpreted the Elab GC-MS chromatograms and concluded that the oil was most likely to be a middle distillate of indeterminate age, with no sign of biodegradation but evidence of significant weathering or water washing. The data review also indicated that the oil was unlikely to be derived from an oil shale source.

15E.2.58 Whilst the analysis would seem to confirm the source of the oil as an historic anthropogenic source, it is less clear how a LNAPL has managed to get to such a depth beneath the water table. Whilst there are mechanisms for LNAPLs to migrate to depths significantly below the water table (e.g. down dip through fractures and bedding planes etc) it usually requires a large head of free product somewhere nearby to provide the downward driving force to overcome the significant density differences. Investigations on the BDAE have not identified any significant or widespread source of free product or hydrocarbons in the shallow soils with the exception of the localised hydrocarbons around TE418 (see above) which are topographically and hydrogeologically down gradient of CBH2_54. It should be noted that naturally present oil shales are well known close to the Hinkley area (e.g. at Kilve) and similar natural oil shale type deposits could also still be an explanation for the source of the hydrocarbon noted in CBH2_54, despite the analytical results indicating the contrary. Other deep boreholes on the nearby by BDAW have occasionally noted pockets of clearly natural tar/bitumen and hydrocarbon odours at considerable depth.

15E.2.59 Monitoring of CBH2_55 located immediately upgradient of CBH2_54 and NBH03 located immediately downgradient have not detected the presence of any free or dissolved phase hydrocarbons. The presence of the small amounts of free product and dissolved phase contamination previously detected in CBH2_54 are therefore not considered to be significant or of major concern.

e) Potential Non Radiological Contaminants - BDAE

i. Shallow Groundwater

15E.2.60 There is no evidence of significant organic contamination (with respect to petroleum hydrocarbons, PCBs, PAHs and VOCs) in the shallow groundwater on the BDAE. The concentrations of metals, metalloids and other inorganics are generally low and below Tier 1 screening criteria, with the exception of a number of piezometers in the northern area of the BDAE within and downgradient of the existing mound and former NDA spoil disposal area, and former fabrication area. Piezometers in these areas have shown slightly elevated concentrations of boron, iron and various inorganic salts and occasionally ammonium. The source of this slightly elevated inorganic, metal and metalloid contamination is believed to be from the spoil and construction and demolition materials present in the mound area, similar materials present in the former NDA spoil disposal area (now removed) and the general Made Ground across the northern and north eastern area of the BDAE as a result of historical activities.

15E.2.61 Given that groundwater flow within the shallow groundwater on the BDAE is to the north north east (i.e. towards the Bristol Channel), the low to very low sensitivity of on-site groundwaters and lack of any other downgradient freshwater surface watercourses that the groundwater on the BDAE could discharge into, the Bristol Channel and associated ecology and ecosystems are considered to be the only valid potential receptors for the slightly inorganic contaminated groundwater on the northern area of the BDAE.

15E.2.62 Groundwater quality in the furthest most downgradient piezometers positioned on the northern boundary of the BDAE immediately before groundwater discharges to the Bristol Channel have shown low concentrations of these contaminants. Furthermore, the brackish water in the Bristol Channel already contains naturally elevated concentration of most of these inorganic determinands (e.g. sulphate, chloride, sodium, potassium, and boron etc), see AMEC report. The slightly elevated inorganic, metal and metalloid contamination noted in certain piezometers in the northern area of the BDAE is not therefore considered to be significant or of concern, and does not require further detailed assessment.

15E.2.63 Groundwater in the slightly deeper Blue Lias aquifer contains higher concentrations of sodium, chloride, and conductivity as well as some other metals (e.g. boron and arsenic) than the overlying shallow groundwater. This indicates that the groundwater chemistry in the Blue Lias changes with depth and in general becomes relatively more saline, with slightly higher concentrations of some metals and metalloids with depth.

15E.2.64 In the event that the ‘shallow’ groundwater in the Blue Lias is to be dewatered during the proposed construction works and then discharged either to fresh waters, or the Bristol Channel or back to shallow groundwater, an assessment of the potential impacts to these receiving controlled waters from the slightly elevated concentrations of inorganic, metal and metalloid contaminants should be made. The concentrations of suspended solids regularly exceed the surface water environmental quality standard, although this is only of environmental significance if, during construction dewatering, water containing suspended solids is discharged to a surface water receptor. Further assessment of the potential impacts to surface water as a result of potentially discharging contaminated dewatered groundwater is contained in Chapter 14 of this volume.

ii. Deep Groundwater

15E.2.65 The analysis results show that the deep groundwater is much more mineralised and exhibits a higher degree of salinity than the shallow groundwater. Concentrations of metals and metalloids above the Tier 1 screening criteria have been reported in most of the samples taken from the shallower of the deep piezometers (CBH2_53). These findings concur with the earlier investigation on the adjacent BDAW. The elevated concentrations recorded in the deeper groundwater are considered to be naturally occurring and not derived from an anthropogenic source.

15E.2.66 Given the extensive depth of the deep groundwater (i.e. >40m) it is not (under current site conditions) considered to pose a risk to other controlled waters or other environmental receptors.

15E.2.67 In the event that the deeper groundwater is to be dewatered and then discharged either to fresh waters, the Bristol Channel or back to shallow groundwater, an assessment of the potential impacts to these receiving controlled waters from the naturally elevated concentrations of various determinands and elevated suspended solids should be made.

15E.3 Southern Phase Construction Area (SCPA)

15E.3.1 The desk based assessment (**Chapter 14 of this volume**) has confirmed that the land is agricultural and has never been used for industrial purposes.

15E.3.2 Potential controlled water receptors on the SCPA include groundwater (e.g. the underlying Secondary A Aquifer) and the surface water courses that cross the site and are present along the southern boundary of the site (e.g. Bum Brook). The desk study has not identified any groundwater or surface water abstractions (e.g. boreholes and wells) on the site itself, however, there are two groundwater abstractions identified at one location 400m to the west of the SCPA.

15E.3.3 A programme of groundwater quality monitoring involving the sampling of seven piezometers (DBH2_12 –DBH2_18) installed across the SCPA has been undertaken. The locations of the piezometers are shown on **Figure 15.15**. The response zones for the seven piezometers ranged between 2 and 13mbgl and targeted shallow groundwater in either the Mercia Mudstone Group/Blue Anchor Formation or the Blue Lias. In total, three sets of samples have been collected from the piezometers on the SCPA (during the second, third and fourth campaigns).

15E.3.4 The results of the non radiological data are summarised in **Table 15E.5** (Summary of Major Ion Chemistry on the SCPA) and **Table 15E.6** (Summary of Non-Radiological Groundwater Analytical Results for the SCPA) and are discussed below. For a more detailed assessment and discussion of the non radiological and radiological groundwater quality data, the reader is referred to AMEC reports (Ref. 15E.3 and Ref. 15E.4).

a) Tier 1 Groundwater Assessment Methodology - SCPA

15E.3.5 This is described under BDAW groundwater quality above.

b) General and Major Ion Chemistry - SCPA

15E.3.6 A summary of the major ion chemistry for the SCPA is presented in **Table 15E.5.**

Table 15E.5: Groundwater Major Ion Chemistry on the SCPA

Parameter	Range Detected in Shallow Groundwater
Total Hardness (mg/l as $CaCO_3$)	367 - 614
pH Value (Units)	6.9 – 7.5
Electrical Conductivity (µS/cm)	771 – 1412

Parameter	Range Detected in Shallow Groundwater
Calcium (mg/l)	95.5 – 187.5
Magnesium (mg/l)	17.1 – 50.8
Sodium (mg/l)	13.1 – 421.6
Potassium (mg/l)	3.1 – 15.8
Ammonium (as NH_4) (mg/l)	<0.01 – 1.91
Chloride (mg/l)	26 - 396
Sulphate (mg/l)	9 - 140
Bicarbonate (mg/l as $CaCO_3$)	380 - 848
Nitrate (mg/l)	<1 - 36

Shallow Groundwater is generally intended to mean groundwater present in the Secondary A Aquifer in the underlying Blue Lias Formation and Penarth Group strata which is usually < 20m bgl,

i. Sulphate, Calcium, magnesium and potassium

15E.3.7 Major ions were recorded at typically low concentrations and below the respective Tier 1 screening criteria over the three campaigns. Exceptions to this were noted at two locations where the concentrations of magnesium exceeded the DWS in Campaign 3 for DBH2_13 (50.8mg/l) and concentrations of potassium exceeded the DWS in Campaigns 2 and 3 for and DBH2_16 (13.5 and 15.8mg/l respectively). The concentrations of potassium in DBH2_26 were relatively consistent across campaigns 2 and 3, but decreased in the fourth campaign to 7.5mg/l.

ii. Sodium and chloride

15E.3.8 Sodium and chloride concentrations exceeded the Tier 1 screening values at one of the seven piezometers (DBH2_12) in the second campaign only. No other exceedances have been recorded for these determinands and the concentrations of these parameters are low with minor variance between the piezometers observed over the three sampling campaigns.

c) Summary Major Ion Chemistry - SCPA

15E.3.9 The general major ion chemistry in the Southern Construction Phase Area shows concentrations of major ions that are considered to be consistent with natural background levels in the area.

d) Potential Groundwater Contaminants - SCPA

15E.3.10 The results of the non radiological data are summarised in **Table 15E.5** (Summary of Major Ion Chemistry on the SCPA) and **Table 15E.6** (Summary of Non-Radiological Groundwater Analytical Results for the SCPA) and are discussed below. For a more detailed assessment and discussion of the non radiological groundwater quality data, the reader is referred to the AMEC report (Ref. 15E.4**)**.

Table 15E.6: Summary of Non-Radiological Groundwater Analytical Results for the SCPA

Determinand	Units	DWS	WFD Screening Values		Range of Concentrations in Shallow Piezometers
			Saltwater EQS	Freshwater EQS	
Dissolved Arsenic*	(µg/l)	10[1] T	25[A 4 GC]	50[A 4 G15]	<1 - 2
Dissolved Cadmium*	(µg/l)	-	0.2[A 4] / 1.5 [MAC 4]	0.25[A(C5) 4] / 1.5 [MAC 4]	<0.1 - 1
Dissolved Chromium*	(µg/l)	50[1] T	15[2]AD	250[2]AD[#]	<1 - 3
Dissolved Lead*	(µg/l)	25 [1]T	7.2[A4]	7.2[A4]	<1
Dissolved Nickel*	(µg/l)	20[1] T	20[A4]	20[A 4]	<1 - 3
Dissolved Copper*	(µg/l)	2000[1] T	5[A 4 GC]	28[A 4 G15#]	<1 - 4
Dissolved Zinc*	(µg/l)	5000[5]T	40[A 4 GC]	-	6 - 982
Dissolved Mercury*	(µg/l)	1[1]T	0.05[A 4] / 0.07 [MAC]	0.05[A 4] / 0.07 [MAC]	<0.05
Dissolved Boron[$]	(µg/l)	1000[1] T	7,000[2]AT	2,000[2]AT	<5 - 872
Dissolved Iron	(µg/l)	200[1]T	1000[A 4 GC]	1000[A 4 G15]	<10 - 78
Dissolved Vanadium	(µg/l)	-	100[2]AT	60[2]AT[#]	<5
Total Zinc	(µg/l)	5000[5]	-	125 [4 AT#G15]	28 - 1184
Total Cadmium	(µg/l)	5[1]	-	5[7]AT	<0.1 - 2.4
Total Mercury	(µg/l)	1[1]	-	1[7]AT	<0.05
Total Boron	(µg/l)	1000[1] T	7,000[2]AT	2,000[2]AT	15 - 1082
Total Hardness	(mg/l as $CaCO_3$)				367 - 614
pH Value*	(Units)	6.5 -9.5[1]	6 – 8.5[4P95]	6[4P5 H] – 9[4P95 H]	6.9 - 7.5
Electrical Conductivity	(µS/cm)	2500[1]	-	-	771 - 1412
Sulphate*	(mg/l)	250[1]	-	400[3] A	9 - 140
Chloride	(mg/l)	250[1]	-	250[3] A	26 - 396
Nitrate	(mg/l)	50[1]	-	-	<1 - 36

Determinand	Units	DWS	WFD Screening Values		Range of Concentrations in Shallow Piezometers
			Saltwater EQS	Freshwater EQS	
Nitrite	(mg/l)	0.5[1]	-	-	<0.02
Ammonium (NH4)	(mg/l)	0.5[1]	-	-	<0.01 - 1.91
Total Ammonia(as N)	(mg/l)	0.29 [P DPA]	-	0.6 [4 P90 T7 G15]	<0.01 - 0.01
Unionised Ammonia (converted from NH4-N)	(mg/l)	-	0.021[A 4 GC]	-	<0.001 – 0.008
Phosphate	(mg/l)	-	-	-	<5
Sodium	(mg/l)	200[1]	-	170A^	13.1 - 421.6
Calcium	(mg/l)	250[9]	-	-	95.5 - 187.5
Magnesium	(mg/l)	50[9]	-	-	17.1 - 50.8
Potassium	(mg/l)	12[9]	-	-	3.1 - 15.8
Suspended Solids	(mg/l)	-	-	25[8]	8 - 3484
BOD	(mg/l)	-	-	5[4 (P 90) T7/G15]	<2 - 14
COD	(mg/l)	-	-	-	<2 - 25
Total Cyanide*	(µg/l)	50[1]	1[A4] / 5[P GC FCN]	1A / 5[4 P G15 FCN]	<1 - 70
Bicarbonate	(mg/l as $CaCO_3$)	-	-	-	380 - 848
Total Petroleum Hydrocarbons*	(µg/l)	10[5]	-	50[6]	<10 - 536
PAHs (speciated)	(µg/l)	0.1[1^^]	-	-	<0.002
VOCs	(µg/l)	-	-	-	<1

Notes:

All units as µg/l unless otherwise stated

The Water Supply (Water Quality) Regulations 2000

National Environmental Quality Standards (EQS) – For List II substances. Source DoE Circular 7/89. (Saltwater EQS = Saltwater concentration, Freshwater EQS = Freshwater Protection of other aquatic life - cyprinid fish).

Environment Agency Non-Statutory (Operational) Environmental Quality Standards. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis.

The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010

The Water Supply (Water Quality) Regulations 1989. N.B These Regulations were superseded by the 2000 regulations therefore there is currently no UK DWS for zinc and / or Total Petroleum Hydrocarbons.

The Surface Waters (Abstraction) for Drinking Water (Classification) Regulations 1996. DW1 treatment (i.e. simple physical treatment and disinfection) limit.

The Surface Waters (Dangerous Substances) (Classification) Regulations 1989

2006 / 44/ EC Fish Directive - Cyprinid Fish Guideline.

The Private Water Supply regulations 1992 N.B. These regulations were superseded by 2009 regulations therefore there is no current UK DWS for these determinands.

^ Guideline Value - Non statutory / proposed EQS, but EQS never adopted in UK.

DPA - River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 Part 7 Groundwater Threshold Values for Groundwater Drinking Water Protected Areas.

- no current threshold value available

 # - Corrected based on the reported average hardness value (399m /l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009.

C5 - Cadmium EQS based on class 5 hardness (>200mg/l $CaCO_3$), corrected based on the reported average hardness value (399mg /l CaCO3mg/l) for the Hinkley C Drainage Ditch and the Holford Stream (258mg/l CaCO3) recorded during monitoring in 2009.

D - Dissolved

T - Total

A - Annual average

P - 95-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 5% of the time or more).

P90 - 90-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is greater than the standard for 10% of the time or more).

P5 - 5-percentile (defined as a standard that is failed if the measured value of the parameter to which the standard refers (e.g. concentration of a pollutant) is less than the standard for 5% of the time or more).

MAC Maximum Allowable Concentration

T7 - Type 7 surface water.

G15 - Threshold value based on 'good standard' to meet objective of WFD for Stogursey Brook to achieve good status by 2015.

GC - Threshold value based on 'good standard' for transitional and coastal waters to meet objective of WFD for Bridgewater Bay to achieve good ecological status by 2027 (no chemical criteria target thresholds specified).

FCN - Threshold value for free cyanide (as HCN)

H - River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2009 Threshold value for high standard.

$ No assessment criteria is currently available for dissolved boron and therefore the dissolved boron concentrations have been compared to total values.

** LOD   Exceedances of the annual average EQS have occurred due to the limit of detection (LOD) not being low enough. This is a consequence of applying new and lower EQS values to data obtained before the issue of these new, lower values. However, these 'exceedances' are not considered to be environmentally significant.*

DWS - Drinking Water Standard

F EQS – Freshwater Environmental Quality Standard (EQS)

n/s = not sampled as piezometers not installed, developed and / or stabilised at the time of sampling

e) Tier 1 Groundwater Risk Assessment - SCPA

i. Metals and metalloids

15E.3.11 Dissolved and total metals and metalloid concentrations recorded in the shallow groundwater were generally low. Most were recorded marginally above or below the limit of detection. Exceedances of the Tier 1 screening values were recorded for dissolved cadmium on one occasion at DBH2_16, total boron at DBH2_13 on two occasions, total iron in DBH2_13 on two occasions, dissolved zinc at four piezometers (DBH2_14, DBH2_15, DBH2_16 and DBH2_17) and total zinc at DBH2_16. High concentrations of dissolved (270 - 982µg/l) and total (374 - 1184µg/l) zinc were noted in piezometer DBH2_16 during the second and third campaigns. However, these reduced significantly by the fourth campaign. None of the groundwater samples recorded elevated concentrations of metals or metalloids above the Tier 1 screening values during the fourth campaign.

ii. Ammonia, ammonium, nitrite, nitrate

15E.3.12 Concentrations of ammonium and total ammonia in the shallow piezometers were generally low and below the Tier 1 screening values. Exceedances of the Tier 1 screening criteria for ammonium were only recorded in three of the seven piezometers (DBH2_13, DBH2_14 and DBH2_15).

15E.3.13 Nitrate concentrations ranges are generally low and none exceed the Tier 1 screening values in any of the campaigns. However, slightly elevated concentrations of nitrate (10 – 36mg/l) have been noted three of the piezometers (DBH2_12, DBH2_17, and DBH2_18). Nitrite concentrations in the shallow groundwater have been recorded below the detection limit in all three campaigns.

iii. pH Value

15E.3.14 The pH values recorded in the shallow groundwater are neutral and are highly consistent in the range 6.9 to 7.5.

iv. Electrical Conductivity Values

15E.3.15 Electrical conductivity values range from low (ranging from 771 to 1,412µS/cm but more typically 800 - 900µS/cm). None of the conductivities in the shallow groundwater exceeded the Tier 1 screening criteria.

v. BOD and COD

15E.3.16 BOD and COD were generally recorded at very low concentrations (<2 and <2 to 12mg/l respectively). During the second campaign a slightly elevated COD concentration was noted in DBH2_15 (25mg/l). BOD concentrations were below the limit of detection with the exception of in DBH2_15 and DBH2_16 during the second campaign, when concentrations exceeded the Tier 1 screening criteria (14mg/l and 8mg/l respectively).

vi. Suspended Solids

15E.3.17 The concentration of suspended solids ranged from 8 to 3,484mg/l and regularly exceeded the Tier 1 screening criteria (25mg/l) in all of the piezometers. The concentrations of suspended solids varied significantly both between locations and between sampling rounds.

vii.Organic Determinands

15E.3.18 With the exception of elevated concentrations of TPH recorded at DBH2_15 in Campaign 2, the concentrations of all organic determinands were below the detection limit.

15E.3.19 The elevated concentrations of TPH recorded in the two duplicate samples taken from DBH2_15 exceeded the Tier 1 screening criteria on the second campaign. Repeat analysis undertaken on this sample provided results below the limit of detection which indicated that a possible discrepancy and uncertainty surrounds the initial values recorded. The concentration of TPH on the third and fourth campaigns in this piezometer was below the limit of detection (<10µg/l). On this basis it is considered that the initial elevated TPH values recorded in this piezometer was a spurious result.

viii. Total and Free Cyanide

15E.3.20 Concentrations of total and free cyanide were generally below the detection limit (1µg/l) and Tier 1 screening criteria throughout the three monitoring campaigns. Exceptions to this were the total concentrations recorded marginally above the detection limit in DBH2_12 and DBH2_18 (second campaign, 3ug/l and 4ug/l, respectively) but these were still below the Tier 1 screening criteria.

15E.3.21 High concentrations of total (70 and 51µg/l) and free (5 and 3µg/l) cyanide in excess of the Tier 1 screening criteria were recorded in the two duplicate samples taken from DBH2_15 during the second campaign. Repeat analysis for total and free cyanide recorded lower (47 and 36µg/l) but still elevated total cyanide and low (<1µg/l) free cyanide. The repeat samples were below the Tier 1 screening criteria. The lower repeat results are probably the result of a degree of sample degradation whilst the samples were in storage. The initial elevated readings were not repeated during the subsequent third and fourth campaigns. This data indicates the initial elevated concentrations were an isolated occurrence.

f) Potential Non Radiological Contaminants - SCPA

15E.3.22 The shallow groundwaters across the SCPA show very little evidence of any contamination by non radiological contaminants, with the exception of very isolated and occasional occurrences of certain heavy metals, ammonia and nitrate. However these are considered to be naturally elevated and not the result of anthropogenic (man-made) contamination. The concentrations of suspended solids regularly exceed the surface water environmental quality standard, although this is only of environmental significance if, during construction dewatering, water containing suspended solids is discharged to a surface water receptor.

15E.3.23 Slightly elevated nitrate concentrations are present in some of the shallow groundwater on the SCPA. In all cases these are below the recognised environmental screening criterion of 50mg/l. The source of these slightly elevated and elevated nitrate concentrations is likely to be application of nitrogenous fertilisers or ploughing of organic-rich soils. The Hinkley Point area is a designated Nitrate Vulnerable Zone, which means that from an environmental impact assessment point of view, the groundwaters and surface waters in the area are sensitive to activities during the construction and operation of the proposed development that could give rise to nitrate pollution.

g) Groundwater Chemistry – Off-site

15E.3.24 Information on groundwater chemistry from the existing Hinkley Point Power Station sites has been obtained from documents made available for the Hinkley Point C Environmental Impact Assessment. Potential groundwater contamination on the Hinkley Point B site has not been included within the assessment due to the significant distance from the proposed Hinkley Point C site (i.e. at least 500m) and the fact that the groundwater flow directions and topographic falls in the area are generally south to north, which means that it is highly unlikely that any potential groundwater contamination on the Hinkley Point B site could affect the development site. Potential groundwater contamination on the Hinkley Point B site has therefore effectively been 'scoped out' for this baseline assessment.

15E.4 Hinkley Point A

15E.4.1 Data on groundwater quality on the Hinkley Point A site has been taken from SERCO (Ref. 15E.6). The investigations have comprised the construction of shallow boreholes, groundwater level monitoring and sampling as well as a soil investigation. The findings of the SERCO report are summarised in **Chapter 14** of this volume.

15E.4.2 The SERCO (2010) report (Ref. 15E 6) provides a summary interpretative report on land quality (soil and groundwater) at Hinkley Point A. The report comprises a collation of the land quality characterisation and monitoring programmes performed on Hinkley Point A to 1996 to June 2009. The report has been divided into two volumes, one to provide an initial over view of all land quality and monitoring data and the other to provide a more in depth appraisal.

15E.4.3 Within the SERCO report, the Hinkley Point A site 'groundwater zone' is divided into four areas as follows:

- Area 1 (east);
- Area 2 (eastern part of radiologically controlled area and turbine hall);
- Area 3 (western part of radiologically controlled area and turbine hall); and
- Area 4 (north).

15E.4.4 Groundwater generally flows south to north across the Hinkley Point A site, from about 12mAOD in the south to 4mAOD in the north. At the time of the report there were 27 extant monitoring boreholes, with 5 destroyed.

15E.4.5 Below is a brief summary of the main groundwater quality findings from the SERCO report (Ref. 15E 6).

15E.4.6 Area 1 is located in the eastern area of the Hinkley Point A site and is reported to contain two areas of potential concern (APC). APC 1 is the Active Effluent Discharge Line (AEDL)/Active Effluent Valve Pit. APC9 is the area around the Emergency Diesel Generator Building (EDGB).

15E.4.7 No non radiological contamination of any significance has been recorded in the groundwater in Area 1 with the exception of elevated hydrocarbon contamination including free product in boreholes G2B, G40, and WD6 which are located down gradient of the EDGB. Concentrations of TPH in these boreholes has frequently been measured at >10,000ug/l. Elevated TPH concentrations (~5000ug/l) have also been noted in borehole G14.

15E.4.8 Area 2 covers the central eastern area of the Hinkley Point A site and contains a number of APCs.

15E.4.9 No non radiological contamination of any significance has been recorded in the groundwater in Area 2 with the exception of slightly elevated hydrocarbon (concentrations ranging from 100-1000ug/l TPH) in some samples taken between 2004 and 2009. However, the most recent available data from January 2009, did not record any elevated TPH contamination in the boreholes in Area 2.

15E.4.10 Area 3 covers the central western area of the Hinkley Point A site and contains a number of APCs.

15E.4.11 Elevated hydrocarbon contamination has been noted in several boreholes within Area 3. The highest concentration (up to 10,000ug/l) have been noted in boreholes G36 and G37 downgradient of the West Blower House. The maximum concentrations (up to 10,000ug/l) identified in these two boreholes have been used as sources 3 and 5 in the ConSim modelling (see **Appendix 15.I**). The maximum concentration (up to 1,000ug/l) noted in G35 and G38 has been used as sources 4 and 6 in the ConSim model (see **Appendix 15.I**). A maximum concentration of 640ug/l of hydrocarbon was identified in boreholes G10. This has been used as source 7 in the ConSim modelling (see **Appendix 15.I**).

15E.4.12 Area 4 covers the northern area of the Hinkley Point A site. It has a number of APCs.

15E.4.13 Elevated TPH has been recorded in a number of boreholes in Area 4 during 2004-2009. The highest concentration (3,800ug/l) has been noted in borehole G3A on one occasion. Other elevated concentrations (up to 1,700ug/l) have been noted in boreholes G31, G32 and G33 to the north of the turbine hall. The source of the contamination is likely to be related to soil contamination associated with former transformer leaks and spills.

a) Summary Off-site

15E.4.14 Elevated hydrocarbon contamination has been noted within the groundwater at a number of locations across the Hinkley Point A site. In general the activities and concentrations have decreased significantly over the monitoring period (2004 – 2009) with most activities and concentrations being below conservative DWS limits in the most recent set of data (January 2009).

References

15E.1 AMEC (19-1-2010 revision C). Summary of Groundwater Quality (Campaign 5) Non-Radiochemical Analysis Results for Built Development Area West Report Ref: 15011/TN/00060.

15E.2 Drever, J.I. (1997). The Geochemistry of Natural Waters, Prentice Hall.

15E.3 AMEC. Desk Based Assessment and Synthesis Report for Built Development Area East and Southern Construction Phase Area, report ref: 15011/TR/00151. Work in progress.

15E.4 AMEC. Summary of Groundwater Quality Campaigns 1, 2, 3 and 4) Non Radiochemical Analysis Results for the Built Development Area East and Southern Construction Phase Area. Report Ref 15011/TN/000158.

15E 5 AMEC. Summary of Groundwater Quality (Campaign 5) Non-Radiochemical Analysis Results Report Ref: 15011/TN/00060.

15E.6 SERCO (March 2010). Summary interpretive Land Quality Report for Hinkley Point A: Volume 1 & 2. Report Ref: SERCO/TAS/E03666/01 for Magnox South.

APPENDIX 15F BASELINE – DETAILED RADIOLOGICAL GROUNDWATER CHEMISTRY

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APPENDIX 15F: BASELINE – DETAILED RADIOLOGICAL GROUNDWATER CHEMISTRY

15F.1 Built Development Area West (BDAW)

15F.1.1 Five sampling campaigns for radiological analysis of groundwaters have been undertaken as part of the baseline assessment for the HPC development site. The radiological sampling campaigns coincided with the non-radiological sampling campaigns. Full analytical results are included in the Summary of Groundwater Quality Radiochemical Report (Ref. 15F.1) and summaries are provided in **Table 15F.1** below.

Samples were scheduled for laboratory analysis with the following radiochemical suite:

- High Resolution gamma spectrometry;
- Gross alpha, (calibrated with Am-241), and Gross beta, (calibrated with K-40);
- Tritium (as tritiated water); and
- Carbon-14.

15F.1.2 The suite was selected to provide a general screen for alpha, beta and gamma-emitters and to provide information with regard to soft beta-emitters (tritium and carbon-14). The inclusion of gross alpha, gross beta and tritium also meets the requirements for drinking water monitoring. The inclusion of gamma spectrometry provides quantitative data with regard to a range of natural and anthropogenic radionuclides.

15F.1.3 The Drinking Water Directive (Council Directive 98/83/EC) sets standards for drinking water quality and presents indicator parameter values for radioactivity which are not mandatory standards, but are set for monitoring purposes. If an indicator value is exceeded remedial action has to be taken only if there is a risk to human health. The following indicator parameter values are included in the Directive:

- Tritium: 100Bq/l; and
- Total indicative dose: 0.10mSv per annum, (excludes tritium, potassium-40, radon, radon decay products).

15F.1.4 The Drinking Water Directive indicator parameter values have been adopted in the United Kingdom in the Water Supply (Water Quality) Regulations 2000 (SI 3184) as amended and can be considered as screening values. Assessment of compliance with the Regulations is the responsibility of the Drinking Water Inspectorate (DWI).

15F.1.5 Monitoring of gross alpha and gross beta activity concentrations is used to screen for total indicative dose, in accordance with DWI draft guidance. If these activity concentrations are less than 0.1Bq/l and 1.0Bq/l respectively, no further investigation is needed. If either activity concentration exceeds its respective screening value, appropriate specific radionuclide analysis should be carried out and the total indicative dose calculated.

15F.1.6 A risk based approach is taken with total indicative dose providing the most restrictive measure of potential radiological contamination. A total indicative dose maximum of 0.1mSv per annum has been recommended, which is 1/10th of the Ionising Radiations Regulations 1999 (IRR99) Public Dose Limit value of 1.0mSv per annum.

15F.1.7 For the purposes of this document, threshold values derived from the Drinking Water Directive and Water Supply (Water Quality) Regulations 2000 (SI 3184) are referred to as DWI screening values.

15F.1.8 The screening values of some of the naturally occurring radionuclides measured during the study were derived from the elemental limits specified in the Radioactive Substances Act 1993 (and its replacement, Schedule 23 of the Environmental Permitting (England and Wales) Regulations 2010). The radionuclide limits were derived by the elemental limit by the number of isotopes of the element in the three natural radioactive decay series headed by uranium-238, uranium-235 and thorium-232.

Table 15F.1: Summary of Radiological Groundwater Screening Values and Background Values in the BDAW

Determinand	Screening Value			Background Values	
	EPR20101 (Bq/kg)	DWI2 (Bq/l)	WHO3 (Bq/l)	HMIP4 (Bq/l)	RIFE5 (Bq/l) (Mean and Range)
Gross Alpha (as Am-241)	NSA	0.1	0.5	0.0041 – 0.42	0.024 (0.02-0.029)
Gross Beta (as K-40)	NSA	1	1	0.026-0.52	0.086 (0.061-0.12)
Ac-228	37	NSA	NSA	NBA	NBA
Ag-110m	NSA	NSA	100	NBA	NBA
Be-7	NSA	NSA	10000	NBA	NBA
Bi-212	NSA	NSA	NSA	NBA	NBA
Bi-214	NSA	NSA	NSA	NBA	NBA
Ce-144	NSA	NSA	10	NBA	NBA
Co-57	NSA	NSA	1000	NBA	NBA
Co-58	NSA	NSA	100	NBA	NBA
Co-60	NSA	NSA	100	NBA	<0.7 (<0.37-<1.1)
Cs-134	NSA	NSA	10	NBA	<0.55 (<0.28-<0.97)
Cs-137	NSA	NSA	10	NBA	<0.21 (<0.001-<0.86)
Eu-152	NSA	NSA	100	NBA	NBA
Eu-154	NSA	NSA	100	NBA	NBA

Determinand	Screening Value			Background Values	
	EPR2010[1] (Bq/kg)	DWI[2] (Bq/l)	WHO[3] (Bq/l)	HMIP[4] (Bq/l)	RIFE[5] (Bq/l) (Mean and Range)
Eu-155	NSA	NSA	1000	NBA	NBA
I-131	NSA	NSA	10	NBA	NBA
K-40	NSA	NSA	NSA	0.013-3.6	0.071 (0.063-0.083)
Mn-54	NSA	NSA	100	NBA	NBA
Nb-95	NSA	NSA	100	NBA	NBA
Np-237	NSA	NSA	1	NBA	NBA
Pa-233	NSA	NSA	100	NBA	NBA
Pa-234m	11.1	NSA	NSA	NBA	NBA
Pb-210	0.93	0.2	0.1	0.0085-0.23	NBA
Pb-212	0.93	NSA	NSA	NBA	NBA
Pb-214	0.93	NSA	NSA	NBA	NBA
Ra-226	0.093	NSA	1	0-0.98	<0.01 (<0.01)
Ru-106	NSA	NSA	10	NBA	NBA
Sb-125	NSA	NSA	100	NBA	NBA
Th-234	6.2	NSA	100	NBA	NBA
Tl-208	NSA	NSA	NSA	NBA	NBA
U-235	247	NSA	1	NBA	<0.01 (<0.01)
Zn-65	NSA	NSA	100	NBA	NBA
Zr-95	NSA	NSA	100	NBA	NBA
C-14	NSA	NSA	100	NBA	NBA
H-3	NSA	100	10000	NBA	<4 (<4)

1.EPR2010 (Environmental Permitting (England and Wales) Regulations 2010) – derived threshold values for individual isotopes of the EPR2010 specified elements.

2.DWI (Drinking Water Inspectorate) - Drinking Water Directive (Council Directive 98/83/EC) sets standards for drinking water quality and presents indicator parameter values for radioactivity indicator parameter values. Have been adopted in the United Kingdom in the Water Supply (Water Quality) Regulations 2000 (SI 3184) as amended and can be considered as screening values with no regulatory status.

3.WHO (World Health Organisation) - guidance levels for radionuclides in drinking water

4.HMIP (Her Majesty's Inspectorate of Pollution) - Department of Environment Report 'Natural Radionuclides in Environmental Media. (Ref Doe/HMIP/RR/93/063).

5.RIFE (Radioactivity In Food and the Environment) Reports - the background values adopted represent the mean of the data reported in the RIFE reports 8 to 13 from 2002-2007 (RIFE 8 being the first report that includes specific data for Ashford Reservoir near Bridgwater).

NSA = No Screening Value Available

NBA = No Background Value Available

Details of analyses and results are contained in the appropriate groundwater quality campaign reports. A summary of the results is given in the paragraphs below.

a) Anthropogenic Radionuclides

15F.1.9 No anthropogenic radionuclides measurable by gamma spectrometry were detected in any of the samples throughout the sampling campaign indicating that there is no significant contamination of the groundwater in the sampling locations included in this monitoring campaign. However, the presence of anthropogenic alpha- and beta-emitting radionuclides that do not have a significant gamma-emission cannot entirely be discounted, for example, plutonium-238, 239 and 240, and strontium-90.

b) Comparison of Results with Screening Values

15F.1.10 Comparison of the gross alpha, gross beta and tritium results with the requirements of the Drinking Water Directive (Council Directive 98/83/EC) and Water Supply (Water Quality) Regulations 2000 has provided several examples of screening value exceedances. These screening value exceedances were associated with the three deep piezometer locations: CBH11, CBH16 and CBH29. CBH11 is located on the northern edge of the BDAW and is monitoring the Blue Lias. CBH16 is located in the central eastern area of the BDAW and is monitoring the Blue Anchor formation. CBH29 is located in central southern area of the BDAW and is monitoring the Blue Anchor formation. There were no examples of Drinking Water Directive (Council Directive 98/83/EC) and Water Supply (Water Quality) Regulations 2000 screening value exceedances observed for the shallow piezometers (DBH09, CBH20, CBH21, CBH24, CBH25, CBH27, CBH33 and CBH35).

c) Gross Alpha and Gross Beta at Location CBH16

15F.1.11 Sampling location CBH16 consistently provided gross beta results above the DWI screening value of 1Bq/l. The elevated gross beta values can largely be attributed to the elevated potassium-40 content of the samples. The gross beta and potassium-40 results, excluding associated uncertainties, for sampling location CBH16 are summarised in **Table 15F.2** below. Mean values for the monitoring programme are included in the table. For the purposes of this assessment, all values, including any "less than" values are included in the calculation of the mean.

Table 15F.2: Gross Beta and Potassium-40 Results for CBH16

Sampling Campaign	Gross Beta Activity Concentration (Calibrated with Potassium-40) Bq/kg	Potassium-40 Activity Concentration Bq/kg
1	4.5	4.1
2	0.6	< 1.8
3	4.6	< 2.8
4	7.8	6.6
5	6.2	5.2
Mean	4.7	4.1*

** "less than" values are included in the calculation of the mean.*

15F.1.12 Guidance in the application of the DWI screening values permits the subtraction of potassium-40 from any gross beta result that exceeds the DWI screening level. The contribution of the potassium-40 to the mean gross beta activity concentration can be calculated by multiplying the mean potassium-40 content by the negatron emission probability of potassium-40 (89.25%). The contribution of potassium-40 to the mean gross beta value is therefore 3.7Bq/kg; hence the mean gross beta excluding potassium-40 is 1Bq/kg, which is equivalent to the DWI gross beta screening value.

15F.1.13 The analytical data do not permit further analysis of the constituents of the gross beta value to be established. The absence of anthropogenic nuclides measurable by gamma spectrometry indicates that the gross beta signal is likely to be due to natural radionuclides; although the presence of anthropogenic beta-emitters that do not have a significant gamma emission, for example, strontium-90, cannot entirely be discounted.

15F.1.14 Four of the gross alpha results for CBH16 were “less than” values that exceeded the DWI screening value (0.1Bq/l). For campaign 4, a positive result was reported (5.6 ± 4.0Bq/kg) although the high relative uncertainty indicates that the result is close to the limit of detection. The high “less than” values reported for the samples from this location are due to the high dissolved solids associated with the water as indicated by the high major ion content (Ref. 15F.1).

d) Gross Alpha and Gross Beta at Location CBH29

15F.1.15 Sampling location, CBH29 provided gross beta results that were consistently close to the DWI screening value (1 Bq/l). The gross beta and potassium-40 results for sampling location CBH29 are summarised in **Table 15F.3** below.

Table 15F.3: Gross Beta and Potassium-40 Results for CBH29

Sampling Campaign	Gross Beta Activity Concentration (Calibrated with Potassium-40) Bq/kg	Potassium-40 Activity Concentration / Bq/kg
1	1.04	< 2.5
2	0.94	< 1.7
3	1.07	< 4.5
4	0.80	< 5.3
5	0.93	< 3.3
Mean	0.96	< 3.5

15F.1.16 The mean gross beta activity concentration is just below the DWI screening value (1Bq/l). In this case, it is not possible to establish whether or not that the gross beta values can largely be attributed to potassium-40 because the results for this radionuclide are all “less than” values that exceeded their associated gross beta values.

In addition, location CBH29 provided three positive gross alpha results that exceeded the DWI screening value of 0.1Bq/l but were below the WHO screening value of 0.5Bq/l. In addition, the mean gross alpha result for the monitoring programme is above the DWI screening value, but below the WHO screening value. The data are summarised in **Table 15F.4** below.

Table 15F.4: Gross Alpha Results for CBH29

Sampling Campaign	Gross Alpha Activity Concentration (Calibrated with Americium-241) Bq/kg
1	0.33
2	0.26
3	< 0.12
4	0.14
5	< 0.12
Mean	0.19*

** "less than" values are included in the calculation of the mean.*

15F.1.17 The analytical data do not permit further analysis of the constituents of the gross alpha value to be established. The absence of anthropogenic nuclides measurable by gamma spectrometry indicates that the gross alpha signal is likely to be due to natural radionuclides; although the presence of anthropogenic alpha-emitters that are not accompanied by any significant gamma emission, for example, plutonium-238, 239 and 240, cannot entirely be discounted.

e) Gross Alpha and Gross Beta at Location CBH11

15F.1.18 Sampling location CBH11 provided one gross alpha result that exceeded the DWI screening value (0.1Bq/l) in campaign 1, although based on the high relative uncertainty, the result (0.76 ± 0.71Bq/kg) was close to the limit of detection. All other gross alpha results were "less than" values that exceeded the DWI screening value.

15F.1.19 The gross beta results for CBH11 in campaigns 2 and 4 (1.39 ± 0.75 and 2.32 ± 0.96Bq/kg respectively) exceeded the DWI screening value (1Bq/l). In addition, the gross beta results for campaigns 3 and 5 were "less than" values for exceeded the DWI screening value.

15F.1.20 The analytical data do not permit further analysis of the constituents of the gross alpha and gross beta values to be established.

15F.1.21 As was the case for CBH16, the elevated gross alpha and gross beta "less than" values reported for the samples from CBH11 are due to the high dissolved solids associated with the water.

f) Tritium Results

15F.1.22 The tritium results covering the monitoring programme were all significantly below the DWI indicator parameter value of 100 Bq/l. Only three positive tritium results were reported. These were for samples DBH09, CBH25 and CBH27 from campaign 2. In each case, the results (2.5 ± 2.5, 2.6 ± 2.6 and 4.7 ± 2.8Bq/l respectively) were close to the limit of detection and were of the same order of magnitude as the adopted RIFE (Radioactivity in Food and the Environment) background value (< 4.0Bq/l).

g) Naturally Occurring Radionuclides

15F.1.23 Naturally occurring radionuclides detected in any of the samples throughout the monitoring programme were carbon-14, potassium-40, lead-214, bismuth-214 and lead-212.

15F.1.24 Carbon-14 was detected in sample CBH11 in campaign 2 at a level close to the limit of detection (4.9 ± 4.6Bq/kg) and significantly below the WHO guidance value (100Bq/l).

15F.1.25 Potassium-40 was detected in samples from location CBH16 in campaigns 1, 4 and 5. Its presence makes a significant contribution to the elevated gross beta results observed for this sample location.

15F.1.26 Bismuth-214 and lead-214 were detected in a number of samples throughout the monitoring programme. These radionuclides are decay products of radon-222; hence in accordance with the Drinking Water Directive (Council Directive 98/83/EC), these radionuclides are excluded from the assessment of total indicative dose. This exclusion also applies to lead-212, which is a decay product of radon-220.

h) BDAW - Non-technical Summary

15F.1.27 The groundwater monitoring programme in the Built Development Area West provided no evidence to suggest that the groundwater was contaminated with significant levels of anthropogenic radionuclides. All of the shallow groundwaters meet the water quality requirements of the Water Supply (Water Quality) Regulations 2000 i.e. the gross alpha, gross beta and tritium levels are below 0.1, 1 and 100Bq/l respectively. The deep groundwaters contained elevated levels of gross beta, which in some cases exceeded the 1Bq/l limit; however, these elevated levels were attributable to the presence of the naturally occurring radionuclide, potassium-40 and is such is not considered significant.

15F.1.28 The shallow and deep groundwaters on the BDAW have not been found to contain any radiological contamination of concern.

15F.2 Built Development Area East (BDAE)

15F.2.1 As outlined above, an extensive programme of groundwater quality monitoring (similar in size and scope to that conducted on the BDAW above) has been conducted on the BDAE. This has involved sampling twenty one piezometers on at least three occasions (thirteen of the piezometers have been sampled on four occasions). Four of the piezometers (DBH2_10, DBH2_21, DBH2_22 and DBH2_27) have been installed along the eastern boundary of the BDAE to monitor for potential cross boundary groundwater contaminant migration from the adjacent Hinkley Point A power station complex.

15F.2.2 Groundwater samples were analysed for the same as for the BDAW above:

- Gross alpha (calibrated with americium-241) and gross beta (calibrated with potassium-40);
- Tritium (as tritiated water);
- High-resolution gamma spectrometry; and
- Carbon-14.

The results of the radiological data are summarised and discussed below.

15F.2.3 In the following sections, the term ‘’positive value’’ relating to a particular determinand is used to indicate that it has been detected and the term “less than” value is used to indicate that the determinand is below a reporting limit.

a) Gross Alpha Activity

15F.2.4 Positive gross alpha results have been reported at seven of the sample locations (DBH2_8, DBH2_9, DBH2_20, DBH2_21, DBH2_23, CBH2_56 and CBH2_57). Positive results that exceeded the DWI screening value (0.1 Bq/l), but were below the WHO screening value (0.5Bq/l) were observed at two of these seven sample locations (DBH2_9 and CBH2_56) in Campaign 3 (0.14 ± 0.11 and 0.124 ± 0.071 Bq/kg respectively). However during Campaigns 2 and 4, the results for DBH2_9 were 0.068 ± 0.059 and < 0.071Bq/kg respectively. For CBH2_56, the Campaigns 2 and 4 results were < 0.067 and 0.049 ± 0.046Bq/kg respectively. Samples were not collected from DBH2_9 and CBH2_56 during Campaign 1. The results for the groundwater monitoring programme indicate that groundwater sampled from locations DBH2_9 and CBH2_56 have not consistently exceeded the DWI screening value (0.1Bq/l).

15F.2.5 There have been eighteen cases of gross alpha results being reported as “less than” values that exceed the DWI screening value (0.1Bq/l). The “less than” values reported for CBH2_53 in Campaigns 2, 3 and 4 (< 2.4, < 1.9 and < 1.4Bq/kg respectively) also exceeded the WHO screening value (0.5Bq/l). The elevated “less than” values reported are due to elevated levels of dissolved solids in the sample which detrimentally affects the limit of detection achievable for the analytical method.

b) Gross Beta Activity

15F.2.6 Positive gross beta results have been reported for all of the samples. There have been gross beta results for four sample locations which have exceeded the DWI and WHO screening value (1Bq/l): CBH2_53 (deep groundwater) in Campaigns 2, 3 and 4; DBH2_9 in Campaigns 2, 3 and 4; CBH2_54 (deep groundwater) in Campaigns 2 and 4; and DBH2_7 in Campaigns 3 and 4. Samples were not collected from locations CBH2_53, CBH2_54 and DBH2_9 during Campaign 1. The gamma spectrometry results provide no evidence of the presence of anthropogenic radionuclides and it is therefore likely that the elevated gross beta values are due to the naturally occurring radionuclide potassium-40, although this could not be confirmed from the radiochemical analyses because the measured potassium-40 results associated with the gross beta exceedances are “less than” values. However, the beta (negatron) activity concentration due to potassium-40 can be calculated from the potassium concentration using a beta activity concentration for natural potassium of 27.4Bq/g. **Table 15F.5** provides a comparison of the beta activity concentration of potassium-40 calculated from the measured potassium concentration (Ref.15F.2) with the measured gross beta activity concentration for samples that exceeded the DWI and WHO screening value.

Table 15F.5: Comparison of Calculated Potassium-40 Beta with Measured Gross Beta for Samples from BDAE that Exceed the DWI and WHO Screening Value

Sample Location	Campaign	Potassium Result mg/l	Calculated K-40 Beta Activity Concentration Bq/l	Measured Gross Beta Activity Concentration Bq/kg
CBH2_53	Campaign 2	213.4	5.8	4.8 ± 2.1
	Campaign 3	236.1	6.5	3.7 ± 2.0
	Campaign 4	186.3	5.1	2.5 ± 1.2
DBH2_9	Campaign 2	98.5	2.7	3.18 ± 0.25
	Campaign 3	351.4	9.6	5.01 ± 0.42
	Campaign 4	235.2	6.4	3.57 ± 0.31
CBH2_54	Campaign 2	78.2	2.1	1.85 ± 0.23
	Campaign 4	28.0	0.77	1.62 ± 0.16
DBH2_7	Campaign 3	29.1	0.80	2.82 ± 0.34
	Campaign 4	27.5	0.75	1.09 ± 0.26

15F.2.7 The beta activity concentrations due to potassium-40 calculated from the potassium concentrations generally show that the elevated gross beta results can be attributed to the potassium-40 content. Guidance in the application of the DWI screening values permits the subtraction of potassium-40 from any gross beta result that exceeds the DWI screening level (1Bq/l). With one exception (Campaign 3: DBH2_7), subtraction of the calculated potassium-40 beta activity concentration from the gross beta results in gross beta results below this screening level.

15F.2.8 The Campaign 3 DBH2_7 gross beta result (2.82 ± 0.34Bq/kg), which is not largely accounted for by the calculated potassium-40 content, is significantly higher than the results for Campaigns 1 and 2 (0.38 ± 0.11 and 0.41 ± 0.18Bq/kg respectively), which were below the DWI and WHO screening value (1Bq/l). The Campaign 4 result for DBH2_7 exceeds the DWI and WHO screening values, but it is largely attributable to the presence of potassium-40 and is therefore not considered to be significant or of concern.

c) Tritium

15F.2.9 Tritium has been detected in the shallow groundwater at several locations (DBH2_9, DBH2_8, DBH2_10, DBH2_23 DBH2_24, DBH2_26 CBH2_56, CBH2_57 and NBH04,) across the BDAE. The positive results reported for DBH2_9 (Campaign 4: 2.6 ± 2.5Bq/l), DBH2_23 (Campaign 4: 2.6 ± 2.5Bq/l); DBH2_10 (Campaign 2: 2.5 ± 2.4Bq/l), DBH2_8 (Campaign 4: 2.8 ± 2.5Bq/l), DBH_24 (Campaign 2: 2.8 ± 2.6Bq/l) and NBH04 (Campaign 4: 3.7 ± 2.5Bq/l) were close to the limit of detection based on the high relative uncertainty reported and were below the upper limit of the adopted RIFE background range (< 4Bq/l). All of the detected tritium activities were below the DWI screening value (100Bq/l).

15F.2.10 Tritium was detected in all of the samples collected from CBH2_57 (Campaign 2: 14.9 ± 1.3Bq/l; Campaign 3: 29.3 ± 3.5Bq/l and Campaign 4: 8.4 ± 2.8Bq/l) at levels above the upper limit of the adopted RIFE background range (< 4 Bq/l), but significantly below the DWI screening value (100Bq/l). Tritium was also detected in three of the four samples collected from DBH2_26 (Campaign 1: 12.5 ± 2.6Bq/l; Campaign 3: 13.0 ± 2.8Bq/l and Campaign 4: 4.5 ± 2.6Bq/l) at levels above the upper limit of the adopted RIFE background range. The Campaign 2 result for DBH2_26 was a positive result (2.6 ± 2.5Bq/l) at a level close to the limit of detection. For CBH2_56, the Campaign 3 result (4.7 ± 2.4Bq/l) exceeded the adopted RIFE background value (<4Bq/l). The other results for this sample location were positive (Campaign 2: 3.0 ± 2.5 Bq/l and Campaign 4: 3.8 ± 2.5Bq/l), but were below adopted RIFE background value.

15F.2.11 The three monitoring boreholes (CBH2_56, CBH2_57 and DBH2_26) where tritium has been detected at levels above the upper limit of the adopted RIFE background range (<4Bq/l) below the DWI screening value (100Bq/l) are located in the north-east of the BDAE close to the Hinkley Point A site boundary.

15F.2.12 All other tritium results were reported as “less than” values falling within the range <1.8 to < 4.0Bq/l.

d) Anthropogenic Radionuclides

15F.2.13 No anthropogenic radionuclides measurable by high-resolution gamma spectrometry have been detected at any of the sample locations during the monitoring programme.

15F.2.14 For all of the samples, the reported “less than” values for cobalt-60 were below the upper limit of the RIFE background range (<1.1Bq/l).

15F.2.15 With four exceptions (DBH2_23 <1.4Bq/kg in Campaign 2; DBH2_10 <1.1Bq/kg in Campaign 1; and CBH2_56 <1.3Bq/kg and DBH2_26 <1.5Bq/kg in Campaign 3) the “less than” values reported for caesium-134 were below the upper limit of the RIFE background range (<0.97Bq/l).

15F.2.16 For all of the samples, the reported “less than” values for caesium-137 were below the upper limit of the RIFE background range (<0.86Bq/l).

15F.2.17 With one exception (DBH2_24 <1.2Bq/kg in Campaign 4, the “less than” values reported for americium-241 were below the upper limit of the WHO screening value for americium-241 (1Bq/l).

15F.2.18 There have been nine neptunium-237 results (DBH2_10 in Campaign 4, DBH2_22 in Campaign 4, DBH2_27 in Campaigns 2 and 4, DBH2_7 in Campaign 4, DBH2_8 in Campaign 3, DBH2_24 in Campaign 4 and NBH04 in Campaigns 1 and 4) reported as “less than” values that exceeded the WHO screening value for neptunium-237 (1Bq/l). The highest “less than” value reported was for the sample from DBH2_7 (<2.4Bq/kg).

e) Naturally Occurring Radionuclides

15F.2.19 Lead-214 and lead-212 are the only naturally occurring radionuclides measurable by high-resolution gamma spectrometry detected in any of the samples to date. Lead-214 was detected in one sample (DBH2_19 0.64 ± 0.42Bq/kg in Campaign 4) at a level close to the limit of detection based on the high relative uncertainty reported and below the screening value derived from EPR2010 (0.93Bq/kg). Lead-212 was detected in five samples in Campaign 2 (CBH2_30, DBH2_27, DBH2_7, DBH2_24 and NBH_04) at levels close to the limit of detection based on the high relative uncertainty reported. The results ranged from 0.25 ± 0.19 to 0.39 ± 0.21Bq/kg, which is below the screening value derived from EPR2010 (0.93 Bq/kg). Lead-214 and lead-212 are decay products of radon-222 and radon-220 respectively; hence in accordance with the Drinking Water Directive (Council Directive 98/83/EC), is excluded from the assessment of total indicative dose.

15F.2.20 All of the results for lead-210 and radium-226, have been reported as "less than" values that have exceeded their respective WHO screening values (0.1 and 1Bq/l). In many cases, the protactinium-234 results have been reported as "less than" values that have exceeded their EPR2010 screening value (11.1Bq/kg). All uranium-235 results have been reported as "less than" values that have exceeded the adopted RIFE background value (<0.010Bq/l) but were below the WHO screening value (1Bq/l). There have also been twenty-two potassium-40 results reported as "less than" values that exceeded the upper limit of the HMIP background range (3.6Bq/l). There are two lead-214 results reported as a "less than" values that exceeded the EPR 2010 screening value (0.93Bq/kg) and one thorium-234 result reported as a "less than" values that exceeded the EPR 2010 screening value (6.2Bq/kg). Reportable "less than" values for naturally occurring radionuclides, including potassium-40, protactinium-234m, radium-226, lead-210, lead-214, bismuth-214 etc, may be elevated because these nuclides are inherently present in the background at levels that can be subject to variation over time; hence, the uncertainty associated with correcting results for the background can be relatively high.

f) Carbon-14

15F.2.21 With one exception in Campaign 3 (CBH2_55: 7.2 ± 7.0Bq/kg), the carbon-14 results reported were "less than" values falling in the range <2.3 to <16 Bq/kg. Based on the high reported relative uncertainty, the positive result is close to the limit of detection. In all cases, the results were below the WHO screening value for carbon-14 (100 Bq/l).

g) BDAE – Non-technical Summary

15F.2.22 The radiochemical analysis results for the groundwater monitoring programme for the Built Development Area East indicate that the groundwater sampled and analysed is not significantly contaminated with anthropogenic radionuclides, and would not present a hazard to human health or be of concern based on a comparison against the public dose limit of 1mSv per annum. Overall, it is therefore unlikely that, the groundwaters would exceed the total indicative dose (committed effective dose) threshold value of 0.1mSv per annum if they were to be consumed as drinking water.

15F.2.23 Slightly elevated levels of tritium above the adopted RIFE background value (<4Bq/l) have been detected at three locations (CBH2_56, CBH2_57 and DBH2_26) in the north-east of the Built Development Area East close to the Hinkley Point A site boundary. However, the activities are below the drinking water screening level of (100Bq/l) and as such are not significant or of concern.

15F.2.24 Under current radioactive substances regulation (permitting regulations EPR2010) there is no de-minimus for man-made radionuclides such as tritium in aqueous solutions where they become a waste (e.g. dewatered groundwater requiring disposal) and as such, currently are not exempt from these regulations. However, this legislation is due to change in the near future (October 2011) (Ref. 15F.3). It will then be likely that the levels of tritium found in groundwater water pumped from these areas (i.e. (CBH2_56, CBH2_57 and DBH2_26) during the planned dewatering during construction, will in future become exempt from radioactive substances regulation if it is considered to be a waste material.

15F.3 Southern Construction Phase Area (SCPA)

15F.3.1 As stated above, a programme of groundwater monitoring involving sampling from seven piezometers on three occasions has been undertaken on the SCPA during 2010. The results of the radiological analysis of the groundwater samples on the SCPA are summarised below.

15F.3.2 Groundwater samples were analysed for the same parameters as for the BDAW and BDAE which included:

- Gross alpha (calibrated with americium-241) and gross beta (calibrated with potassium-40);
- Tritium (as tritiated water);
- High-resolution gamma spectrometry; and
- Carbon-14.

a) Gross Alpha Activity

15F.3.3 Positive gross alpha results have been reported at five of the seven sample locations to date (DBH2_12, DBH2_14, DBH2_16, DBH2_17 and DBH2_18). Gross alpha results that exceed the DWI screening value (0.1Bq/l), but are below the WHO screening value (0.5Bq/l) have been reported for two of the sample locations (DBH2_12 and DBH2_17). The Campaign 2 result for DBH2_12 was 0.117 ± 0.049Bq/kg. The other gross alpha results for this sample location (Campaign 3: 0.096 ± 0.048Bq/kg and Campaign 4: 0.052 ± 0.044Bq/kg) are at or below the DWI screening value. The Campaign 3 result for DBH2_17 was 0.141 ± 0.057Bq/kg. The other gross alpha results for this sample location (Campaign 2: 0.099 ± 0.049Bq/kg and Campaign 4: 0.080 ± 0.044Bq/kg) are at or below to the DWI screening value. The mean gross alpha results (excluding uncertainties) for sample locations DBH2_12 and DBH2_17 are 0.088 and 0.107Bq/kg respectively; the latter value being marginally above the DWI screening value (0.1Bq/l), but below the WHO screening value (0.5Bq/l).

b) Gross Beta Activity

15F.3.4 Positive gross beta results have been reported for all of the samples to date. The results have ranged from 0.072 ± 0.024 to 0.424 ± 0.048Bq/kg, which are below the DWI and WHO screening value (1Bq/l). The highest result reported was for sample DBH2_16 for Campaign 3.

c) Tritium

15F.3.5 With two exceptions, the tritium results were reported as “less than” values falling within the range <1.8 to <3.9Bq/l. The two positive tritium results were reported for sample DBH2_16 for Campaign 2 (2.1 ± 1.9Bq/l) and sample DBH2_14 for Campaign 4 (2.7 ± 2.2Bq/l). These positive results are at a level close to the limit of detection based on the high relative uncertainty reported. All of the results are significantly below the DWI screening value (100Bq/l) and are below the upper limit of the adopted RIFE background range (<4Bq/l).

d) Anthropogenic Radionuclides

15F.3.6 No anthropogenic radionuclides measurable by high-resolution gamma spectrometry have been detected to date at any of the sample locations.

15F.3.7 For all of the samples, the reported “less than” values for cobalt-60 were below the upper limit of the RIFE background range (<1.1Bq/l).

15F.3.8 With one exception in Campaign 2 (DBH2_12: <2.4Bq/kg), the “less than” values reported for caesium-134 were below the upper limit of the RIFE background range (<0.97Bq/l).

15F.3.9 For all of the samples, the reported “less than” values for caesium-137 were below the upper limit of the RIFE background range (<0.86Bq/l).

15F.3.10 With one exception (DBH2_14: <1.1Bq/kg in Campaign 4), the americium-241 results reported were “less than” values that were below the WHO screening value for americium-241 (1Bq/l).

15F.3.11 With four exceptions (DBH2_13: <1.3Bq/kg in Campaign 2, DBH2_12: <2.5Bq/kg in Campaign 4, DBH2_14: <1.6Bq/kg in Campaign 4 and DBH2_15: <1.5Bq/kg in Campaign 4), the neptunium-237 results reported were “less than” values that were below the WHO screening value for neptunium-237 (1Bq/l).

e) Naturally Occurring Radionuclides

15F.3.12 No naturally occurring radionuclides have been detected in any of the samples. All of the results for lead-210 and radium-226, have been reported as “less than” values that have exceeded their respective WHO screening values (0.1 and 1Bq/l). In many cases, the protactinium-234 results have been reported as “less than” values that have exceeded their EPR2010 screening value (11.1Bq/kg). All uranium-235 results have been reported as “less than” values that have exceeded the adopted RIFE background value (<0.010Bq/l) but were below the WHO screening value (1Bq/l). There have been eight potassium-40 results reported as “less than” values that exceeded the upper limit of the HMIP background range (3.6Bq/l). There has also been one lead-214 result that exceeded the EPR 2010 screening value (0.93Bq/kg). Reportable “less than” values for naturally occurring radionuclides, including potassium-40, protactinium-234m, radium-226, lead-210, lead-214, bismuth-214 etc, may be elevated because these nuclides are inherently present in the background at levels that can be subject to variation over time; hence, the uncertainty associated with correcting results for the background can be relatively high.

f) SCPA – Non-technical Summary

15F.3.13 The radiochemical analysis results for the groundwater monitoring programme for the SCPA indicate that the groundwater sampled and analysed is not contaminated with anthropogenic radionuclides, and would not present a hazard to human health or be of concern based on a comparison against the public dose limit of 1mSv per annum. Overall, it is therefore unlikely that, the groundwaters would exceed the total indicative dose (committed effective dose) threshold value of 0.1mSv per annum if they were to be consumed as drinking water.

15F.4 Hinkley Point A

15F.4.1 As previously discussed, data on groundwater quality on the Hinkley Point A site has been taken from the SERCO and Golder reports made available to AMEC (Ref. 15F.4, Ref.15F.5, Ref. 15F.6, Ref. 15F.7, Ref 15F.8).

15F.4.2 Groundwater samples were analysed for gross alpha, gross beta and tritium, with Sr-90 in five selected boreholes.

15F.4.3 Within the SERCO report (Ref. 15F.4) the Hinkley Point A site 'groundwater zone' is divided into four areas and results are presented below for each area.

a) Area 1

15F.4.4 Area 1 is located in the eastern area of the Hinkley Point A site and is reported to contain two areas of potential concern (APC).

15F.4.5 Gross alpha activity was below the World Health Organisation Drinking Water Standard (WHO DWS) of 0.5Bq/l in all samples between 2004 -2009.

15F.4.6 Gross beta activity was below the WHO DWS of 1Bq/l in all the boreholes with the exception of one borehole (G22) which recorded slightly elevated levels (1.7Bq/l) in 2005, but which was less than the WHO DWS of 1Bq/l in 2009.

15F.4.7 Tritium activities in groundwater are typically <20 Bq/l with the exception of boreholes G17, G24, and G25 which show slightly elevated tritium activities (up to 42Bq/l). The slightly elevated activities are located down gradient of the AEVP which may be the source. However, all the recorded tritium activities are well below the UK DWS of 100Bq/l.

b) Area 2

15F.4.8 Area 2 covers the central eastern area of the Hinkley Point A site and contains a number of APCs.

15F.4.9 Gross alpha activity was below the WHO DWS of 0.5Bq/l in all samples between 2004 -2009

15F.4.10 The majority of monitoring boreholes in Area 2 have recorded gross beta activities less than the WHO DWS of 1Bq/l with the exception of borehole G9 which has shown activities ranging from 2 - 8Bq/l between 2004 – 2009. The beta activity in this location has however shown a definite downward trend over the monitoring period and when last monitored in early 2009 was 3.3Bq/l.

15F.4.11 Tritium activities in groundwater in the area are typically <100Bq/l with the exception of borehole G13 which has regularly detected elevated tritium ranging from 100 to 800Bq/l. The tritium levels in this borehole have shown an overall downward trend from 2004 -2009.

c) Area 3

15F.4.12 Area 3 covers the central western area of the Hinkley Point A site and contains a number of APCs.

15F.4.13 Gross alpha activity has been below the WHO DWS of 0.5Bq/l in the majority of boreholes in Area 3 with the exception of one elevated sample (0.5 to 2.0Bq/l) in borehole G7. However the alpha activity in this borehole in the most recent sampling (January 2009) was below the WHO DWS of 0.5Bq/l.

15F.4.14 Gross beta activity above the WHO DWS of 1 Bq/l has been noted in borehole G6 (2 to 14Bq/l) between 2004 and 2009. Based on these results, and the range of concentrations as indicated on the Figure on page 89 of the SERCO report (Ref. 15F.4), a conservative activity of 20 Bq/l has been assumed for G6 which is source 1 in the ConSim modelling (see **Appendix 15.I**). This borehole is located downgradient of the R2 Flask Washdown Bay. The gross beta activity in borehole G6 in the latest set of available results (January 2009) was still elevated (6Bq/l). Slightly elevated gross beta activities (1 to 3Bq/l) were also noted in borehole G7 which is near to one of the cooling ponds. Borehole G34 recorded gross beta activities of 4Bq/l on one occasion.

15F.4.15 Elevated tritium activities have also been noted in several of the boreholes in Area 3 between 2004 - 2009. The highest activities (1910, 1850 and 1520Bq/l) were noted in boreholes A6, G7 and G35 downgradient of the decontamination building and R2 cooling pond, respectively. The activities have since decreased sharply, with the activity in borehole G7 (269Bq/l) only remaining above the UK DWS of 100Bq/l in January 2010.

d) Area 4

15F.4.16 Area 4 covers the northern area of the Hinkley Point A site. It has a number of APCs.

15F.4.17 Gross alpha activity has been recorded above the WHO DWS of 0.5Bq/l in three boreholes within Area 4 between 2004 - 2009. However the alpha activities in all boreholes in the most recent sampling (January 2009) were below the WHO DWS of 0.5 Bq/l.

15F.4.18 Gross beta activity is generally elevated in boreholes close to the sea wall, however this is not believed to be from a manmade source on the HPA rather from seawater (which contains naturally levels of the beta emitting radionuclide K-40).

15F.4.19 Tritium activities across the area have all been below the UK DWS of 100Bq/l.

e) Additional Routine Groundwater Monitoring (July 2009 – August 2010)

15F.4.20 A routine groundwater quality monitoring programme has been undertaken on the Hinkley Point A site by Golder Associates (GA) on behalf of Magnox South between July 2009 and August 2010 and the data for this has been presented factually in the monitoring reports.

15F.4.21 During the GA groundwater monitoring visits, a similar groundwater monitoring well network to that previously sampled by SERCO was used, except in August 2010 when the borehole network was extended following a supplementary investigation which was undertaken in accordance with the recommendations made in the SERCO report (Ref. 15F.4). Groundwater samples collected during the routine monitoring visits were analysed for a range of radiochemical and non-radiochemical determinands.

15F.4.22 A review of the analytical data recorded during the additional routine monitoring programme indicates that the radiochemical and non-radiochemical contaminant concentrations are generally similar to those recorded during the previous monitoring undertaken by SERCO and that no new source of contamination has been identified in the groundwater. The highest concentrations of tritium recorded over the three monitoring visits were in the range 89.5 to 438Bq/l which were recorded at borehole G35 (located towards the western boundary of the Hinkley Point A site). The highest Strontium-90 concentrations were in the range 1.58 to 2.78Bq/kg, with the highest value recorded at borehole G9 which is located in the central southern area of the Hinkley Point A site.

15F.4.23 The concentrations of non-radiochemical determinands recorded during the GA monitoring visits were also similar to the data range recorded previously by SERCO, although notable concentrations of speciated hydrocarbon fractions (speciated TPH working group criteria) have been recorded on the January and August 2010 monitoring visits conducted. Elevated hydrocarbon fraction concentrations were recorded at boreholes G1A and G22 (July 2010) in the range 1040 – 3890µg/l and G4A and G36 (August 2010) in the range 1550 and 4460µg/l.

15F.4.24 Very elevated concentrations of dissolved speciated hydrocarbon fractions (various aliphatic and aromatic fractions) were recorded at G2B (141mg/l) in August 2010, which is located close to the eastern boundary of the Hinkley Point A site and at a distance which exceeds that of the modelled maximum zone of influence associated with construction dewatering on the proposed Hinkley Point C site. Although not discussed directly in the factual report, free phase product has been recorded at G2B which may have influenced the dissolved concentrations recorded in the sample recovered from this borehole. Samples of groundwater were not previously taken from this borehole because free phase product had been detected.

15F.4.25 Analytical data for the ‘new’ shallow boreholes included in the monitoring network (August 2010) show relatively low concentrations of inorganic and organic contaminants which are generally consistent with those recorded in the groundwater at other boreholes. Detectable concentrations of speciated hydrocarbons were recorded at G42A (328µg/l), G45B (18µg/l) and G46 (92µg/l).

15F.5 Hinkley Point B

15F.5.1 Potential radiological groundwater contamination on the Hinkley Point B site has not been included given the large distance (>500m) from the Hinkley Point B site to the development site and known groundwater flow directions being south to north (i.e. not towards the development site from the Hinkley Point B site), any radiological groundwater contamination on the B station site has been ‘scoped out’.

References

15F.1 AMEC. Summary of Groundwater Quality (Campaign 5) Radiochemical Analysis Results. Report Ref: 15011/TN/00030.

15F.2 AMEC. Summary of Groundwater Quality Campaigns 1, 2, 3 and 4) Non Radiochemical Analysis Results for the Built Development Area East and Southern Construction Phase Area. Report Ref 15011/TN/000158.

15F.3 The Environmental Permitting (England and Wales) (Amendment) (No.2) Regulations 2011 (Draft).

15F.4 SERCO (March 2010). Summary interpretive Land Quality Report for Hinkley Point A: Volume 1 & 2. Report Ref: SERCO/TAS/E03666/01 for Magnox South.

15F.5 Golder Associates. Hinkley Point A Groundwater Monitoring (July 2009). October 2009.

15F.6 Golder Associates. Hinkley Point A Groundwater Monitoring (January 2010). March 2010.

15F.7 Golder Associates. Hinkley Point A Groundwater Monitoring (August 2010). December 2010.

15F.8 Golder Associates. Factual Letter Report on the Contaminated Land Intrusive Ground Investigation at the Hinkley Point A Site (May 2010).

APPENDIX 15G: COMPARISON OF CONCENTRATIONS FOR SELECTED INORGANIC DETERMINANDS RECORDED AT UP GRADIENT AND DOWN GRADIENT PIEZOMETERS

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Table 1. Comparison of Concentrations for Selected Inorganic Determinands Recorded at Up Gradient and Down Gradient Piezometers in the BDAW and BDAE

Determinand	Comparison of Data for each area											
Determinand	Up gradient piezometers (BDAW) CBH27, 33 & 35 (inc. 33 dup)			Down gradient Piezometers (BDAW) CBH20, 21 & 25 (inc. 20 dup)			Up gradient*** Piezometers (BDAE) DBH2_10, 19, 20 & 21			Down gradient** Piezometers (BDAE) DBH2_8, 9, 22, 23, 24, 26, 27, NBH01, 03, 04, CBH2_30, 56 & 57 (inc. DBH2_9 & 2_27 dup)		
	Range	Average	Exc. Of Tier 1	Range	Average	Exc. Of Tier 1	Range	Average	Exc. Of Tier 1	Range	Average	Exc. Of Tier 1
Boron (Dissolved)	<5 -145	33	0 (16)	77-730	239	0 (16)	15-634	225	0 (16)	16-3165	966	**17** (50)
Boron (total)	262-325	291	0 (3)	359-460	402	0 (3)	61-960	332	0 (16)	35-4196	1216	**22** (50)
Iron (dissolved)	<5-12*	N/A	0 (16)	<1-29	N/A	0 (16)	<1-127	55	0 (16)	4-586	105	0 (50)
Iron (total)	-	-	-	-	-	-	23-532	136	**3** (16)	26-796	189	**16** (50)
Sulphate (mg/l)	16-156	73	0 (16)	25-82	59	0 (16)	36-269	123	**2** (16)	4-803	233	**16** (50)
Chloride (mg/l)	13-141	41	0 (16)	54-287	99	**1** (16)	33-97	54	0 (16)	37-589	161	**11** (50)
Ammonium as NH_4 (mg/l)	<0.01-0.3	0.10	0 (16)	<0.01-1.02	0.32	**4** (16)^	<0.01-0.40	0.18	0 (16)	<0.01-2.53	0.77	**25** (50)
Total Ammonia as N (mg/l) (Calculated)[Eq]	<0.01-0.23	0.08	0 (16)	<0.01-0.79	0.25	**4** (16)^	<0.01-0.05	0.01	0 (16)	<0.01-2.30	0.20	**9** (50)
Sodium (mg/l)	22.5-408.8	71.6	**1** (16)	46.9-189.3	87.4	**1** (14)	29.9-78.9	44.8	0 (16)	38.8-744.6	207.7	**15** (50)
Calcium (mg/l)	103.1-143.7	123	0 (10)	72.2-99.0	86.1	0 (10)	96.5-299.4$	153.6$	**2** (16)	36.4-404.5	143.7	**6** (50)
Magnesium	17.7-31.2	23.9	0 (10)	23.9-48.0	35.0	0 (10)	28.6-41.2	33.5	0 (16)	0.2-151.7	68.7	**34** (50)
Potassium	2.4-7.2	3.9	0 (10)	2.7-8.9	5.2	0 (10)	2.8-8.9	5.1	0 (16)	2.9-351.4	23.5	**6** (50)

Concentrations reported in µg/l unless otherwise stated
^ 3 exceedances recorded at CBH20
$ Elevated calcium recorded at DBH2_20 on 2 campaigns
*anomalous data removed from the data set
** Within or downgradient of existing spoil mound, former NDA spoil disposal area and former fabrication area on BDAE.
*** Upgradient of the existing spoil mound former NDA spoil disposal area and former fabrication area on BDAE.

	Background Concentrations (BDAW)		Upgradient (i.e Background Concentrations (BDAE)		DBH2_8		DBH2_9		DBH2_22		DBH2_23		DBH2_24	
	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Boron (Dissolved)	<5 -146	33	15-634	225	455-2270	1254	16-127	72	141-993	633	43-541	280	28-847	530
Boron (total)	262-325	291	61-960	332	620-2693	1566	46-169	96	182-1409	832	55-708	489	35-1063	660
Iron (dissolved)	<5-12*	N/A	<1-127	55	20-235	93	<10	<10	<10-81	N/A	18-31	25	45-586	316
Iron (total)	-	-	23-532	136	44-313	146	<10-55	51	26-191	74	30-232	96	146-666	389
Sulphate (mg/l)	16-156	73	36-269	123	289-347	308	16-94	39	74-132	99	549-803	649	135-215	162
Chloride (mg/l)	13-141	41	33-97	54	64-127	91	102-131	110	54-95	77	37-81	67	52-335	232
Ammonium as NH_4 (mg/l)	<0.01-0.3	0.10	<0.01-0.40	0.18	0.25-1.07	0.60	0.68-2.31	1.47	0.67-1.78	1.15	0.02-0.18	0.08	0.06-1.06	0.66
Total Ammonia as N (mg/l) (Calculated)[Eq]	<0.01-0.23	0.08	<0.01-0.05	0.01	<0.01-0.19	0.05	0.67-2.30	1.47	0.01-0.52	0.14	<0.01-0.02	N/A	<0.01-0.01	0.00
Sodium (mg/l)	22.5-408.8	71.6	29.9-78.9	44.8	73.1-155.4	105.5	238.1-744.6	452.4	75.5-98.5	86.8	69.1-124.5	92.9	50.2-285.7	205.2
Calcium (mg/l)	103.1-143.7	123	96.5-299.4[$]	153.6[$]	81.9-213.2	144.7	70.2-404.5	288.5	61.5-103.0	75.0	202.2-341.6	254.0	134.5-169.5	148.9
Magnesium	17.7-31.2	23.9	28.6-41.2	33.5	80.7-133.0	101.1	0.2-0.7	0.4	72.3-102.6	85.3	81.0-127.3	94.7	36.0-95.7	74.7
Potassium	2.4-7.2	3.9	2.8-8.9	5.1	6.7-12.1	9.0	98.5-351.4	202.9	8.9-11.9	10.3	6.0-10.5	7.6	3.3-11.2	8.1

Concentrations reported in µg/l unless otherwise stated
^ 3 exceedances recorded at CBH20
$ Elevated calcium recorded at DBH2_20 on 2 campaigns
*anomalous data removed from the data set
** Within or downgradient of existing spoil mound, former NDA spoil disposal area and former fabrication area on BDAE.
*** Upgradient of the existing spoil mound former NDA spoil disposal area and former fabrication area on BDAE.

Table 2. Comparison of Concentrations for Selected Inorganic Determinands Recorded at Down Gradient Piezometers in the BDAE Against 'Background' BDAW and BDAE Concentrations

Determinand	Background Concentrations (BDAW)		Background Concentrations (BDAE)		DBH2_26		DBH2_27		NBH01		NBH03		NBH04	
	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Boron (Dissolved)	<5 -146	33	15-634	225	38-914	341	2759-3165	2943	360-1125	780	1304-1620	1420	111-673	384
Boron (total)	262-325	291	61-960	332	60-1069	509	3069-4196	3603	410-1369	967	1661-2161	1868	160-792	480
Iron (dissolved)	<5-12*	N/A	<1-127	55	14-198	106	19-73	50	29-191	118	16-157	76	16-257	145
Iron (total)	-	-	23-532	136	33-404	155	92-375	184	57-455	249	67-287	190	164-796	417
Sulphate (mg/l)	16-156	73	36-269	123	145-621	276	4-36	17	453-550	504	150-200	172	163-679	444
Chloride (mg/l)	13-141	41	33-97	54	47-98	69	513-589	549	77-101	90	95-101	98	71-94	86
Ammonium as NH_4 (mg/l)	<0.01-0.3	0.10	<0.01-0.40	0.18	<0.01-0.34	0.14	1.29-2.53	1.81	0.38-1.13	0.62	0.84-1.90	1.39	0.09-0.26	0.14
Total Ammonia as N (mg/l) (Calculated)^{Eq}	<0.01-0.23	0.08	<0.01-0.05	0.01	<0.01-0.26	0.09	0.01-1.20	0.25	0.00-0.36	0.09	0.01-0.65	0.17	<0.01-0.08	0.02
Sodium (mg/l)	22.5-408.8	71.6	29.9-78.9	44.8	42.5-95.7	68.7	479.0-559.6	511.8	87.0-118.5	99.0	129.4-166.9	148.8	81.7-148.6	106.9
Calcium (mg/l)	103.1-143.7	123	96.5-299.4$^{\$}$	153.6$^{\$}$	86.1-251.3	166.0	36.4-121.5	76.9	126.8-211.8	160.0	55.9-132.9	81.7	73.0-211.1	153.6
Magnesium	17.7-31.2	23.9	28.6-41.2	33.5	22.0-81.0	53.3	53.5-88.5	64.2	110.4-151.7	126.2	72.8-92.5	79.0	78.2-125.6	93.6
Potassium	2.4-7.2	3.9	2.8-8.9	5.1	2.9-8.1	5.2	7.8-13.2	9.6	8.0-11.8	9.7	8.7-10.4	9.3	5.9-9.2	7.6

Concentrations reported in µg/l unless otherwise stated
^ 3 exceedances recorded at CBH20
$ Elevated calcium recorded at DBH2_20 on 2 campaigns
*anomalous data removed from the data set
** Within or downgradient of existing spoil mound, former NDA spoil disposal area and former fabrication area on BDAE.
*** Upgradient of the existing spoil mound former NDA spoil disposal area and former fabrication area on BDAE.

Determinand	Background Concentrations (BDAW)		Background Concentrations (BDAE)		CBH2_30		CBH2_56		CBH2_57					
	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Boron (Dissolved)	<5 -146	33	15-634	225	2363-2849	2623	112-146	126	120-175	156				
Boron (total)	262-325	291	61-960	332	2891-3296	3108	150-231	181	193-201	198				
Iron (dissolved)	<5-12*	N/A	<1-127	55	33-425	166	20-149	85	4-25	14				
Iron (total)	-	-	23-532	136	55-524	261	72-207	135	43-144	82				
Sulphate (mg/l)	16-156	73	36-269	123	113-139	125	75-123	96	104-110	107				
Chloride (mg/l)	13-141	41	33-97	54	370-399	389	44-52	47	46-49	48				
Ammonium as NH_4 (mg/l)	<0.01-0.3	0.10	<0.01-0.40	0.18	0.10-1.11	0.61	<0.01-0.05	0.05	0.10-0.12	0.11				
Total Ammonia as N (mg/l) (Calculated)^{Eq}	<0.01-0.23	0.08	<0.01-0.05	0.01	<0.01-0.32	0.09	<0.01	N/A	<0.01	N/A				
Sodium (mg/l)	22.5-408.8	71.6	29.9-78.9	44.8	484.3-596.6	560.7	53.9-61.9	58.0	38.8-68.6	50.5				
Calcium (mg/l)	103.1-143.7	123	96.5-299.4$^{\$}$	153.6$^{\$}$	37.0-47.4	41.9	146.4-184.6	166.2	91.6-161.8	131.5				
Magnesium	17.7-31.2	23.9	28.6-41.2	33.5	21.1-46.4	31.6	32.5-36.1	34.3	34.8-51.9	41.7				
Potassium	2.4-7.2	3.9	2.8-8.9	5.1	4.7-9.1	6.2	3.7-4.5	4.2	4.5-7.3	5.8				

Concentrations reported in µg/l unless otherwise stated
^ 3 exceedances recorded at CBH20
$ Elevated calcium recorded at DBH2_20 on 2 campaigns
*anomalous data removed from the data set
** Within or downgradient of existing spoil mound, former NDA spoil disposal area and former fabrication area on BDAE.
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APPENDIX 15H DETAILED GROUNDWATER MODEL CALIBRATION

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APPENDIX 15H: DETAILED GROUNDWATER MODEL CALIBRATION

15H.1 Introduction

15H.1.1 This appendix details the process through which the MODFLOW groundwater model was calibrated. This process started with a sensitivity analysis to determine the most sensitive parameters on which the calibration was focused to begin with, followed by a steady state and several transient calibrations as detailed below. The transient calibrations utilised both on-shore pumping test data and calibration against annual rainfall recharge. The transient calibrations were based on the initial steady state calibration.

15H.2 Sensitivity Analysis

15H.2.1 A sensitivity analysis using the Groundwater Vistas 'auto-sensitivity' functionality was performed to determine the most sensitive parameters in the model, and also those that are insensitive and were therefore set at fixed values initially. The parameters assessed were Kx, Ky, and Kz for all zones and layers in the model. Note that in Groundwater Vistas, anisotropy between Kx and Ky cannot be separately assessed in either auto-sensitivity or auto-calibration modes. This requires additional manual calibration steps to be performed if any horizontal anisotropy is required in the model.

15H.2.2 **Table 15H.1** details the parameters used for the sensitivity analyses.

Table 15H.1: Model Sensitivity Analysis Values

Parameter	Layer	Base Value (m/d)	Range
Kx (=Ky)	1	0.19	+/- half an order of magnitude for each (1 order of magnitude in total for each)
Kx (=Ky)	2	0.0039	
Kx (=Ky)	3	4.41	
Kx (=Ky)	4	0.0432	
Kx (=Ky)	5	0.0432	
Kz	1	0.00086	
Kz	2	4.00E-06	
Kz	3	0.001	
Kz	4	4.00E-05	
Kz	5	0.0002	

15H.2.3 **Figure 15.H.1** shows the sensitivity analysis results in terms of average head change across the model domain in response to the parameter change in question. Average head change is a calculation performed by Groundwater Vistas and is a summary of the average head change in each cell for each layer in response to the change in each parameter from the head at the start of the simulation. The permeability results in **Figure 15.H.1** show that the Kx and Ky for Layers 1 and 3 in the model are by far the most sensitive, with Kx, Ky and Kz for all other layers being relatively insensitive.

The steady state calibration process described below therefore focused on Kx and Ky in Layers 1 and 3 initially.

15H.3 Steady State Calibration

15H.3.1 An initial calibration was undertaken under steady state conditions (i.e. without any time-variant factors) with the aim of establishing a preliminary match of the observed patterns of groundwater flow and fitting to specific target boreholes where possible. The target data used for this calibration step are shown in **Table 15H.2**. These data are dip levels from BDAW boreholes from January 2010, and are the most complete dataset were available that represent peak water levels. Dip levels taken across the site (BDAW, BDAE and SCPA) in December 2010 show levels several metres lower than the January 2010 data (2010 being a relatively dry rainfall year). It is important to use peak water levels as target data for this stage of the calibration so that an estimate of peak rainfall recharge can be made. The transient model (see below) was based on this steady state model and was begun during a period of high rainfall (January 2010) and therefore high groundwater heads. This approach allowed an appropriate steady state stress period for the start of the transient model to be achieved.

Table 15H.2: Steady State Calibration Targets

Borehole	Response Zone	Target Head (mAOD)
CBH09	Blue Anchor (layer 5)	7.17
CBH10	Blue Lias (layer 1/2)	16.27
CBH11	Blue Lias (layer 1/2)	11.86
CBH16	Blue Anchor (layer 5)	12.11
CBH17	Blue Lias (layer 1/2)	13.28
CBH18	Blue Lias (layer 1/2)	13.11
CBH21	Blue Lias (layer 1/2)	14.04
CBH24	Blue Lias (layer 1/2)	11.58
CBH25	Blue Lias (layer 1/2)	20.22
CBH26	Blue Lias (layer 1/2)	14.42
CBH27	Blue Lias (layer 1/2)	17.02
CBH29	Blue Anchor (layer 5)	6.63
DBH05	Westbury (layer 4)	6.94
DBH06	Blue Lias (layer 1/2)	11.47
DBH07	Blue Lias (layer 1/2)	12.87
DBH08	Blue Lias (layer 1/2)	13.59
DBH09	Blue Lias (layer 1/2)	14.96
DBH10	Blue Lias (layer 1/2)	17.32

15H.3.2 The steady state model calibration is shown in **Figure 15.H.2** to **Figure 15.H.6** for model Layers 1 to 5 respectively. The residual heads for the final calibrated steady state model are shown in **Figure 15.H.7**. **Figure 15.H.8** shows a plot of observed versus simulated model heads.

15H.3.3 The January 2010 targets in **Table 15H.2** are spread over Layers 1, 4 and 5, with the vast majority being in Layer 1. The calibration for Layer 1 (**Figure 15.H.2**) is very good with the majority of computed heads in the model within 1-2 metres of their respective targets (**Figure 15.H.7**). However for the deeper layers (Layers 4 and 5), the residual heads are larger (**Figure 15.H.7**). This could be due to changes in salinity with depth. This is most obvious in borehole CBH16 which is hypersaline (approximately three times more saline than seawater). As seawater is denser than freshwater, the equivalent head will be higher than the observed heads. Calculations for this borehole suggest that this head may be depressed by between 3.6 and 7m which would act to make the calibration of Layer 5 even more difficult to achieve. Furthermore, the CBH16 groundwater conductivity of 150,000µS/cm suggests strongly that this is not part of a groundwater regime that could be considered 'active' in the context of the model, even within the low permeability of Layer 5. If it were more active, the hypersaline water would have dissipated over time. It was therefore decided to remove CBH16 from the target dataset for this model as the disparity of the head for this borehole compared to its neighbour (CBH09) cannot be accounted for in the model.

15H.3.4 The calibrated heads and residuals in Layer 1 (**Figure 15.H.2** and **Figure 15.H.7**) do not show any broadly discernible patterns with regards to the distribution of positive and negative residual heads which suggests that there are no medium to large scale influences due to spatial recharge, permeability or faults that are not incorporated in the model.

15H.3.5 It should also be noted that the sensitivity analysis detailed above showed that the sensitive geological parameters in the model are Kx and Ky in Layers 1 and 3. The parameters associated with Layers 4 and 5 are insensitive and the calibration process discussed here therefore only indirectly affected heads in Layers 4 and 5, to begin with.

15H.3.6 **Table 15H.3** shows the calibrated steady state parameters achieved through several calibration iterations focussing on Kx and Ky in Layers 1 and 3 (the sensitive parameters and layers).

15H.3.7 It was decided to remove borehole DBH04 from the target dataset as the hydrograph showed no head response over the monitoring period. It was confirmed that this borehole contains a very low volume of water and that the datalogger in DBH04 is therefore likely to be recording the depth of the bottom of the borehole. This resulted in only one target in Layer 4 (DBH05) remaining.

15H.3.8 Outside the BDAW and BDAE (for which there are no available up to date calibration target data) the groundwater heads broadly match (within a few metres) expected groundwater levels. This includes areas such as the neighbouring Hinkley Point A and B power stations and the groundwater levels in the south east of the model towards Wick Moor and Holford Stream. However, it is difficult to be certain about the calibration expectations for these areas due to a lack of data.

15H.3.9 The calibrated steady state model mass balance is very good with an error of less than 0.02%.

15H.3.10 The calibrated parameters in **Table 15H.3** were used as the basis for the two pumping test calibrations detailed below. It should be noted that the Kx value for layer 3 at 4.41m/d (**Table 15H.2**) is considerably higher than measured values of permeability from packer tests in the Lilstock, but is considered to represent not only the Lilstock Formation but also the effect of higher permeability in the Planorbis Beds at the base of the Blue Lias (i.e. just above the junction between the base of Layer 2 and top of Layer 3).

Table 15H.3: Calibrated Steady State Parameters

	Layer 1 permeability (m/d)		Layer 3 permeability (m/d)		Zone 2 Recharge (m/d)	Zone 2 Recharge (m/a)	Sum of Squared Residuals
	Kx	Ky	Kx	Ky			
Default parameters	0.43	0.22	0.43	0.2	0.0007	0.256	489
Final calibrated values	0.19	0.095	4.41	2.21	0.00075	0.272	58

15H.4 Pumping Test Calibrations

15H.4.1 The transient pumping test calibrations were based on the above steady state calibration and aimed to replicate the maximum drawdowns of the two pumping tests by primarily varying the storage and specific yield parameters in the model. It was intended that the calibrated permeability parameters derived during the steady state calibration would only be modified if a reasonable calibration using storage and specific yield could not be achieved. Both pumping test models were run for the same duration as the related field test, as described below.

15H.4.2 Both pumping tests were designed by EDF and undertaken using a similar cruciform pattern of monitoring wells (**Figure 15.H.10** and **Figure 15.H.11**). Due to the proximity of the closest monitoring boreholes to the pumping borehole and the resolution of the model, it was decided to use only the drawdown curves for the most distant wells from each test. The most distant wells are also the most representative of the bulk aquifer properties.

15H.4.3 Groundwater Vistas requires specific storage to be entered into the model, not the storage coefficient. Specific storage was calculated by dividing the storage coefficient by the average layer thickness (27.95m, 34m, 5m, 9.24 and 38.18m for Layers 1 to 5 respectively) for each layer. This resulted in specific storage values of 3.6E-06, 2.9E-06, 2E-05, 1.1E-06 and 2.6E-07 for Layers 1 to 5 respectively. The specific storage value of 3.6E-06 for Layer 1 was addressed during the two pumping test calibrations as detailed below.

a) 2008 Pumping Test Transient Calibration

15H.4.4 Following steady state calibration, the model was calibrated against pumping test data supplied by EDF as collected during the on-shore hydrogeological testing in December 2008. The pumping well (PW) was pumped for a continuous 48 hours at a rate of 22.5m^3/h for the first 36 hours, followed by a reduced rate of 18m^3/h to reduce drawdown and avoid damaging the pump. Drawdown curves were supplied for twelve monitoring wells (PZ1 – PZ12) surrounding the pumping well, from which the approximate maximum drawdown in each was estimated.

15H.4.5 Two of the further monitoring wells were selected against which to calibrate the model (maximum drawdown) to represent the drawdown from the pumping well in both the north-south and east-west directions. The monitoring wells chosen were PZ1 to the west and PZ6 which is to the north of the PW pumping well (**Figure 15.H.10**). The maximum drawdowns (targets) were estimated at PZ1 (4.5m) and PZ6 (5.2m). It is suggested from these drawdown observations that this pumping test did not show any horizontal anisotropy in the aquifer (although analysis of the retest of this pumping well in August 2010 did show an anisotropy of around 1.3:1 Ky:Kx). As the initial parameters for the model, and the steady state calibration were conducted on the basis of a 2:1 Ky:Kx anisotropy, it is clearly not possible for the model to reproduce the PZ1 and PZ6 drawdowns from this pumping test without removing the anisotropy from the permeabilities in the model.

15H.4.6 It should also be noted that because of the short duration of the test relative to the time step of the model, it was not possible to reproduce time-series drawdowns in the piezometers; hence calibration has much greater relevance to the permeability than the storage properties.

15H.4.7 **Table 15H.4** shows the results of the 2008 pumping test calibration. Iteration 1 shows that the model is insensitive to changes in specific yield in Layer 1. Iterations 2-11 show that the model is, however, sensitive to specific storage in Layer 1 with a reduction of approximately one order of magnitude required in order to reduce the calculated drawdown in the model towards the target drawdowns. The half an order of magnitude difference in specific storage between iterations 10 and 11 showed no discernable difference in the drawdowns calculated in the model which suggests that the value of 1.0E-7 for Layer 1 specific storage is towards the lower bound of this parameter (using steady state calibrated permeabilities).

15H.4.8 Up to iteration 10/11, it is clear that the drawdown for PZ6 to the north of the PW pumping well could not be achieved, and that a significant residual drawdown remains present in the model. The calculated drawdown of PZ1 To the west is significantly better at within 20cm.

15H.4.9 To attempt to address this difference, iterations 12 to 14 show the results following variations in Ky. The model failed to converge with reduced values of Ky (most probably due to a lack of water in the vicinity of the pumping well). This was attempted to be addressed in iteration 15 by raising specific storage. However the iteration 15 model also failed to converge.

Table 15H.4: 2008 Pumping Test Model Calibration for PZ1 and PZ6.

	Layer 1						W	N	Sum of Squared Residuals	
Iteration	Kx (E-W) m/d	Ky (N-S) m/d	Kz m/d	Sy	Ss (S/m)		PZ1	PZ6		Comments
						Targets	4.5	5.2	PZ1 & PZ6	
Default	0.19	0.095	0.00086	0.03	3.6E-06		3.7	2.2	9.64	Calibrated steady state parameters for permeability
1	0.19	0.095	0.00086	0.02	3.6E-06		3.7	2.2	9.64	Not sensitive to L1 Sy
2	0.19	0.095	0.00086	0.03	1.0E-06		4.1	2.5	7.45	Model sensitive to L1 Ss
3	0.19	0.095	0.00086	0.03	5.0E-05		1.2	0.6	32.05	Storage too great, too much water to pumping well
4	0.19	0.095	0.00086	0.03	1.0E-05		3	1.7	14.50	
5	0.19	0.095	0.00086	0.03	5.0E-06		3.5	2.1	10.61	
6	0.19	0.095	0.00086	0.03	2.5E-06		3.8	2.3	8.90	
7	0.19	0.095	0.00086	0.03	1.5E-06		4	2.4	8.09	
8	0.19	0.095	0.00086	0.03	9.0E-07		4.1	2.5	7.45	
9	0.19	0.095	0.00086	0.03	5.0E-07		4.2	2.5	7.38	
10	0.19	0.095	0.00086	0.03	1.0E-07		4.3	2.6	6.80	
11	0.19	0.095	0.00086	0.03	5.0E-08		4.3	2.6	6.80	No further change for drop in Ss
12	0.19	0.2	0.00086	0.03	1.0E-07		1.3	1.3	25.45	L1 Ss from iteration 10
13	0.19	0.05	0.00086	0.03	1.0E-07		7.2	3.3	10.90	Model VERY sensitive to L1 Ky
14	0.19	0.01	0.00086	0.03	1.0E-07		-	-	-	Model did not converge
15	0.19	0.01	0.00086	0.03	5.0E-06		-	-	-	Model did not converge

NOT PROTECTIVELY MARKED

b) 2010 Pumping Test Transient Calibration

15H.4.10 Calibration was also performed against the constant rate phase of the second pumping test performed in 2010. The pumping well PW2-1 (**Figure 15.H.11**) was pumped at a rate of 1.52l/s for 4 days followed by a period of recovery. Based on the results and conclusions from the assessment of the first pumping test (see above) four of the monitoring wells were chosen against which to calibration of the model response was undertaken. The monitoring wells chosen were PZ2-6, PZ2-5, PZ2-1 and PZ2-12. These four wells represent the furthest monitoring wells from the pumping well in all four directions. This allows the largest aquifer volume response to be assessed. As per the previous pumping test the monitoring wells closest to the pumping well were not included due to their high response versus model discretisation.

15H.4.11 The 2010 pump test was undertaken in July 2010 with the constant rate test lasting 4 days precisely. The desired pumping rate was 1.5l/s (130m^3/day) with records taken manually using totalising and electromagnetic flow meters. The drawdown from the pumping test was measured in a cross configuration of observation boreholes, which extended north to south and east to west. These boreholes were situated at distances of between 3m and 50m from the pumping well. The model cell resolution in the vicinity of the pumping test was 10m in both the north – south and east – west directions.

15H.4.12 **Figure 15.H.9** shows the results from the 2010 pumping test. This plot shows the drawdown observed at the end of the test in addition to the end of test observed groundwater level and borehole name. **Figure 15.H.9** shows that the peak observed drawdown during the pumping test are greater along the east-west transect compared to the north-south transect. In the east-west direction the observed drawdowns are 6.0m and 6.1m in the most easterly and westerly observation boreholes respectively. In the north-south direction, the drawdowns at the same distance from the pumping well are 3.9m and 3.5m respectively.

15H.4.13 It should be noted that this pumping test was undertaken during July 2010 during the summer dry period observed in borehole hydrographs. As the steady state calibration was undertaken based on winter groundwater levels (January 2010), the steady state model was re-calibrated using a lower zone 2 recharge (173mm/a) to match the July heads. If this correction were not applied, the model would require far more pumping to match the July 2010 pumping test observed drawdowns.

15H.4.14 **Table 15H.4** shows the results of the 2008 pumping test calibration. All of the observation and abstraction boreholes are completed in the Blue Lias (Layer 1) so fitting the observed drawdowns focused on changing the hydraulic parameters in Layer 1. In the first set of iterations the Layer 1 specific yield was varied to try and simulate the observed drawdowns (**Table 15H.4**, iterations 1-6). During the later iterations (7-11), Kx and Ky were varied to try and improve the drawdowns based on the anisotropy observed in the test and present in the default permeability data.

15H.4.15 The initial model iterations (1-6) resulted in modelled drawdowns that were too small compared to the observed data. The specific yield was reduced within these iterations, however this resulted in the model drying up with these lower specific yield rates. The specific yield in iteration 6 (0.007) was the lowest specific yield where the pumping well in the model did not run dry, but at this specific yield, all the modelled drawdowns were too low.

15H.4.16 It was concluded that iteration 9 represents the best combination of parameters to calibrate the model to observed 2010 pumping test drawdowns. The layer 1 Kx, Ky, Sy and Ss parameters from iteration 9 (**Table 15H.5**) were entered into the full transient model as the default parameters for Layer 1. Although iteration 10 does show slightly better residuals heads, the change to the horizontal anisotropy ratio was deemed to be less realistic than for iteration 9.

15H.4.17 Two pumping tests (at PW and PW2-1), both located in important areas of the site, have provided valuable insights into the behaviour of the aquifer, in particular in demonstrating the complex manner in which water levels would evolve during long term pumping. Model calibration has attempted to use this information explicitly, as well as drawing on them as a source of knowledge about the aquifer. The explicit use of this information is particularly important at Hinkley Point C because there are very few measured flows to guide the calibration. However, because of the necessarily coarse grid and time step used in groundwater flow models, it cannot be expected to fully reproduce the detailed responses observed in the pumping tests. Nevertheless, this part of the calibration has shown that the permeability parameters derived from field testing and the steady state calibration appear reasonable, and also provide an indication that the storage parameters, which are assessed in more detail in the next section, are credible. In addition, the horizontal anisotropy observed at PW2-1 has been reproduced in the model.

Table 15H.5: 2010 Pumping Test Calibration Results

Iteration	Layer 1 kx (m/d)	Layer 1 ky (m/d)	Layer 1 Specific Yield (Sy)	Layer 1 Specific Storage (Ss)	PZ2-1 (East)	PZ2-5 (West)	PZ2-6 (North)	PZ2-12 (South)	Comment
					Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m) Residual (m)	
				Observed drawdown (m) >	6.00	6.10	3.93	3.52	
Default	0.19	0.095	0.03	3.60E-06	1.7 / 4.31	1.6 / 4.5	1.1 / 2.83	0.6 / 2.92	Modelled drawdowns too low in all four boreholes
1	0.19	0.095	0.01	3.60E-06	3.5 / 2.51	3.3 / 2.8	2.4 / 1.53	1.5 / 2.02	As default, but with reduced Specific Yield. Increased drawdown in all layers which is an improved model fit
2	0.19	0.095	0.03	1.00E-06	1.7 / 4.31	1.6 / 4.5	1.1 / 2.83	0.6 / 2.92	As default, but with reduced Specific Storage. No difference (2 .d.p.) from default results. This suggests no sensitivity to Specific Storage at the monitoring borehole locations
3	0.19	0.095	0.005	3.60E-06	N/A as pumping well dries out	N/A as pumping well dries out	N/A as pumping well dries out	N/A as pumping well dries out	As default, but with the Specific Yield reduced more than in iteration 1. The fit compared to observed drawdowns is close. Pumping well runs dry during the final pumping period.
4	0.19	0.095	0.002	3.60E-06	N/A as pumping well dries out	N/A as pumping well dries out	N/A as pumping well dries out	N/A as pumping well dries out	As default, but with the Specific Yield further reduced more than in iteration 3. This value is consistent with the storage figure in the Hinkley C pump

Iteration	Layer 1 kx (m/d)	Layer 1 ky (m/d)	Layer 1 Specific Yield (Sy)	Layer 1 Specific Storage (Ss)	PZ2-1 (East)	PZ2-5 (West)	PZ2-6 (North)	PZ2-12 (South)	Comment
					Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m) Residual (m)	
									test analysis. Pumping well runs dry in this simulation after one time step and the pumping stops.
5	0.19	0.095	0.005	3.60E-06	N/A as pumping well dries out	N/A as pumping well dries out	N/A as pumping well dries out	N/A as pumping well dries out	As iteration 3, but re-wetting turned enabled. Model takes far longer to converge. The pumping cell still runs dry.
6	0.19	0.095	0.007	3.60E-06	4.2 / 1.81	3.9 / 2.2	3.1 / 0.83	2 / 1.52	As default, but reduced Sy below iteration 1. This iteration does not dry out at the pumping well. This is as low as the pumping can go with current hydraulic conductivity.
7	0.38	0.19	0.0035	3.60E-06	3.8 / 2.21	3.6 / 2.5	3.2 / 0.73	2.4 / 1.12	As iteration 6, but increased Kx and Ky, and reduced Sy. This run does not dry out at the pumping well. Drawdowns slightly less than iteration 6
8	0.38	0.19	0.002	3.60E-06	4.5 / 1.51	4.3 / 1.8	3.9 / 0.03	3.1 / 0.42	As iteration 7, but with reduced storage. The pumping well in this iteration did not dry out. Improved fits on drawdowns, especially along the N-S transect
9	0.38	0.19	0.001	3.60E-06	5.5 / 0.51	5.3 / 0.8	4.8 / -0.87	4 / -0.48	As iteration 8, but with reduced storage. The pump in this run did not go dry. The fit on the N-S transect has got worse, and the E-W

Iteration	Layer 1 kx (m/d)	Layer 1 ky (m/d)	Layer 1 Specific Yield (Sy)	Layer 1 Specific Storage (Ss)	PZ2-1 (East)	PZ2-5 (West)	PZ2-6 (North)	PZ2-12 (South)	Comment
					Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m)/ Residual (m)	Modelled Drawdown (m) Residual (m)	
									transect has improved compared to observed drawdowns.
10	0.53	0.134	0.001	3.60E-06	5.8 / 0.21	5.5 / 0.6	4.1 / -0.17	3.3 / 0.22	As iteration 9. Increased anisotrophy in layer 1 horizontal conductivity to try and extend the cone of depression to better match the larger drawdowns E-W compared to N-S.
11	0.7	0.1	0.001	3.60E-06	5.9 / 0.11	5.6 / 0.5	3.7 / 0.23	2.8 / 0.72	As iteration 10. Further increases to the amount of anisotrophy in layer 1 horizontal conductivity. Improved matching of observed drawdowns on some boreholes (along the E-W transect), the match to observed drawdowns on the N-S transect has become slightly worse

c) Full Transient Model Calibration

15H.4.18 The final calibration was carried out using a transient model designed to represent a two year period of rainfall calculated on a monthly basis (**Table 15H.6**). The two-year period was chosen to allow the model to stabilise during the first year prior to a comparison against observed hydrographs during the second year.

15H.4.19 The 24 months in the model were aggregated into 24 stress periods (SPs) to represent each month of the year. This resulted in 25 stress periods overall (SP1 remaining steady state to provide a stable numerical basis for the starting model, as recommended by Groundwater Vistas software documentation). The 24 months of recharge distribution is based on the conceptual annual recharge model described in **Chapter 15** and represents an average annual rainfall appropriate to the Hinkley region and is not a Hinkley Point C specific rainfall pattern. The calibration results (hydrographs) presented below therefore do not exactly match the observed data, but aim to match the amplitude of the winter peak and summer fall in heads. This is an appropriate calibration methodology as future rainfall patterns are unknown and therefore the average recharge distribution is considered more appropriate.

15H.4.20 Boreholes CBH24, CBH33 and DBH10 were selected for the purposes of transient calibration to provide a south-north cross section of heads through the Built Development Area. The field hydrographs for these boreholes show high water levels in the winter months (November – February) and a long recession through the summer and early autumn (see **Figure 15.H.12**). To compare with simulated model heads from the average annual recharge distribution, and to account for the variable seasonality of groundwater level minima and maxima, the hydrographs in **Figure 15.H.12** where shifted forwards 91 days in time to allow the curves to be matched.

15H.4.21 Several transient model iterations and the final calibrated values are summarised in **Table 15H.7**. The aim of the iterations was to produce an average annual model response of the same magnitude as the winter/summer head changes shown in observed data. During the calibration process and further consideration of the conceptual system Layers 2 and 3 were changed to convertible (confined/unconfined) layer type status.

15H.4.22 **Figure 15.H.13** to **Figure 15.H.15** show the calculated model hydrographs for the calibrated transient model for the target boreholes CBH24, DBH10 and CBH33 respectively. The figures show that a good average transient calibration has been achieved for Layer 1 through the development area from south to north.

15H.4.23 **Figure 15.H.16** shows the transient calibration contours for Layer 1 in the second January of the two year simulation period (representative of a wet time of year). **Figure 15.H.17** shows the Layer 1 transient calibration contours from the final October of the two year simulation (representative of a dry time of year, before the late autumn/winter increase in recharge). The figures show a 2-4m drop in groundwater head between the two periods which is a good match to changes in observed groundwater levels.

15H.4.24 The overall mass balance for the calibrated full transient model is very good at less than 0.4% error.

Table 15H.6: Transient Model Recharge Distribution

Stress Period	Month	Zone 2 Recharge (m/d)
Steady state (SP1)		0.0007452
SP2	January	0.0014204
SP3	February	0.0013967
SP4	March	0.0012547
SP5	April	0.0009232
SP6	May	0.0006628
SP7	June	0.0004261
SP8	July	0.0003077
SP9	August	0.0002841
SP10	September	0.0003077
SP11	October	0.0004735
SP12	November	0.0006865
SP13	December	0.0009232
SP14	January	0.0014204
SP15	February	0.0013967
SP16	March	0.0012547
SP17	April	0.0009232
SP18	May	0.0006628
SP19	June	0.0004261
SP20	July	0.0003077
SP21	August	0.0002841
SP22	September	0.0003077
SP23	October	0.0004735
SP24	November	0.0006865
SP25	December	0.0009232

Table 15H.7: Transient Calibration – Final Calibrated Parameters

		Kx (East-West)		Ky (North-South)		Kx/Ky	Kz (Vertical)		Kx/Kz	Sy	Ss	Layer Type
		m/d	m/s	m/d	m/s		m/d	m/s		(-)	(-)	
Layer 1	Weathered Blue Lias	0.38	4.40E-06	0.19	2.20E-06	2	4.74E-04	5.49E-09	800	0.02	3.00E-05	Convertible
Layer 2	Fresh Blue Lias	0.0039	4.51E-08	0.0019	2.20E-08	2.1	3.25E-05	3.76E-10	120	0.02	3.00E-05	Convertible
Layer 3	Lilstock	4.41	5.10E-05	2.21	2.56E-05	2	0.882	1.02E-05	5	0.02	3.00E-05	Convertible
Layer 4	Westbury	0.25	2.89E-06	0.125	1.45E-06	2	2.50E-03	2.89E-08	100	0.01	3.00E-06	Confined
Layer 5	Blue Anchor	0.1	1.16E-06	0.05	5.79E-07	2	0.02	2.31E-07	5	0.01	3.00E-06	Confined

KEY

SEE GRAPH

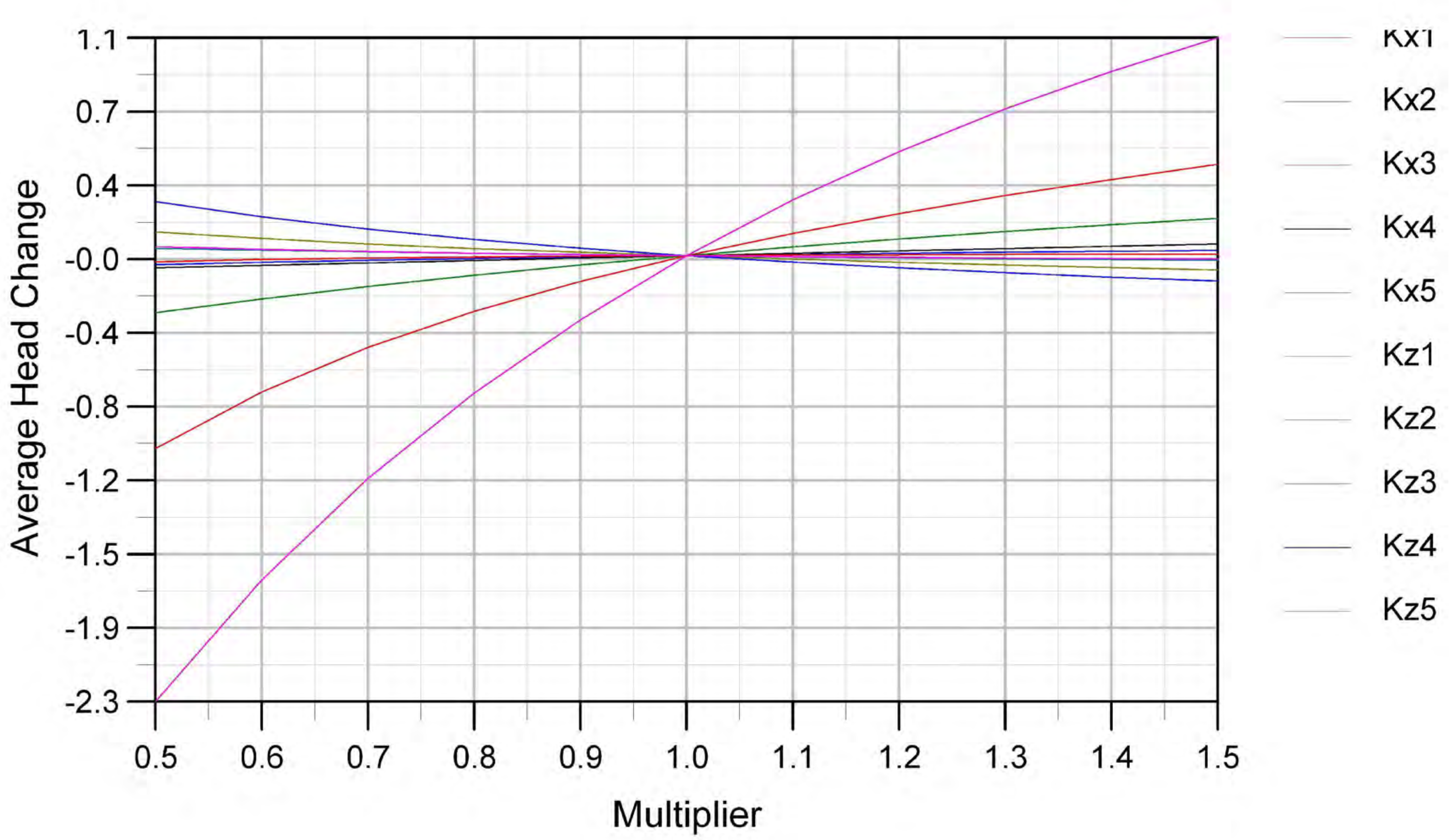

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FIGURE TITLE:

PERMEABILITY SENSITIVITY ANALYSIS
(Kx=Ky)

FIGURE NO:	REVISION:
FIGURE 15.H.1	01

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CALCULATED GROUNDWATER CONTOURS (mAOD)

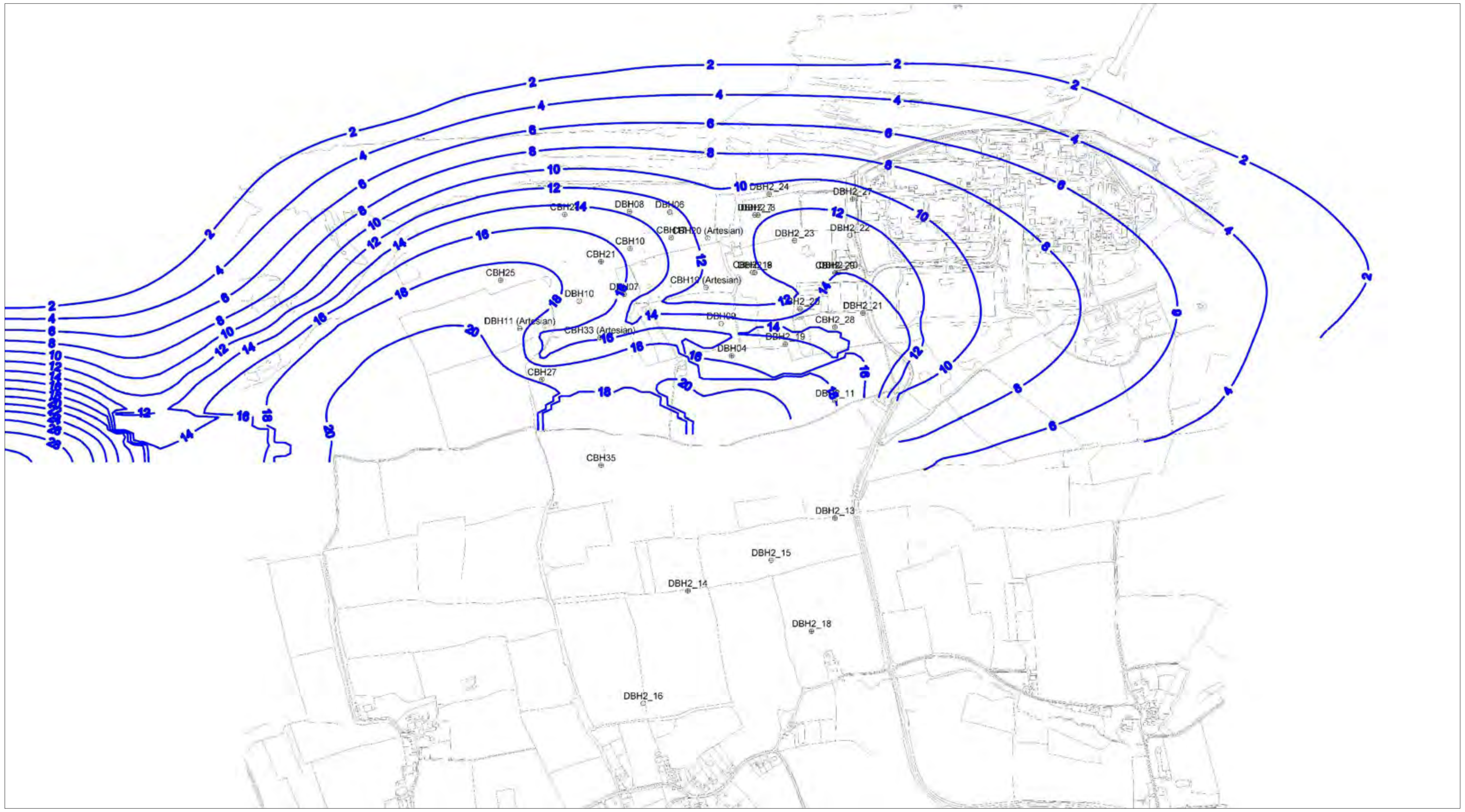

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FIGURE TITLE:

LAYER 1 FINAL STEADY STATE CALIBRATION

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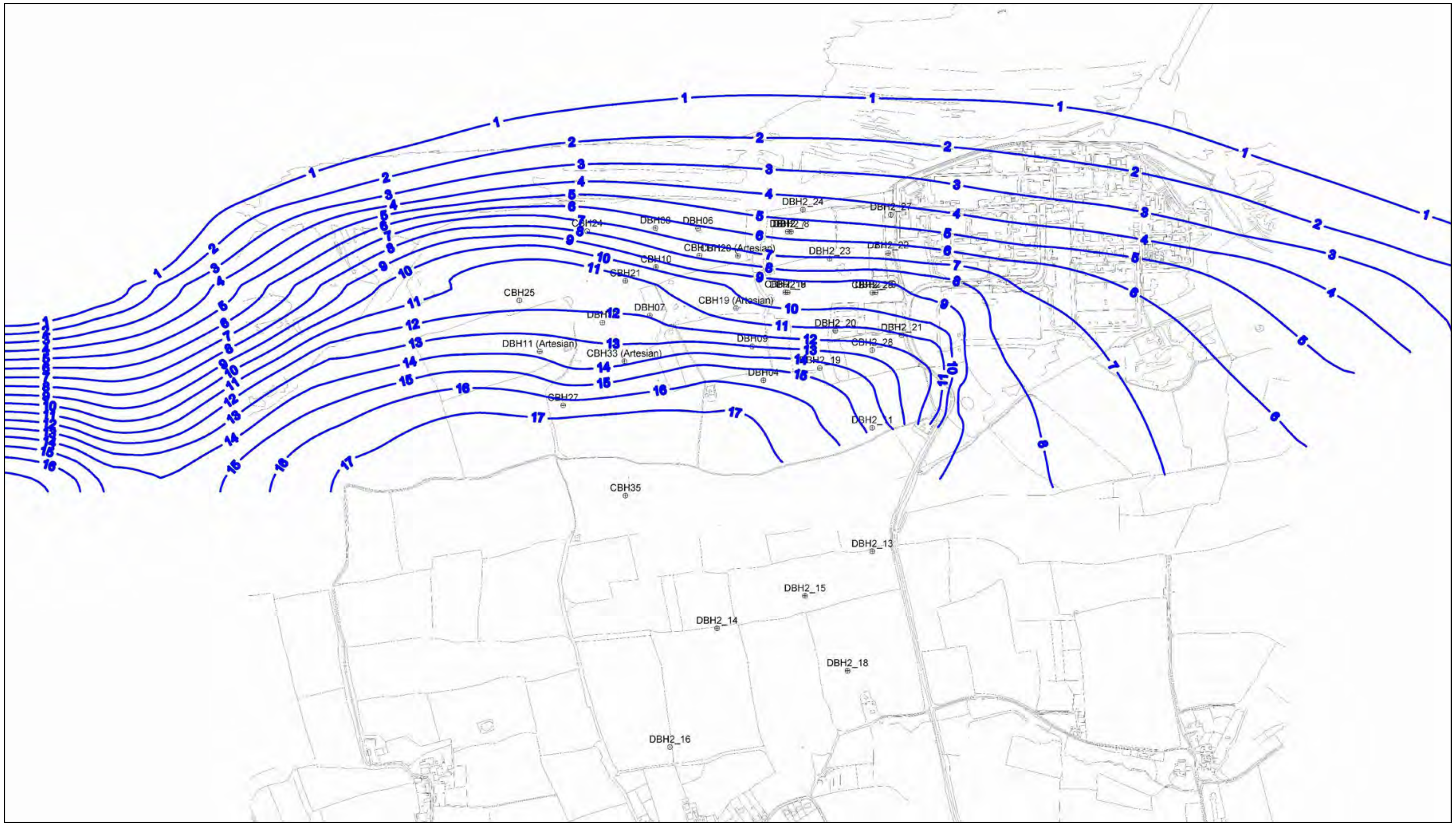

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FIGURE TITLE:

LAYER 2 FINAL STEADY STATE CALIBRATION

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CALCULATED GROUNDWATER CONTOURS (mAOD)

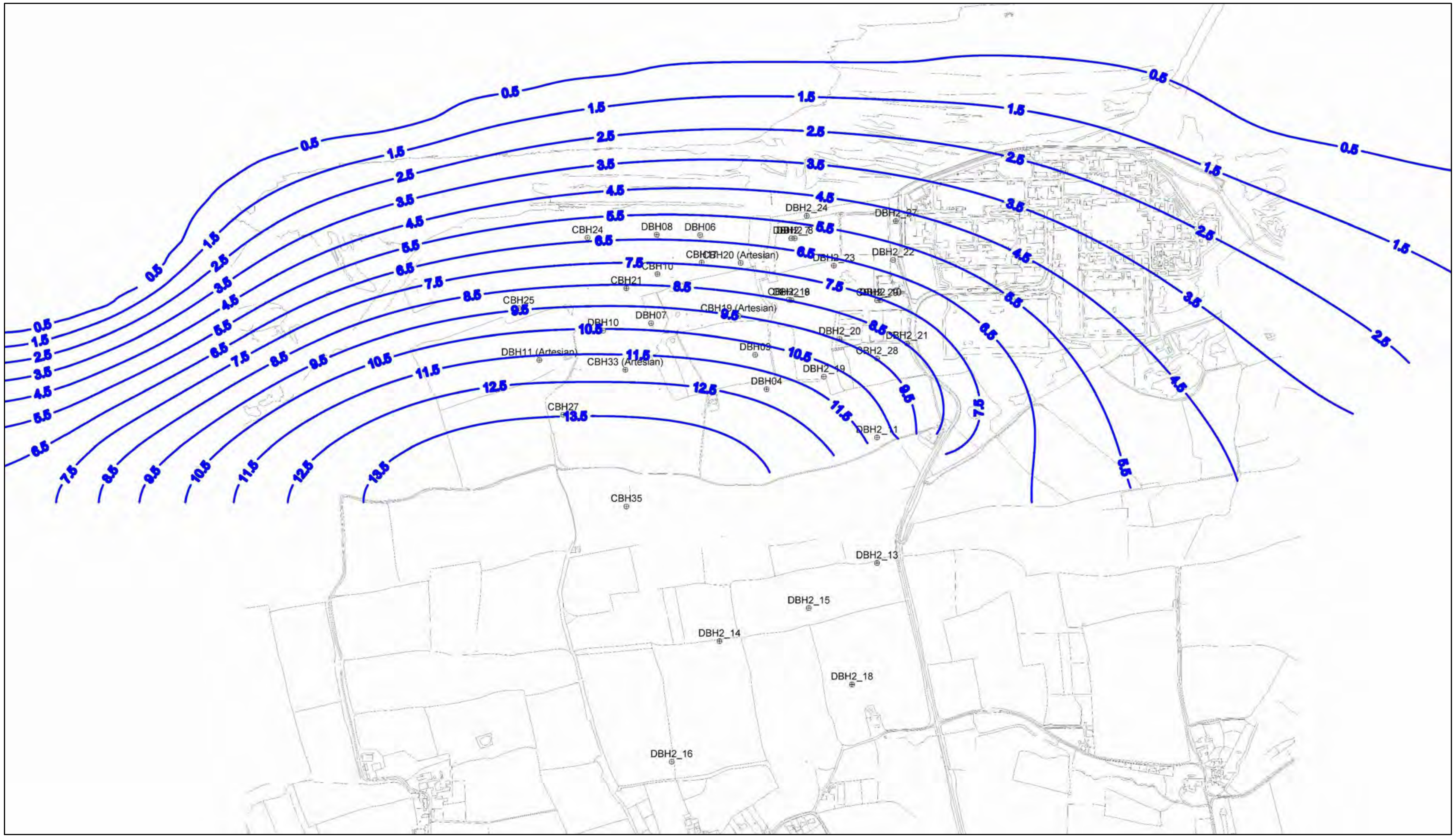

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FIGURE TITLE:

LAYER 3 - FINAL STEADY STATE CALIBRATION

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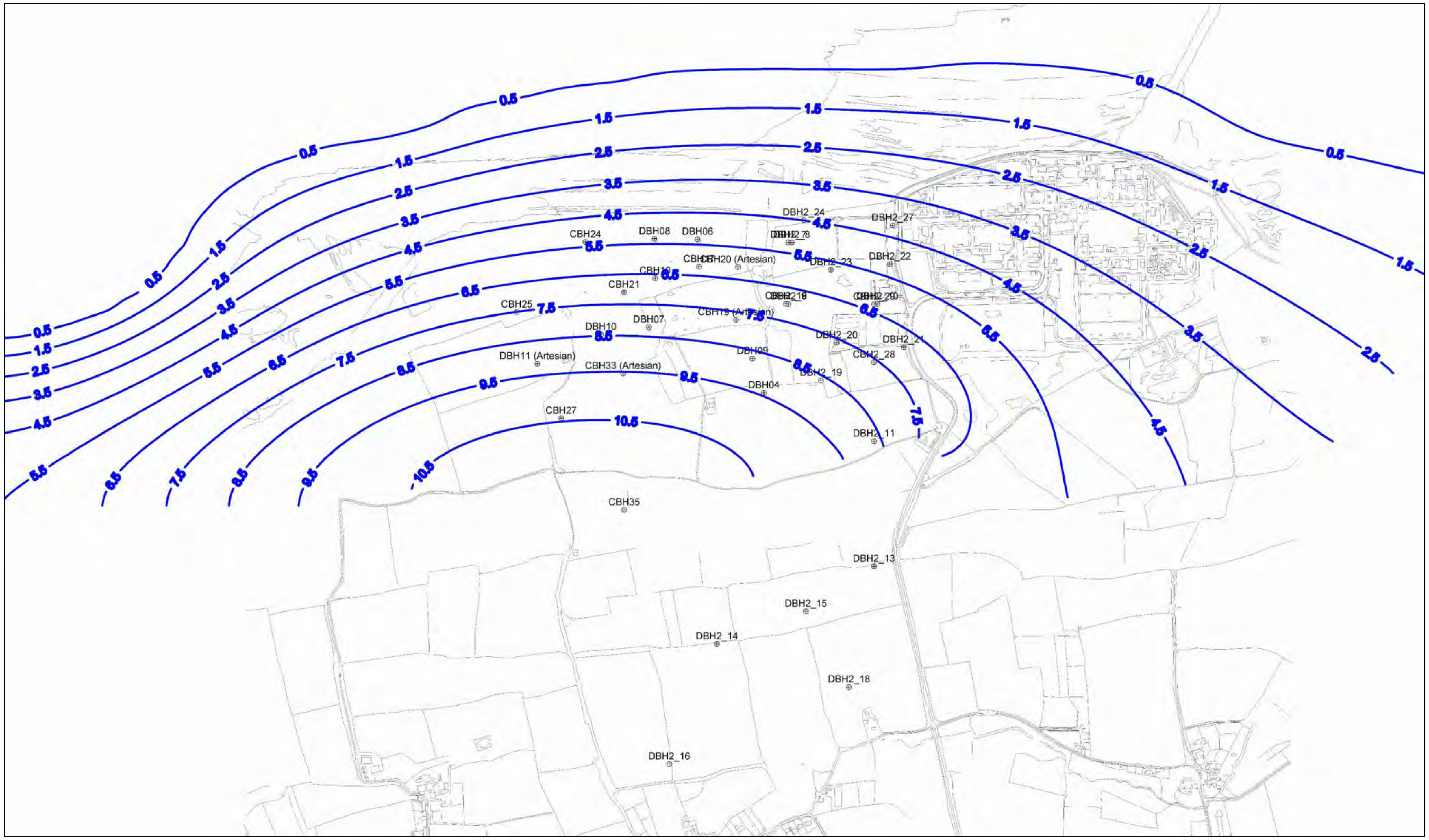

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CALCULATED GROUNDWATER CONTOURS (mAOD)

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VOLUME 2 CHAPTER 15

FIGURE TITLE:

LAYER 4 - FINAL STEADY STATE CALIBRATION

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FIGURE 15.H.5		01
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CALCULATED GROUNDWATER CONTOURS (mAOD)

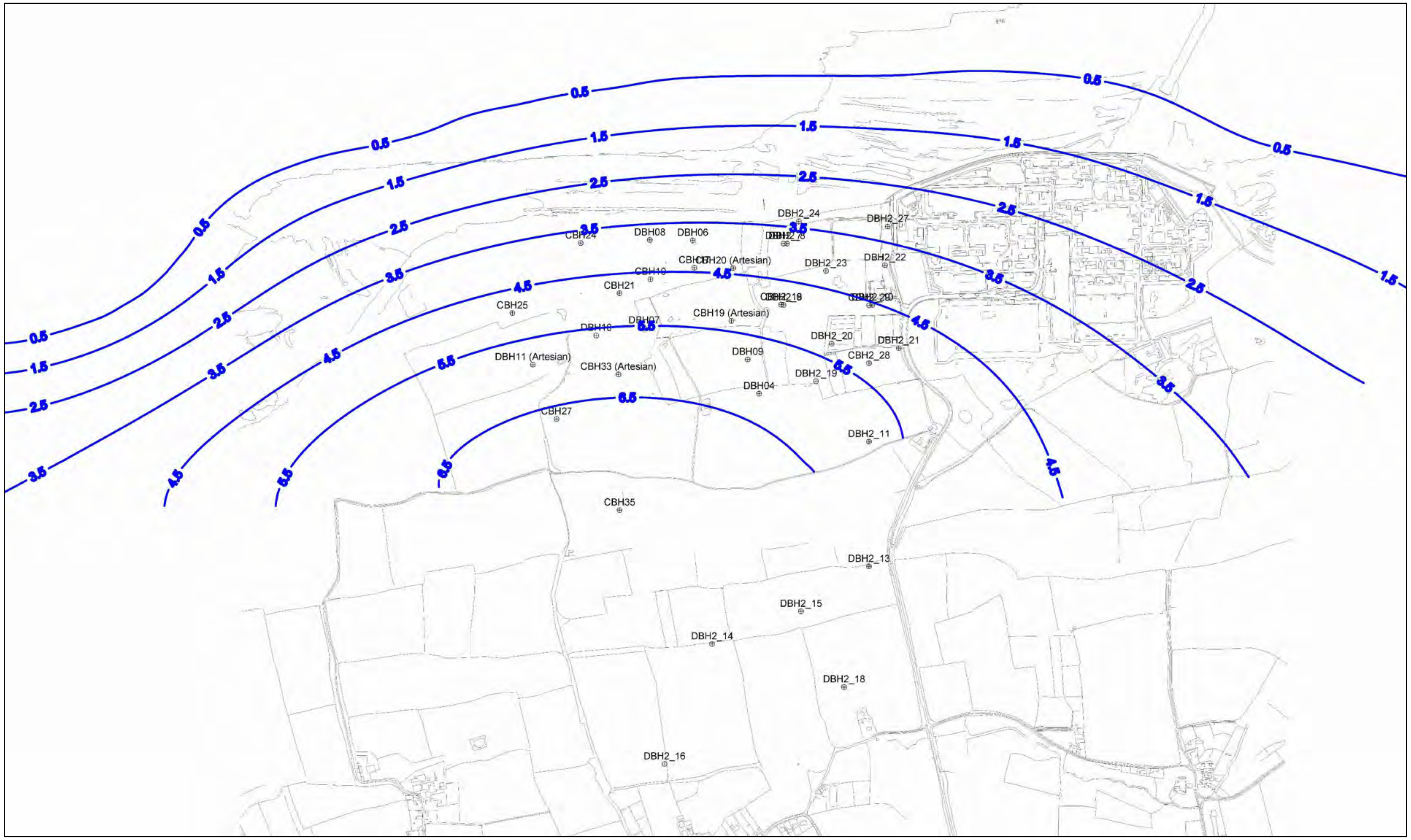

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FIGURE TITLE:

LAYER 5 - FINAL STEADY STATE CALIBRATION

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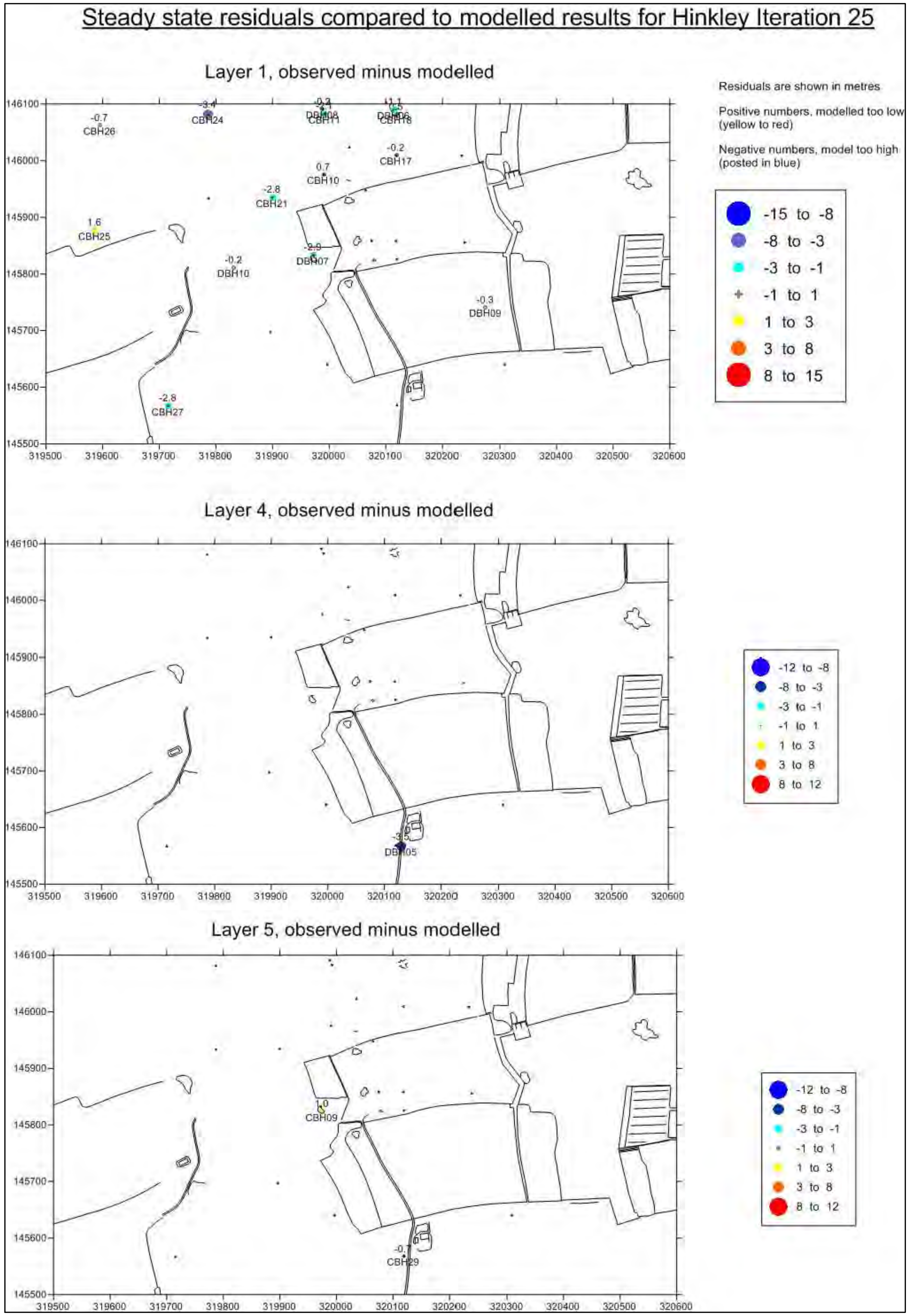

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FOR KEY SEE FIGURE CONTENT

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VOLUME 2 CHAPTER 15

FIGURE TITLE:

STEADY STATE CALIBRATION
ITERATION 25 RESIDUALS

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FIGURE 15.H.7		01
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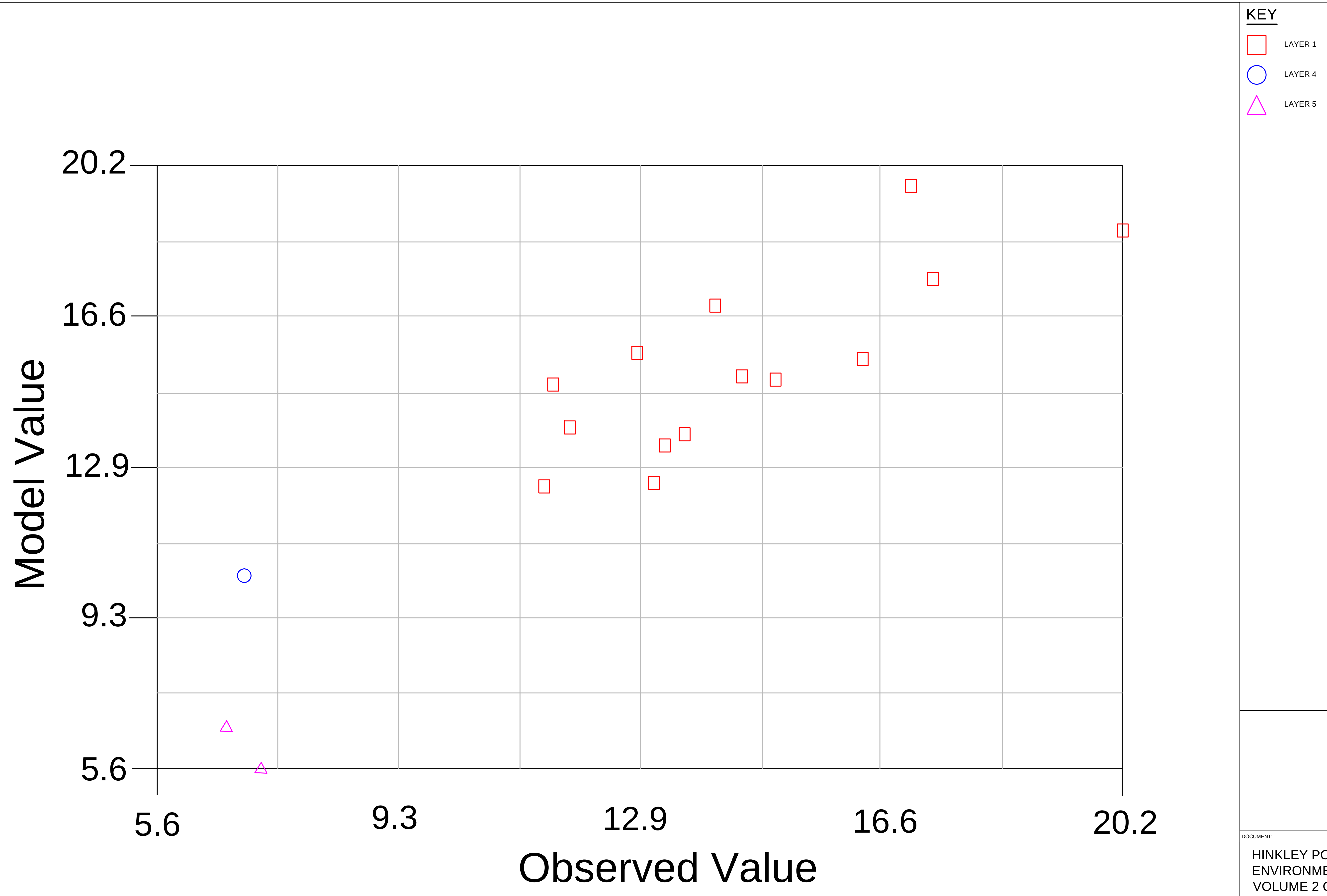

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VOLUME 2 CHAPTER 15

FIGURE TITLE:
STEADY STATE CALIBRATED MODEL
OBSERVED VERSUS SIMULATED HEADS

FIGURE NO:		REVISION:
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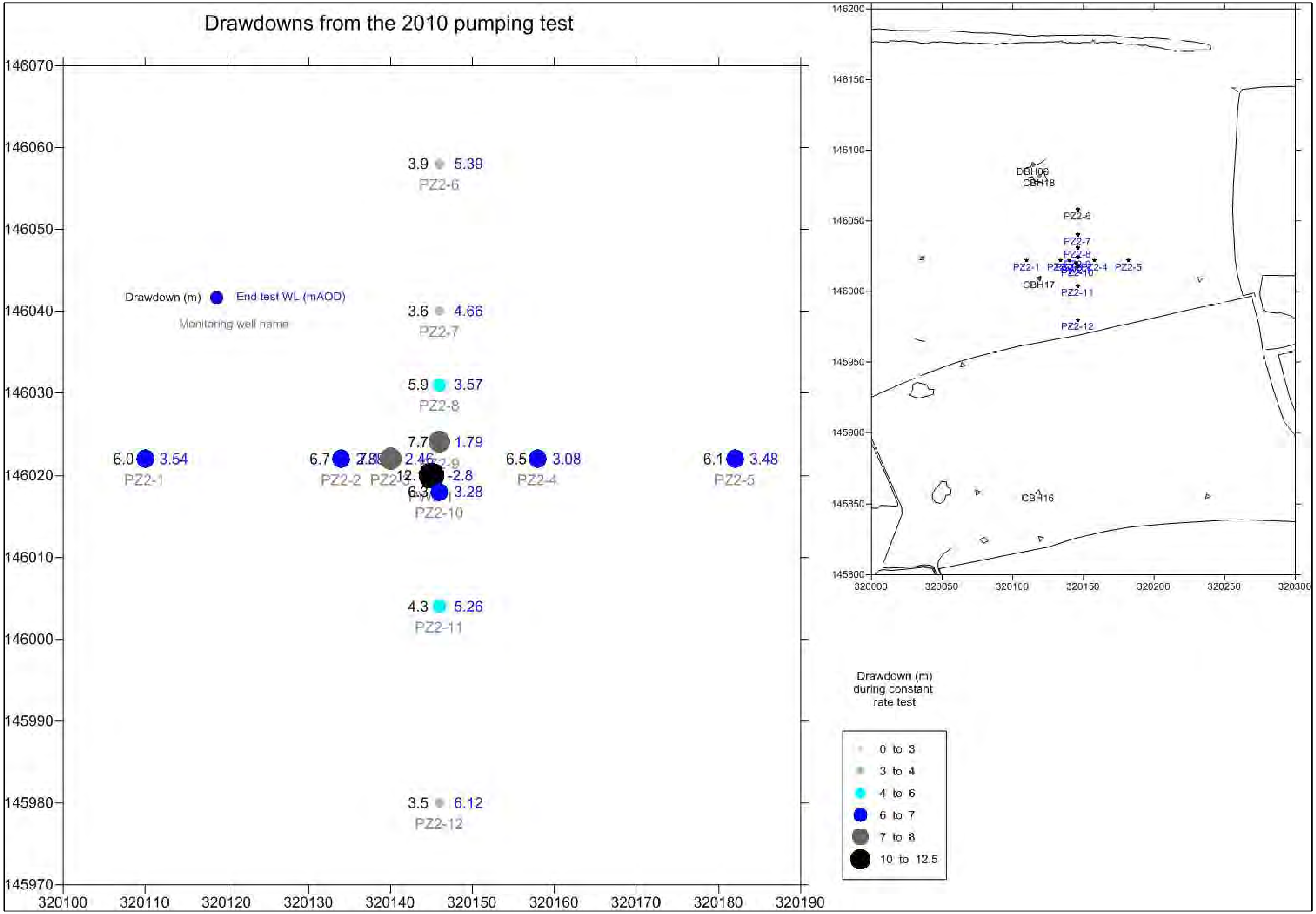

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FIGURE TITLE:

BDAW PW2 2010 PUMPING TEST
OBSERVED RESULTS

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FIGURE 15.H.9	01

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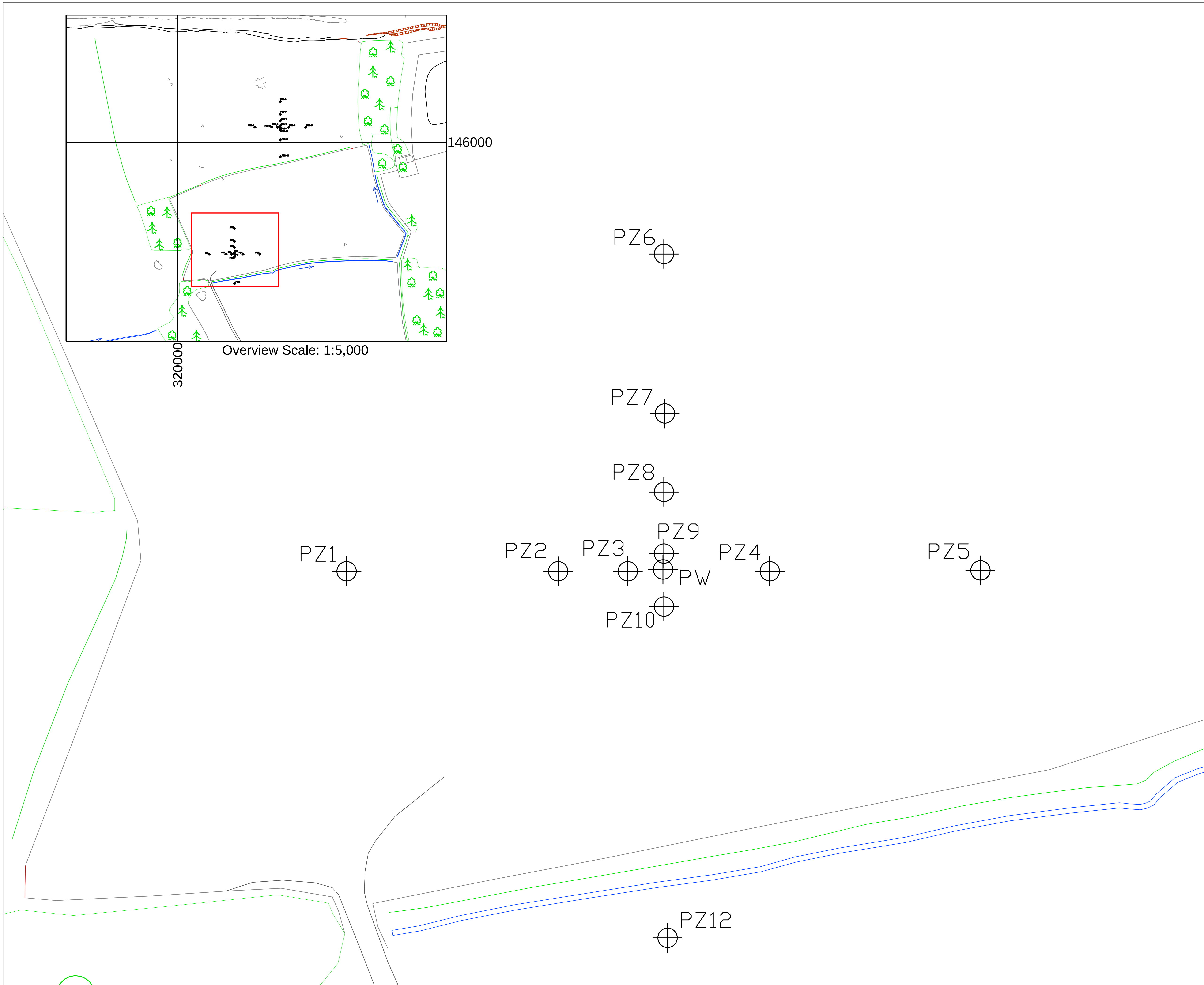

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FIGURE TITLE:

BDAW PW1 2008 PUMPING TEST CONFIGURATION

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FIGURE 15.H.10	01

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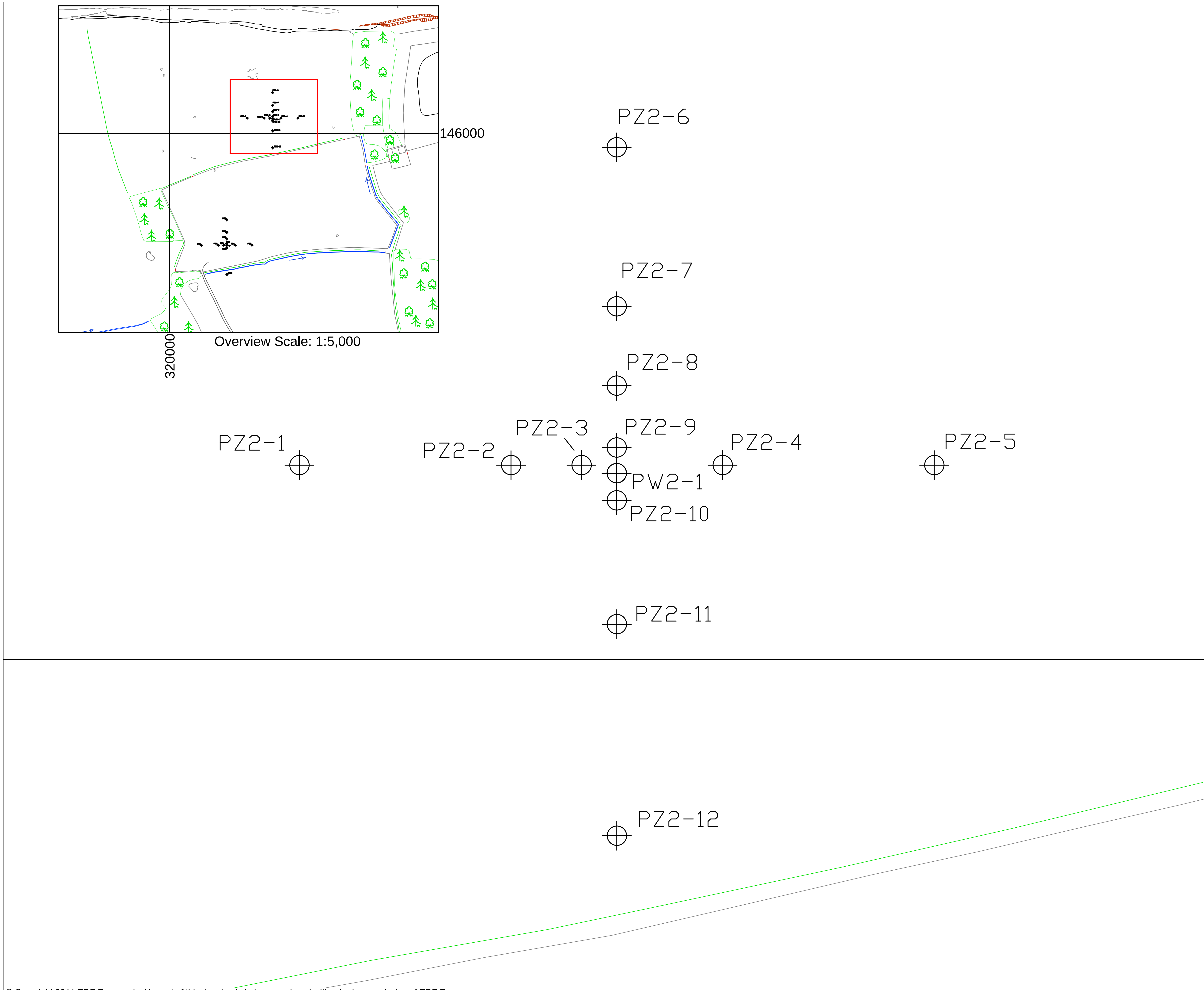

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FIGURE TITLE:

BDAW PW2 2010 PUMPING TEST CONFIGURATION

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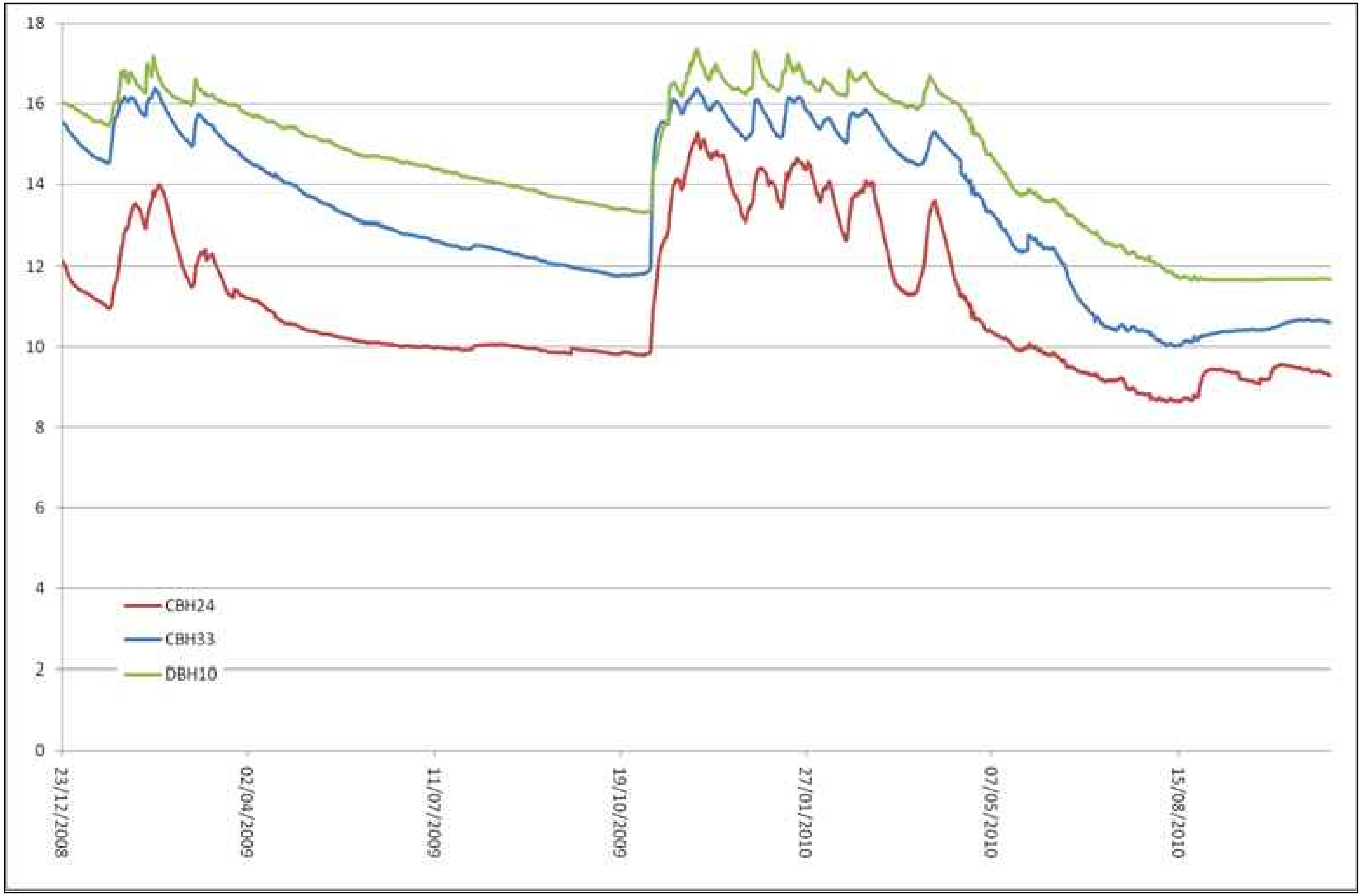

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FIGURE TITLE:

HYDROGRAPHICS FOR CBH24, CNH33 AND DBH10

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FIGURE 15.H.12		01
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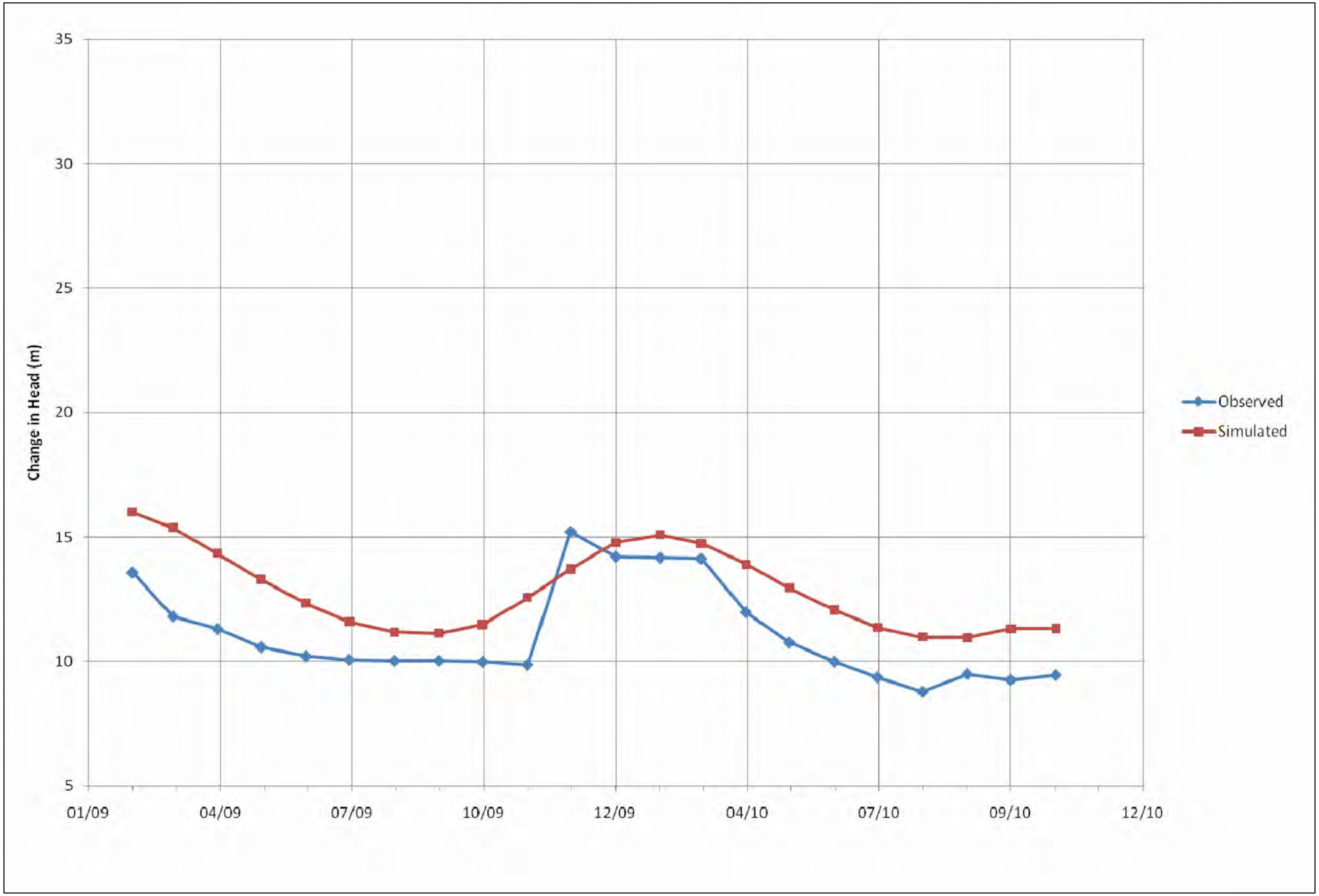

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FIGURE TITLE:

TRANSIENT CALIBRATION: OBSERVED VERSUS SIMULATED HYDROGRAPH (CHB24)

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FIGURE 15.H.13	01

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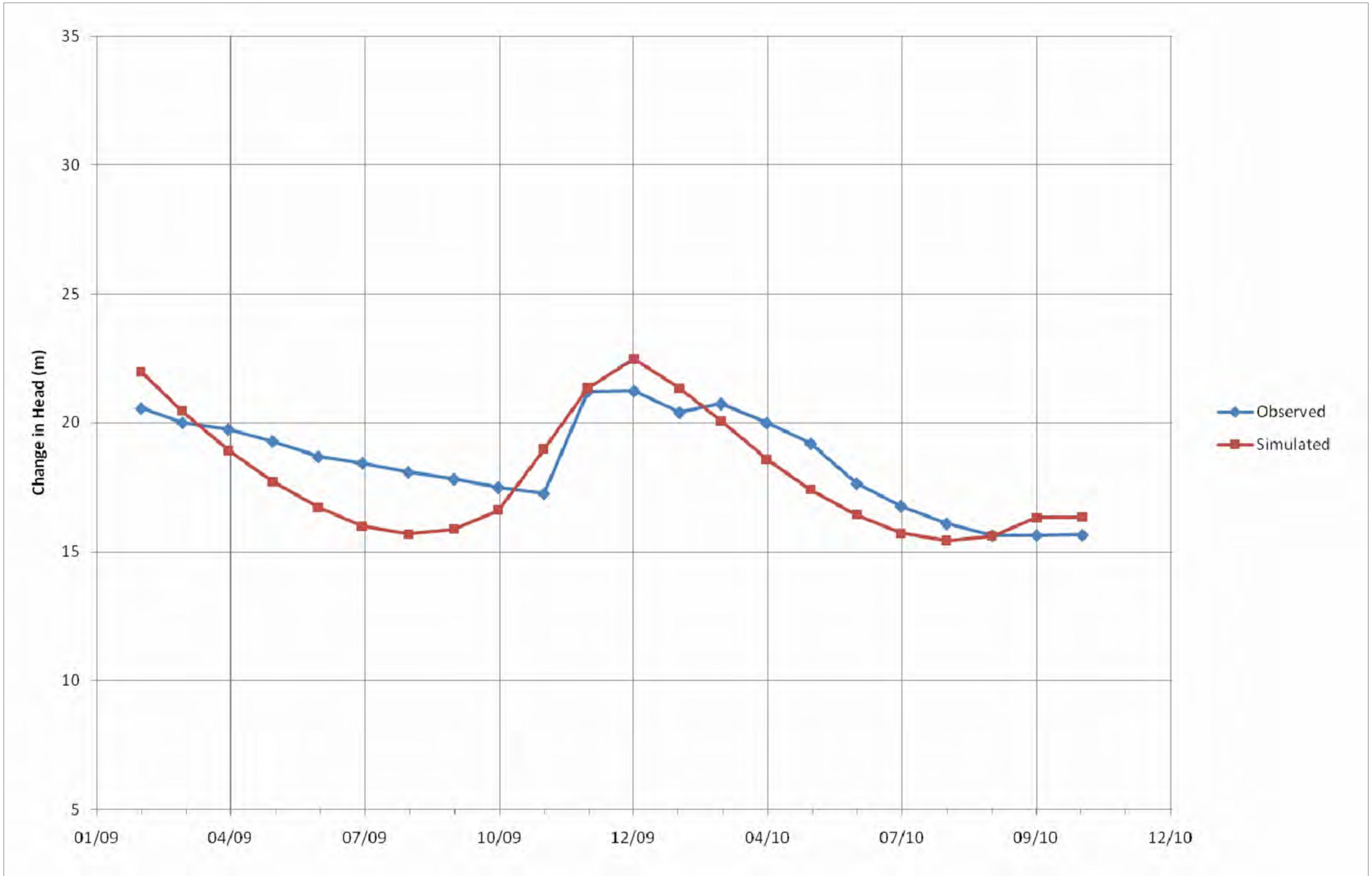

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FIGURE TITLE:

TRANSIENT CALIBRATION: OBSERVED VERSUS SIMULATED HYDROGRAPH (DBH10)

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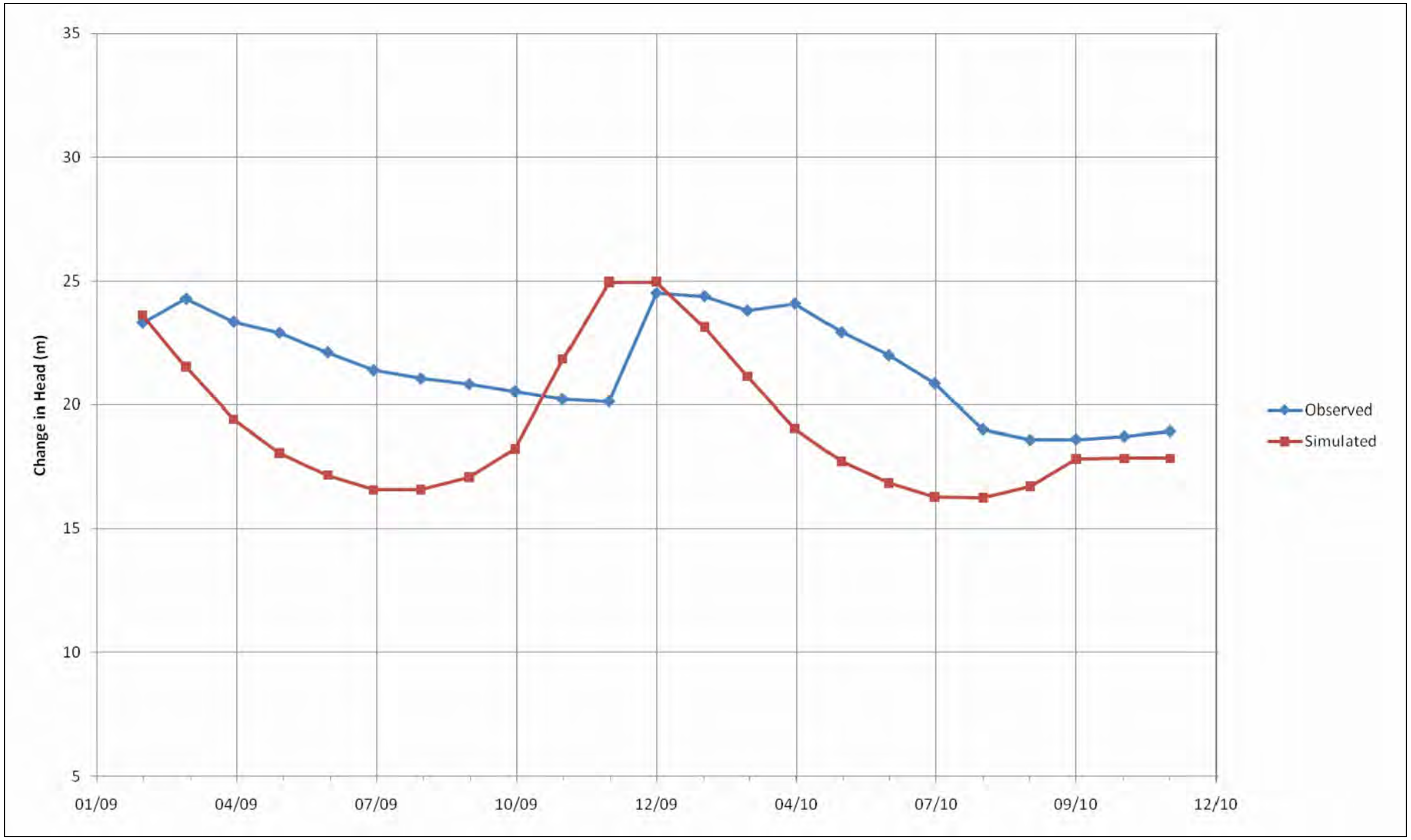

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FIGURE TITLE:

TRANSIENT CALIBRATION: OBSERVED VERSUS SIMULATED HYDROGRAPH (CBH33)

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FIGURE 15.H.15		01
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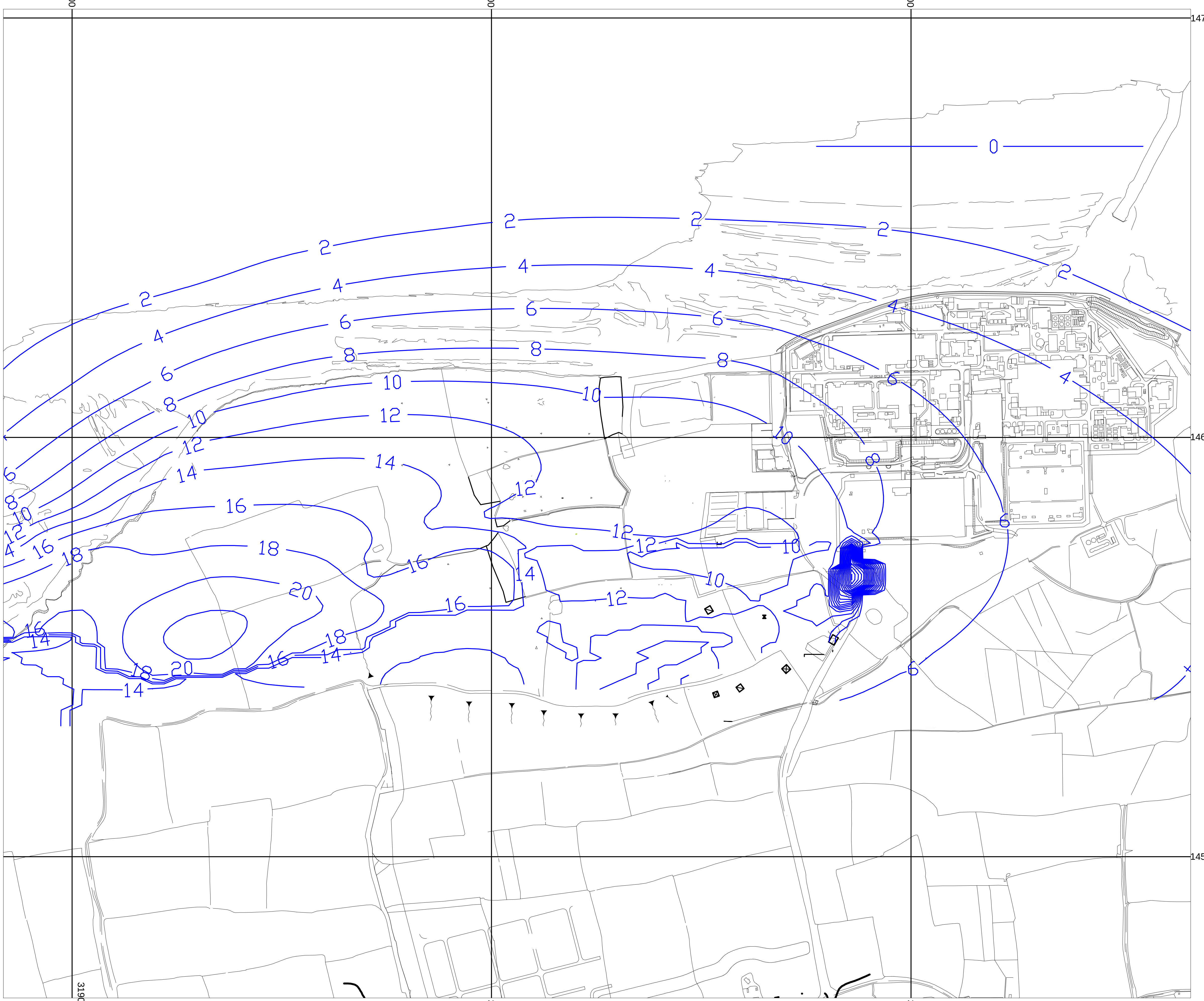

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MODELED GROUNDWATER CONTOURS (mAOD)

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FIGURE TITLE:

PLAN SHOWING GROUNDWATER CONTOURS TRANSIENT CALIBRATION CONTOURS - JANUARY

FIGURE NO:	REVISION:
FIGURE 15.H.16	01

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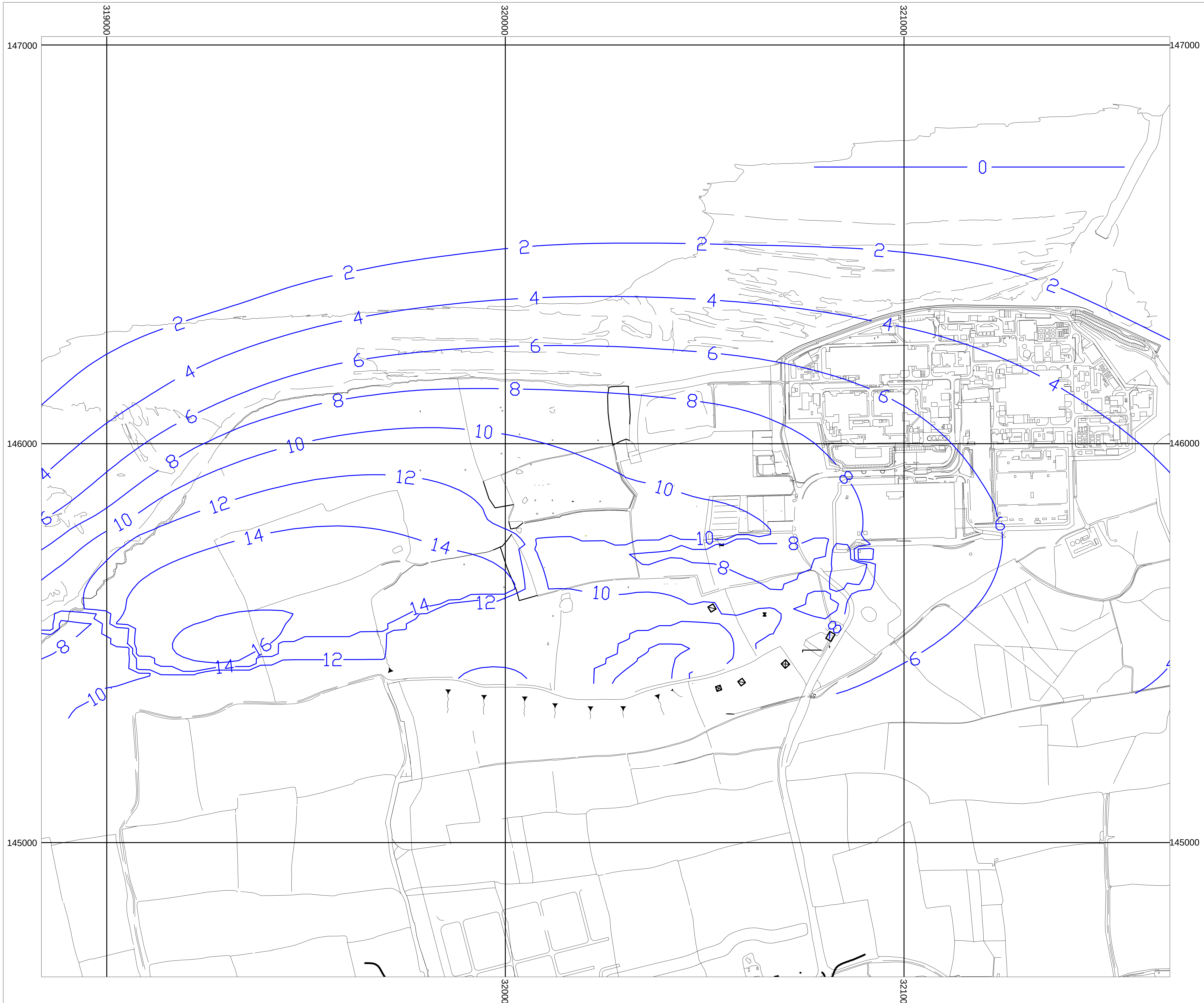

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MODELED GROUNDWATER CONTOURS (mAOD)

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FIGURE TITLE:

PLAN SHOWING GROUNDWATER CONTOURS TRANSIENT CALIBRATION CONTOURS - OCTOBER

FIGURE NO:		REVISION:
FIGURE 15.H.17		01
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APPENDIX 15I: CONTAMINANT TRANSPORT ASSESSMENT

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APPENDIX 15I: CONTAMINANT TRANSPORT ASSESSMENT

15I.1 Introduction

15I.1.1 This appendix details a contaminant transport assessment regarding the potential for contaminants from the Hinkley Point A (HPA) site to cause impacts to the Hinkley Point C (HPC) site during the period of construction dewatering.

15I.1.2 This approach involved a tiered assessment utilising both contaminant and source screening, and modelling using GoldSim as discussed below.

15I.2 Scope and Methodology

a) Introduction

15I.2.2 The tiered assessment involved the successive screening (and elimination) of potential contaminant sources from an initial schedule, so that detailed assessment was focused on the most relevant contaminants and sources that remain (i.e. those that are not excluded at the previous tier).

For this study the following tiers have been employed (**Figure 15I.1**):

- Tier 1 – contaminant and source screening; and
- Tier 2 – modelling of those sources not eliminated at Tier 1.

b) Assumptions

15I.2.3 This section details the general assumptions made across this study both at Tier 1 and 2, and highlights the conservative approach adopted through many aspects of the modelling process. The following conservative assumptions should be taken into account when considering any marginal failures of the Tiered Assessment process, detailed later in this section:

- Groundwater contaminants are present in the shallow Lower (Blue) Lias aquifer present beneath the HPA site.
- Unsaturated zone transport was ignored as a conservative assumption. Contamination present in perched water above the main groundwater level would have a significantly faster travel time to receptors than through the unsaturated zone. Where it is not clear if reported contaminant data is in the unsaturated zone or aquifer, it is conservatively assumed to be present in the saturated zone.
- A direct pathway to the HPC new build site is present once dewatering begins. This is a conservative assumption as the pathlines in **Figure 15I.2** suggest that the groundwater pathway would actually be curved (i.e. longer).
- It is assumed that advection dominates contaminant transport on the Hinkley Point sites and diffusion is not considered here. Except where groundwater velocities are very low, molecular diffusion is commonly disregarded, especially at the site scale.
- It is assumed that all contamination is fully dissolved and no free-phase hydrocarbon product is present.

- Where site specific data are not available, literature values and professional judgement were applied.
- Source term concentrations lacking specific values (as shown **Figure 15I.3** to **Figure 15I.6**) were assumed to be at top end of their respective concentration ranges.
- It was assumed that all beta activity is due to Sr-90. In reality it is likely that some beta activity is due to naturally occurring K-40 etc. This assumption provides an overestimate of Sr-90 concentrations. Some beta may also be due to Cs-137 which is more highly retarded than Sr-90. Assuming beta activities are 100% Sr-90 is a conservative assumption for the purposes of retardation and travel time.
- Biodegradation and retardation occurs. The model is run with biodegradation (decay) both on and off. Appropriate literature values are used for biodegradation rates for naphthalene.
- Sources of identical contaminants are modelled as separate sources but together in the same model and results reported as total (combined) concentrations.
- Background concentrations are assumed to be zero.
- Dewatering duration is assumed in the model to be five years, adding a one-year margin to the design four years.
- In the cases where TPH and Diesel Range Organics (DRO) contamination has been identified, for the purposes of the model this has been assumed to be naphthalene (a more mobile hydrocarbon).

15I.3 Tiered Assessment Process

15I.3.1 A tiered assessment process was used which is regarded as best practice in the UK by the Environment Agency (EA) Model Procedures for the Management of Contaminated Land guidance (Ref. 15I.1). The basis of tiered assessments is to apply successive or more complex tests to selected contaminants with a view to eliminating insignificant contaminants from the need for further assessment. This is efficient (since it avoids unnecessary effort devoted to contaminants that can be screened out early on) and also provides an objective indication of the contaminants that are potentially significant and require further assessment.

15I.3.2 The assessment is considered complete for any given contaminant and tier level once it has been demonstrated that the contaminant has passed (i.e. has not been shown to exceed screening levels) the given tier of assessment. Only if a contaminant assessment fails at a given tier level is it necessary to proceed to the next tier. The EA tiered assessment approach is therefore designed such that it may not necessarily have to be completed in its entirety.

15I.3.3 In Tier 1, two screening criteria are used to interrogate the data. The first screens out sources which lie outside (i.e. to the north and east) of the dewatering-induced flow divide line across the HPA site identified from the groundwater flow model (**Figure 15I.7**) which id detailed in **Chapter 15** of this volume. The second screens out sources which have groundwater contaminants already lower than the compliance screening values. Only contaminant sources which cannot be excluded by either of these criteria are considered further in the Tier 2 assessment.

a) Tier 1 – Contaminant Screening

15I.3.4 Groundwater contamination on the HPA site was screened against UK drinking water standards (DWS), World Health Organization (WHO) guideline values and Environmental Quality Standards (EQS) in order of decreasing preference.

15I.3.5 Certain contaminants with documented low solubility and/or low mobility were also screened out qualitatively, e.g. PCBs.

15I.3.6 Only contaminants failing the Tier 1 assessment were assessed at Tier 2.

15I.4 Contaminant Screening Criteria

15I.4.1 The following contaminant screening criteria were derived for this assessment.

- UK DWS:
  - H-3: 100 Bq/l (2.79E-10mg/l)
  - Hg: 0.001mg/l
- WHO Guideline Values:
  - Sr-90: 10 Bq/l (1.95E-9mg/l)
- EQS (freshwater):
  - Naphthalene: 0.01mg/l
  - Speciated PAHs (naphthalene): 2.4E-3mg/l
  - Hg: 5.0E-5mg/l

a) Tier 1 – Source Screening

15I.4.2 Source screening was also undertaken on the basis of the likely capture zone from the proposed dewatering on the HPC site (**Figure 15I.7**). Sources outside this capture zone were screened from further assessment as they are not likely to be drawn towards the HPC site during construction dewatering.

b) Tier 2 – Quantitative Assessment (GoldSim Modelling)

15I.4.3 Contaminants failing the Tier 1 screening process were taken forward for consideration at Tier 2 which in some cases included modelling using GoldSim where necessary (see below). Contaminants were modelled over two distances:

- from source to the HPA/C site boundary (**Figure 15I.8** and **Figure 15I.9**); and
- from source to the closest engineering dewatering location, determined to be the north west corner of the proposed main nuclear island (**Figure 15I.10** and **Figure 15I.11**).

15I.4.4 Predicted concentrations of contaminants were calculated at both compliance locations (site boundary and dewatering location) and compared to DWS and EQS values in order to determine their significance if mobilised onto the HPC site.

15I.4.5 For the deterministic (best estimate) simulation, maximum concentrations from four modelled receptors were compared to screening values.

15I.4.6 To address potential parameter uncertainty and variability the, UK best practice requires a set of stochastic (Monte Carlo) models to determine whether the deterministic models may have underestimated receptor concentrations.

15I.4.7 For the Monte Carlo simulations, 95th percentile values were compared to screening values. Two sets of Monte Carlo assessments were conducted. Firstly, a set of Monte Carlo assessments were conducted where one single parameter was varied in each case. A second, more complex set of Monte Carlo assessments were also conducted where several (non-mutually exclusive) parameters were varied together.

15I.5 Tier 1 Assessment

a) Contaminant Screening

15I.5.2 For the Tier 1 assessment, the following groundwater contaminants summarised as of significance by SERCO (2010) (Ref. 15I.2) were assessed (**Figure 15I.3** to **Figure 15I.6**):

- Sr-90. Beta emitter thought to represent about 50% of the total beta activity on the HPA site (**Figure 15I.3**).
- H-3 (**Figure 15I.4**). Two sources of H-3 (tritium) higher than DWS are included in the assessment. Other sources, some of which are closer to the site boundary are not included as they are lower than DWS at source. One source at 148Bq/l exists just to the east of the flow divide in **Figure 15I.4**. This (148Bq/l) is a small failure of the H-3 DWS (approximately one order of magnitude less than the two sources included) and dilution will reduce this concentration to below the DWS over the distance to the site boundary. Therefore it was not included.
- Diesel range organics (DRO) and heavier mineral oil organics (compounds from C21-C38 range). According to recent EA guidance (Table 5.1 in Consim Manual Release 2, Golder Associates (Ref.15I.3)) hydrocarbons in the range C18-C34 (DRO) are not considered mobile. It is assumed here that naphthalene is a suitable analogue for the lighter total petroleum hydrocarbon (TPH) fractions potentially present on the HPA site in the absence of speciated data in SERCO (2010) (Ref. 15I.2). No contaminants in the C21-C38 range were modelled here as these are not considered mobile.
- Naphthalene. SERCO (Ref. 15I.2) refers to potential sources of TPH which are not speciated. As TPH covers a wider range of organic compounds including lighter fractions than DRO (above), the assessment here has taken several TPH sources (**Figure 15I.5**) and conservatively assumed that they are composed entirely of naphthalene. Naphthalene is a conservative assumption as it is too heavy to volatilise quickly and is relatively mobile compared to other potential TPH components.
- Mercury (Hg). Slightly elevated mercury was measured in borehole G10 (**Figure 15I.6**) in 2004 at 3.9µg/l (**Figure 15I.6**). This borehole was not re-sampled during the 2009 sampling reported in (SERCO 2010 (Ref. 15I.2)). Borehole G10 is located close to the HPA site boundary in the direction of groundwater flow under dewatering conditions. For both of these conservative reasons this potential Hg contamination was included in the Tier 1 assessment.
- Other metallic compounds. (SERCO 2010 (Ref. 15I.2)) lists a small number of other metallic compounds that are occasionally present above DWS. However, these were thought to be due to sulphidic mineralisation and leaching of the Lower (Blue) Lias and are not man-made sources of contamination (SERCO 2010

(Ref. 15I.2)). No specific sources of metallic contamination are identified and therefore no other metals were identified for the Tier 1 assessment.

- PCBs. There is only anecdotal evidence that PCBs may be present on the HPA site in (SERCO 2010 (Ref. 15I.2)). Due to their immiscible and highly retarded nature, PCBs were not included in this assessment. PCBs are not widely regarded as mobile groundwater contaminants.

15I.5.3 Where specific source term concentrations were not specified in (SERCO 2010 (Ref. 15I.2)) the upper value of the range (see **Figure 15I.3** to **Figure 15I.6**) was assumed as a conservative assumption.

b) Source Screening

15I.5.4 **Figure 15I.7** shows the effects of the proposed HPC dewatering drawdown on the HPA site. The zone of influence only extends part way across the HPA site. Hinkley Point B (HPB) is located further to the East and is therefore uninfluenced by the HPC dewatering. HPB was therefore not considered further in this assessment.

15I.5.5 On **Figure 15I.7** a green line is shown which approximately marks a flow divide under dewatering conditions based on the MODFLOW pathlines shown in red. Contaminants to the south and west of this line are likely to be drawn towards the HPC development site under dewatering conditions. Contaminants to the north and east of the green line are likely to flow towards the Bristol Channel as under baseline conditions and will not impact the HPC site.

15I.5.6 The precise location of this flow divide is unknown and the green line in **Figure 15I.7** represents an approximate location. As the results of this assessment will show, contaminants present in groundwater close to this line are clearly not of concern, hence only the approximate location of this flow divide is required.

15I.5.7 **Figure 15I.3** to **Figure 15I.6**, which are based on data from (SERCO 2010 (Ref. 15I.2)) were primarily used to specify the number of source term locations on the HPA site for the Tier 2 assessment (i.e. those sources deemed to be significant by SERCO (Ref. 15I.2)) with more recent data from Golder (Ref. 15I.4, Ref. 15I.5) also included.

i. H-3 Contamination (G35)

15I.5.8 In July 2009, a H-3 concentration of 438Bq/l was recorded in borehole G35. In February 2010 this had reduced to 89.5Bq/l and therefore below the UK DWS screening value. This source does not require further assessment as it is below the Tier 1 screening value at a concentration that would be fit for human consumption.

ii. H-3 Contamination (G42A)

15I.5.9 In April 2010 a H-3 concentration of 295Bq/l was recorded in borehole G42A. By September/October 2010 this had reduced to 36.2Bq/l (below UK DWS screening level) and does not require further assessment as it is below the Tier 1 screening value at a concentration that would be fit for human consumption.

iii. H-3 Contamination in Borehole (G44)

15I.5.10 In May 2001 a H-3 concentration of 325Bq/l was recorded in borehole G44. In September/October 2010 this had reduced to 39.7Bq/l and hence below the UK DWS screening value. This does not require further assessment as it is below the Tier 1 screening value at a concentration that would be fit for human consumption.

iv. Hydrocarbon Contamination (G2B)

15I.5.11 Borehole G2B is further to the east of the HPA site than the groundwater flow divide (**Figure 15I.7**). The direct distance from G2B to the HPC dewatering zone is over 670m. **Figure 15I.12** shows a set of particle traces in the MODFLOW model released along the same northing as borehole G2B. The capture zone is based on a set of unretarded particles inserted into the MODFLOW groundwater model. Unretarded particles to the east of this line will not reach the dewatering location over the five year dewatering period.

15I.5.12 It is therefore highly unlikely that retarded hydrocarbon contamination present in groundwater in borehole G2B (outside of the capture zone) will migrate onto the HPC site during the five year dewatering period and hence this source does not require assessment.

v. Hydrocarbon (Free Phase) Contamination (G40)

15I.5.13 Borehole G40 is also located further to the east of the HPA site than the groundwater flow divide (**Figure 15I.7**). It is highly unlikely conceptually that free phase hydrocarbons can migrate onto the HPC site over a five year period from this location, because free phase contamination is not dissolved and is highly immobile.

15I.5.14 The free phase hydrocarbon contamination in G40 therefore does not require assessment.

15I.6 Tier 2 Assessment (GoldSim Model)

15I.6.1 From the Tier 1 assessment, the following contaminant types require further consideration:

- Tritium (H-3);
- Strontium-90 (Sr-90);
- Naphthalene; and
- Mercury (Hg).

15I.6.2 Of these contaminants, H-3 is by far the most mobile as it is by nature unretarded. An assessment of H-3 was undertaken at Tier 2 to determine whether this most mobile contaminant presents a significant risk to the HPC site or the dewatering location. It was decided that if H-3 presented no significant risk then the other contaminants failing Tier 1 (which are retarded to some degree) would also not present a significant risk, so long as they are not present on the HPA site at a location closer to the HPC site. **Figure 15I.5** and **Figure 15I.6** show that only source 7 containing Hg and hydrocarbons (naphthalene; but not Sr-90) is located very close to the HPA/C site boundary. This source was therefore considered at Tier 2.

a) Generic Parameters

15I.6.3 Site parameters for the deterministic (best estimate) Tier 2 assessment using GoldSim are presented below and in **Table 15I.1**.

- Only groundwater source term concentrations present in the aquifer were modelled (this assessment does not consider the overlying unsaturated zone, a conservative approach).
- Biodegradation/radioactive decay were included.
- All sources with the same contaminants were modelled collectively (total concentrations at receptors are reported in the results below).
- Longitudinal and lateral dispersivity were set to 1/10th and 1/30th of the source to receptor path length respectively and were not varied stochastically. This assumption was taken to avoid excessive or unrealistic lateral dispersion.

15I.6.4 Site Parameters – Monte Carlo (only where different from deterministic model parameters in **Table 15I.1**). GoldSim models with only individual stochastic parameters:

- 1000 model iterations.
- All stochastic parameters were entered as uniform distributions.

15I.6.5 See **Table 15I.1** for parameter ranges. Model sensitivity to each parameter is assessed separately.

15I.6.6 Site Parameters – Monte Carlo. Combined parameter models (models with combined but unrelated parameters). Refer to **Table 15I.1** for parameter ranges where they are not quoted here:

- Partition coefficient for retarded contaminants (Sr-90, naphthalene and Hg) +/- 1 order of magnitude compared to deterministic values in **Table 15I.5**, and naphthalene biodegradation rate: 0 – 1 years.
- Porosity and hydraulic gradient.
- Partition coefficients (+/- 1 order of magnitude), naphthalene degradation rate (0 - 1 years), porosity and hydraulic gradient.

15I.7 GoldSim Model Setup

15I.7.1 The GoldSim models were run for a five year dewatering period giving an additional one-year conservative margin to the design dewatering period of four years.

15I.7.2 **Table 15I.1** details the hydrogeological parameters used in the models.

Table 15I.1: Site Parameters (GoldSim).

Parameter	Units	Best Estimate (deterministic)	Best Estimate Justification	Range (Monte Carlo)	Monte Carlo Justification
Source areas	m^2	1	Simple assumption. Model insensitive to source area.	n/a	Unit area, variation not required.
Dry bulk density	g/cm^3	1.8	Conservative estimate based on brief qualitative assessment of raw SSL data. EDF interpretation indicates 2.1-2.6 (best estimate 2.37) which would increase retardation for all contaminants (except H-3 for which it is irrelevant).	1.5-2.2	Wide range of values to represent potential geology present at HPA/HPC.
Porosity	-	0.02	Expert opinion based on site specific data (0.03 upper bound for limestone effective fracture porosity, 0.02 for mudstone). A range of values to be simulated in Monte Carlo assessments.	0.01-0.05	Range of potential porosities from 1-5% to represent potential fracture flow porosity variability.
Aquifer thickness	m	35	Estimated from conceptual model and MODFLOW model. Saturated thickness of Lower (Blue) Lias aquifer.	10-50	Lower bound thickness of 10m represents flow through Lower (Blue) Lias limestone bands only. Upper bound thickness of 50m to represent large scale matrix flow through entire thickness of Lower (Blue) Lias aquifer. GoldSim model not sensitive to this parameter.
Hydraulic conductivity	m/s	4.4E-6	Average value taken from calibrated MODFLOW model in [2].	9E-7 – 5.1E-5	One order of magnitude range selected to represent a significant variation in the calibrated MODFLOW value used in the deterministic assessment. Monte Carlo values represent the range 0.1-1m/d.
Hydraulic gradient	-	0.019	Calculated as average of two hydraulic gradients: from centre of HPA site to EDF site boundary and centre of HPA site to closest dewatering location based on MODFLOW groundwater contours	0.01-0.03	A significant range of hydraulic gradients particularly towards the steeper/conservative end of the range (0.03). Higher hydraulic gradients coupled with very low porosities will generate a significantly higher groundwater velocity than is expected to occur under dewatering conditions.
Groundwater flow direction	Degrees	270	Direct path to receptors, conservative assumption - curved/longer path predicted in	n/a	GoldSim is a one dimensional model, flow direction is therefore not relevant.

Parameter	Units	Best Estimate (deterministic)	Best Estimate Justification	Range (Monte Carlo)	Monte Carlo Justification
			MODFLOW model		
Longitudinal dispersivity	m	1/10th path length	Calculated following direct advice from software vendor. Should not be varied stochastically.	n/a	Model sensitive to this parameter. Higher values lead to extremely large lateral dispersion at source which is not appropriate. Advice received from software developer.
Lateral dispersivity	m	1/30th path length	Calculated following direct advice from software vendor. Should not be varied stochastically.	n/a	Model sensitive to this parameter. Higher values lead to extremely large lateral dispersion at source which is not appropriate. Advice received from software developer.
Source term infiltration	mm/yr	25	Based on conceptual and MODLFOW models.	-	GoldSim assessment results are not sensitive to this parameter.

15I.8 H-3 Assessment

15I.8.1 H-3 was modelled with a half-life of 12.33 years, a partition coefficient of 0ml/g (unretarded) and unlimited solubility.

Recent monitoring data for H-3 (2009/2010) indicate that:

- Measured H-3 concentrations on the HPA site have declined since 2004/5. For example, the concentration in borehole G7 has dropped from 1000 to 180 Bq/l.
- The highest recording in 2004/5 was in borehole A6 which has since been infilled and which therefore cannot provide further data.
- Due to uncertainty regarding the H-3 source, it cannot be confirmed whether the centre of the plume has been intercepted.
- The boreholes on the HPA site are all shallow. The northern wells in particular may therefore miss H-3 contamination travelling northwards due to dips in the geological strata.

15I.8.2 Due to the above, it was decided to model decayed H-3 source terms from the position of the G7 and A6 boreholes as opposed to using the lower concentrations as measured on-site during 2010 (**Figure 15I.13**) as this is a conservative approach given the above conceptual uncertainties.

15I.8.3 On the basis of the 2004/5 data presented above, it was calculated that late December 2010 concentrations at G7 and A6 following radioactive decay alone would be 706 and 1349Bq/l respectively. The concentrations are fixed and do not decline with time.

15I.9 H-3 Tier 2 Results

15I.9.1 The results of the H-3 assessment are shown in **Table 15I.2** below. For the deterministic model, H-3 peaks at the site boundary at approximately five times less than the UK drinking water standard of 100Bq/l. The dewatering location being further from the sources shows an insignificant peak concentration of 6.1Bq/l. Neither result is therefore significant.

15I.9.2 Overall, the highest concentration predicted at the site boundary is from the Monte Carlo model of permeability and hydraulic gradient in combination. However, at 20.5Bq/l, the increase from the deterministic result is small, and remains approximately five times lower than the UK Drinking Water Standard for H-3. At the dewatering location, the highest result overall (7.7Bq/l) remains insignificant.

Table 15I.2: GoldSim H-3 Contaminant Transport Results

	Site Boundary (Bq/l)	Dewatering (Bq/l)
Deterministic	18.9	6.1
Monte Carlo Prediction (95th ile) Parameter Varied:		
Effective Porosity	19.6	7.0
Aquifer thickness	18.9	6.1
Hydraulic conductivity	20.4	7.7
Hydraulic gradient	19.7	6.9
Porosity & hydraulic gradient	19.9	7.2
Permeability & hydraulic gradient	20.5	7.7

15I.9.3 A final Monte Carlo assessment was also undertaken to increase the permeability in the model to account for on-site pumping test results which may show higher localised areas of permeability than is apparent from the MODFLOW calibrated model. The results of this analysis are shown in **Table 15I.3**. The results show that the model is relatively insensitive to increases in permeability and that no significant increases in H-3 concentrations were predicted.

Table 15I.3: GoldSim H-3 Sensitivity Assessment of Higher Upper Blue Lias Permeabilities

	H-3 Concentration at Receptor After 5 Years			
	Site Boundary		Dewatering	
Hydraulic conductivity (m/s)	**K=4.4E-06**	**K=2.2E-05**	**K=4.4E-06**	**K=2.2E-05**
Deterministic	18.9	20.3	6.1	7.6
Permeability (95th ile)	20.4	20.5	7.7	7.7
Permeability & gradient (95th ile)	20.5	20.2	7.7	7.4

15I.10 H-3 Tier 2 Conclusion

15I.10.1 It is concluded that significant concentrations of H-3 are unlikely to migrate onto the HPC site from HPA during construction dewatering, in the context of the current UK Drinking Water Standard of 100Bq/l. Whilst this assessment focuses on intergranular/matrix flow and transport, the potential for fast pathways through rock fractures does exist. These fractures are however unlikely to extend continuously from the H-3 sources to the dewatering location. Furthermore the Monte Carlo analyses undertaken (e.g. effective porosity and hydraulic gradient) do allow for significantly faster contaminant transport that would be characteristic of fast pathways.

15I.10.2 Modelling, using GoldSim and employing conservative assumptions, indicates that H-3 concentrations will not exceed approximately 20% of the UK DWS (100Bq/l) at the site boundary, and will be much lower at the dewatering locations.

a) Sr-90

15I.10.3 Sr-90 is not present on the HPA site at any sources closer than those included in the H-3 assessment. As Sr-90 is retarded and the unretarded H-3 results do not show any significant results, it is not necessary to consider Sr-90 at Tier 2. Sr-90 will not pose a significant risk to the HPC site or the dewatering location under dewatering conditions.

b) Hg and Naphthalene Assessment (Source 7)

15I.10.4 Following the H-3 assessment, both Hg and naphthalene (0.0039 and 0.6mg/l respectively) from Source 7 were assessed since the source is close to the site boundary. This assessment was carried out using the same hydrogeological parameters as shown above, and the specific contaminant properties shown in **Table 15I.4**.

Table 15I.4: Contaminant Parameters for Naphthalene and Hg.

Contaminant	Parameter			
	Half-life/ Biodegradation Rate (Years)	Partition Coefficient (ml/g)	Henry's Law Constant (-)	Aqueous Solubility (mg/l)
Naphthalene**	0.296***	6.44****	1.74E-2	31.0
Hg	Unlimited	145*****	-	Unlimited******

***All naphthalene values taken from Ref.15.I.6. Aerobic sandy loam data for naphthalene have been ignored as not appropriate to this geological assessment.*

****Most conservative/appropriate value from[5].*

*****Log soil organic carbon-water partitioning coefficient (Koc) of 3.11 taken from[5] at 25 degrees Celsius. Partition coefficient (Kd) calculated assuming a conservative Fraction of organic carbon (Foc) of 0.5%.*

******Kd at pH 6.8 as recommended by ConSim manual. At higher pHs, Hg is significantly more retarded therefore 145ml/g a conservative estimate.*

*******Assumed to not be solubility limited as a conservative assumption.*

c) Naphthalene and Hg Tier 2 Results and Conclusion

15I.10.5 The results of the GoldSim models for Hg show that in both the deterministic and Monte Carlo models, no Hg reaches the site boundary or dewatering location.

15I.10.6 For naphthalene, in both the deterministic and Monte Carlo models, no contamination reaches the dewatering location. At the site boundary, in the deterministic model, concentrations of naphthalene peak approximately ten orders of magnitude less than the UK drinking water standard. From the Monte Carlo models, the highest concentration at the site boundary rises to nine orders of magnitude less than the UK drinking water standard.

15I.10.7 It is therefore concluded that Hg and naphthalene do not present a significant risk to the HPC site or the dewatering location.

15I.11 Assessment of HPA Contaminant Depths

15I.11.1 In addition to the above assessment, a further assessment has been undertaken of the potential for groundwater contamination sources on HPA to reach the higher permeability Lilstock Formation, a zone also considered to include the Planorbis beds at the base of the Blue Lias Formation. This was considered to be an important conceptual uncertainty given the depths of investigations on the HPA site, as discussed below.

15I.11.2 According to the 1980s HPC site investigation (Ref. 15I.7), the Planorbis beds are calculated to be an average of 12.7m thick. The geological formations underlying HPC are shown to dip in a northwards direction according to various cross sections (cross section locations shown on **Figure 15I.10**). According to the north-south cross section E (reproduced here in **Figure 15I.11**), this dip results in the Planorbis beds reaching outcrop (beneath made ground) around the location of trial pit TP2. It is estimated that TP2 is located at approximately 320530, 145770; to the south east of the HPC drainage ditch (**Figure 15I.12**). It is hence estimated that the Planorbis outcrop would be approximately 280m south of the peak H-3 concentrations on HPA in borehole A6 (assuming that the Planorbis zone outcrops on the HPA site at the same northing). The east-west cross section B (reproduced in **Figure 15I.13**) is at a northing approximately around the locations of contaminant interest. From **Figure 15I.13** the top of the Planorbis beds are shown to be relatively flat across the formation strike, with a level around -28m AOD. The ground surface is shown at +15m AOD making the Blue Lias above the Planorbis approximately 43m thick at this northing.

15I.11.3 The Blue Lias to a depth of 40m below ground level is conceptualised to have an estimated vertical:horizontal permeability anisotropy of 1:800 as discussed in **Chapter 15** of this volume. This would make it highly unlikely that shallow contamination in the Blue Lias could penetrate several 10s of metres vertically downwards to the Planorbis beds. At depths greater than 40m below ground level, the Blue Lias is conceptualised to have lower horizontal permeability due to compression of the formation. Therefore in areas where the Blue Lias is very thick, vertical permeability across the entire formation will be lower still, even at a conceptualised anisotropy of 1:120, further reducing the likelihood of vertical contaminant migration into the Planorbis beds.

15I.11.4 The Monte Carlo hydraulic gradient range in the GoldSim modelling (**Table 15I.1**) was 0.01 to 0.03 with a deterministic value of 0.019. The Monte Carlo upper range of 0.03 is significantly higher than both deterministic values and therefore encompasses any increases in hydraulic gradient derived from more recent MODLFOW modelling. However, hydraulic gradient is only one of several parameters relevant to this discussion, and it should also be noted that the MODFLOW model Layer 1 (Upper Blue Lias) horizontal permeability has been reduced from 0.42m/d (on which the GoldSim model was based) to a final calibrated value of 0.38m/d which will in part reduce the effects of the increase in deterministic hydraulic gradient.

15I.11.5 **Table 15I.5** summarises the groundwater level and borehole information from HPA currently available. The installation depth data in **Table 15I.5** summarises the lithological descriptions, all of which correspond to Blue Lias type material. The March 2010 “Golder – base of BH” in **Table 15I.5** shows the depths of the boreholes where this is available. None of the boreholes penetrate the Blue Lias more than about 15m, leaving about 30m of additional Blue Lias below before the Planorbis beds are reached. The other columns in **Table 15I.5** show rest water levels from various data sources quoted across various timeframes. All the water levels are representative of Upper Blue Lias levels. In summary this demonstrates that the HPA contaminated land investigations were shallow and did not penetrate through the Blue Lias formation (which is known to be thicker than the HPA boreholes are deep). Therefore, on the basis of available information, all the contaminant data quoted is restricted to relatively shallow levels and lies well above the Planorbis beds. Whilst this cannot fully rule out deeper contamination, the high vertical permeability anisotropy of the Blue Lias formation (1:800) will actively prevent significant downwards contaminant migration. Where present, the deeper (compressed) Blue Lias is of even lower permeability and will act as an additional vertical migration barrier. The possibility of HPA contamination reaching the Planorbis beds is therefore assessed as very low.

15I.11.6 It is therefore concluded that the shallow contamination reported on the HPA site was suitably modelled in the GoldSim assessment reported above, including suitable conservative assumptions and Monte Carlo simulations and does not require repeating following more recent MODFLOW modelling.

Table 15I.5: Hinkley Point A Borehole and Groundwater Summary Information

Location	Installation Depth (mbgl)	Lithology	Ground Elevation (mAOD)	Significant Contamination Identified	Groundwater Elevations April 2004 mAOD	Groundwater Elevations Dec 13-14 2004 mAOD	Groundwater Elevations Mar 2005 mAOD	Golder Factual Report July 2009 Data (Ref 15I.8)	Serco March 2010 Report (Ref. 15I.2)	Mar 2010 Golder Letter Report (Ref. 15I.4)		May 2010 Golder Letter Report (Ref. 15I.9)	Dec 2010 Golder Letter Report (Ref. 15I.5)	
								GW Rest (mAOD)	GW elevation 2004-2009 (mAOD)	Base of BH (m AOD)	GW Rest (m AOD)	GW Rest (m AOD)	GW Rest (mAOD)	Free Product Rest Level (mbgl)
A1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A4A shallow	1.40-4.50	Mudstone with limestone bands	11.18	-	8.84	8.57	8.50	-	8.50-9.88	-	-	-	-	-
A4B deep	8.90-14.50	Mudstone with limestone bands	11.18	-	9.88	-	-	9.40	8.84-10.02	-	-	-	-	-
A5	9.50-12.50	Mudstone with limestone bands	11.18	-	7.78	7.59	7.07	7.63	7.00-7.78	-1.78	8.01	-	-	-
A6	0.90-7.50	Mudstone with limestone bands	11.06	Tritium	9.77	9.61	-	-	9.61-9.77	-	-	-	-	-
A7	9.90-17.00	Mudstone with limestone bands	11.05	-	11.05	artesian	-	-	11.05	-	-	-	-	-
A8	0.80-8.00	Mudstone with limestone bands	10.90	-	7.69	7.98	7.8	-	7.69-7.98	-	-	-	-	-
A9	10.00-16.50	Mudstone with limestone bands	11.19	-	7.68	7.64	7.47	7.80	6.79-8.44	-4.18	8.58	-	7.68	-
A10	0.80-8.00	Mudstone with limestone bands	11.23	-	8.04	7.40	7.05	7.89	6.77-8.10	3.07	7.92	-	-	-
A11	6.50-14.40	Mudstone with limestone bands	11.21	-	10.01	-	-	-	10.01	-	-	-	-	-
A12	2.00-8.00	Mudstone with limestone bands	11.19	-	10.18	-	-	-	10.18	-	-	-	-	-
G1A	4.00-7.50	Mudstone with limestone bands	17.05	-	13.68	13.84	13.31	12.32	10.18-13.84	9.95	11.65	-	12.03	-
G1B	10.20-15.40	Mudstone with limestone bands	17.11	-	13.90	13.85	13.13		13.12-13.90	-	-	-	-	-
G2A	2.80-7.00	Mudstone with limestone bands	11.12	-	7.70	7.22	7.34	7.53	6.82-8.29	4.14	8.42	-	-	-
G2B	6.80-14.50	Mudstone with limestone bands	11.14	-	7.04	6.72	6.68	7.20	6.36-7.19	-3.30	7.34	-	6.88	4.20
G3A	4.00-9.60	Made ground, mudstone with limestone bands	11.09	-	4.13	3.49	-	-	3.49-4.13	-	-	-	-	-
G3B	8.80-15.00	Made ground, mudstone with limestone bands	11.18	-	4.30	4.23	3.99	-	3.81-4.33	-	-	-	-	-

Location	Installation Depth (mbgl)	Lithology	Ground Elevation (mAOD)	Significant Contamination Identified	Groundwater Elevations April 2004 mAOD	Groundwater Elevations Dec 13-14 2004 mAOD	Groundwater Elevations Mar 2005 mAOD	Golder Factual Report July 2009 Data (Ref 15I.8)	Serco March 2010 Report (Ref. 15I.2)	Mar 2010 Golder Letter Report (Ref. 15I.4)		May 2010 Golder Letter Report (Ref. 15I.9)	Dec 2010 Golder Letter Report (Ref. 15I.5)	
G4A	3.00-7.00	Made ground, mudstone with limestone bands	11.05	-	4.70	4.61	4.59	4.65	4.52-4.86	4.28	4.71	-	4.55	-
G4B	9.90-15.00	Made ground, mudstone with limestone bands	11.22	-	4.46	4.35	4.17	4.49	3.32-4.98	-4.00	4.73	-	4.42	-
G5A	1.40-5.80	Made ground, mudstone with limestone bands	8.15	-	-	-	-	-	5.17	-	-	-	-	-
G5B	5.90-11.00	Made ground, mudstone with limestone bands	8.08	-	-	-	-	-	4.78	-	-	-	-	-
G6	1.70-7.50	Mudstone with limestone bands	11.07	Sr-90/Tritium	8.04	8.07	7.85	7.88	7.74-8.07	3.63	7.86	-	7.82	-
G7	1.50-7.50	Mudstone with limestone bands	11.16	Tritium	8.26	8.12	7.91	8.04	7.75-8.26	3.70	8.06	-	-	-
G8	2.00-7.00	Mudstone with limestone bands	11.10	-	8.57	8.02	7.82	8.71	7.47-8.97	3.52	8.79	-	8.37	-
G9	1.50-7.50	Mudstone with limestone bands	11.19	-	8.68	-	8.01	9.17	7.77-9.25	3.06	8.74	-	8.98	-
G10	4.00-7.30	Mudstone with limestone bands	12.25	Naphthalene/ mercury	8.22	-	8.52	-	8.22-9.32	-	-	-	-	-
G11	0.80-7.50	Mudstone with limestone bands	11.34	Tritium	7.47	7.24	8.72	7.49	6.72-8.18	3.94	7.56	-	-	-
G12	8.00-14.50	Mudstone with limestone bands	11.07	-	7.78	7.39	6.86	7.92	6.64-8.00	-4.01	7.88	-	7.67	-
G13	8.30-14.50	Mudstone with limestone bands	11.10	Tritium	8.72	8.47	8.19	8.73	8.02-8.89	-3.83	8.68	-	8.52	-
G14	8.40-14.50	Mudstone with limestone bands	11.11	-	7.71	7.62	7.68	7.57	7.42-8.78	-3.91	8.03	-	7.74	-
G15	4.00-8.00	Mudstone with limestone bands	11.13	Tritium	5.20	5.20	5.98	5.35	5.03-5.98	3.03	5.23	-	-	-
G16	8.30-14.50	Mudstone with limestone bands	11.14	-	10.36	9.87	9.92	10.08	9.69-10.55	-3.86	10.17	-	-	-
G17	7.90-14.00	Mudstone with limestone bands	11.15	-	7.74	7.28	6.63	7.10	6.26-7.74	-3.48	7.62	-	7.50	-
G18	1.80-8.00	Mudstone with limestone bands	11.09	-	8.74	-	-	-	8.74	-	-	-	-	-
G19	2.00-8.00	Mudstone with limestone bands	11.16	-	9.05	-	8.19	-	8.19-9.05	-	-	-	-	-
G20	no installation	-	-	-	-	-	-	-	-	-	-	-	-	-
G21	no installation	-	-	-	-	-	-	-	-	-	-	-	-	-

Location	Installation Depth (mbgl)	Lithology	Ground Elevation (mAOD)	Significant Contamination Identified	Groundwater Elevations April 2004 mAOD	Groundwater Elevations Dec 13-14 2004 mAOD	Groundwater Elevations Mar 2005 mAOD	Golder Factual Report July 2009 Data (Ref 15I.8)	Serco March 2010 Report (Ref. 15I.2)	Mar 2010 Golder Letter Report (Ref. 15I.4)		May 2010 Golder Letter Report (Ref. 15I.9)	Dec 2010 Golder Letter Report (Ref. 15I.5)	
G22	1.5-7.5	Mudstone with limestone bands	-	-	-	-	8.16	-	7.94-9.27	-	-	-	-	-
G23	8.5-14.5	Mudstone with limestone bands	-	-	-	-	6.18	-	6.16-7.04	-	-	-	-	-
G24	8.5-14.5	Mudstone with limestone bands	-	-	-	-	6.41	-	6.00-7.40	-	-	-	-	-
G25	8.6-14.6	Mudstone with limestone bands	-	-	-	-	6.54	-	6.14-7.34	-	-	-	-	-
G26	8.1-15.1	Mudstone with limestone bands	-	-	-	-	4.94	-	4.29-5.02	-	-	-	-	-
G27	8.5-14.5	Mudstone with limestone bands	-	-	-	-	8.65	-	8.02-9.16	-	-	-	-	-
G28	1.5-7.5	Protocataclastic/'fault rock'	-	-	-	-	9.61	-	8.99-9.92	-	-	-	-	-
G29	2.0-7.7	Made ground, mudstone with limestone bands	-	-	-	3.85	3.86	-	3.74-5.11	-	-	-	-	-
G30	1.5-7.4	Made ground, mudstone with limestone bands	-	-	-	4.30	4.21	-	4.11-4.52	-	-	-	-	-
G31	8.2-8.65	Made ground, mudstone with limestone bands	-	-	-	4.64	4.57	-	4.27-4.97	-	-	-	-	-
G32	2.0-8.35	Made ground, mudstone with limestone bands	-	-	-	4.62	4.64	-	4.49-5.07	-	-	-	-	-
G33	1.4-8.4	Made ground, mudstone with limestone bands	-	-	-	10.26	4.84	-	4.56-7.58	-	-	-	-	-
G34	1.5-7.5	Mudstone with limestone bands	-	-	-	-	8.29	-	7.82-8.29	-	-	-	-	-
G35	1.5-7.5	Mudstone with limestone bands	-	Naphthalene/ Tritium	-	-	7.81	-	7.75-7.81	-	-	-	-	-
G36	1.5-7.5	Mudstone with limestone bands	-	Naphthalene	-	-	7.28	-	6.92-8.39	-	-	-	-	-
G37	1.7-7.7	Mudstone with limestone bands	-	Naphthalene/ Tritium	-	-	7.04	-	6.34-7.25	-	-	-	-	-
G38	1.5-7.5	Mudstone with limestone bands	-	Naphthalene	-	-	6.86	-	6.86-7.86	-	-	-	-	-
G39	No information available	-	-	-	-	-	-	-	-	-	-	-	-	-
G40	1.6-7.6	Mudstone with limestone bands	-	-	-	-	-	-	7.83-8.98	-	-	-	-	2.30
G41	8.0-15.0	Dark grey mudstone	11.08	-	-	-	-	-	-	-	-	7.88	7.61	-

Location	Installation Depth (mbgl)	Lithology	Ground Elevation (mAOD)	Significant Contamination Identified	Groundwater Elevations April 2004 mAOD	Groundwater Elevations Dec 13-14 2004 mAOD	Groundwater Elevations Mar 2005 mAOD	Golder Factual Report July 2009 Data (Ref 15I.8)	Serco March 2010 Report (Ref. 15I.2)	Mar 2010 Golder Letter Report (Ref. 15I.4)		May 2010 Golder Letter Report (Ref. 15I.9)	Dec 2010 Golder Letter Report (Ref. 15I.5)	
G42A	8.0-15.0	Dark grey mudstone	11.1	Tritium	-	-	-	-	-	-	-	9.13	-	-
G42B	2.0-8.0	Dark grey mudstone	11.1	-	-	-	-	-	-	-	-	-	7.63	-
G43	8.0-15.0	Dark grey mudstone	11.14	-	-	-	-	-	-	-	-	8.04	7.92	-
G44	2.0-8.0	Dark grey mudstone	11.11	-	-	-	-	-	-	-	-	-	8.19	-
G45A	8.0-15.0	Dark grey mudstone	8.13	-	-	-	-	-	-	-	-	4.95	4.55	-
G45B	2.0-8.0	Brown clay/dark grey mudstone	8.18	-	-	-	-	-	-	-	-	-	4.86	-
G46	14.0-20.0	Dark grey mudstone	11.2	-	-	-	-	-	-	-	-	-	4.24	-
OSD1	9.8-15.8	Mudstone with limestone bands	-	-	-	-	-	-	6.51-7.85	-	-	-	-	-
OSD2	10.0-15.0	Mudstone with limestone bands	-	Tritium	-	-	-	-	3.57-4.38	-	-	-	-	-
OSD3	10.0-15.0	Mudstone with limestone bands	-	-	-	-	-	-	3.55-4.03	-	-	-	-	-

15I.12 Conclusions

15I.12.1 The results for H-3 show that over an assumed 5 year dewatering period, H-3 from the HPA site is not likely to be drawn on to the HPA site or into the extracted dewatering water at a significant concentration compared to the current UK drinking water standard of 100Bq/l.

15I.12.2 Sr-90, Hg and naphthalene are all retarded contaminants and thus as such are even less likely to migrate a significant distance during the period of dewatering. However, some sources of these contaminants are closer to the HPA/C site boundary than for H-3, so some confirmatory modelling was undertaken. The results of this modelling confirmed that these contaminants are highly unlikely to present a risk to the HPC site or the dewatering location during dewatering.

15I.12.3 In summary, based on the above analysis there are no contaminants on the HPA site which present a risk to the HPC site or dewatering location under anticipated dewatering conditions.

References

15.I.1 Model Procedures for the Management of Contaminated Land. Contaminated Land Report 11 (CLR11). Environment Agency 2004.

15.I.2 SERCO (March 2010). Summary interpretive Land Quality Report for Hinkley Point A: Volume 1 & 2. Report Ref: SERCO/TAS/E03666/01 for Magnox South.

15.I.3 ConSim Manual Release 2. Golder Associates.

15.I.4 Golder, 2010a. Hinkley Point A Groundwater Monitoring and Associated Works (January 2010). Project No 09514270167.503.

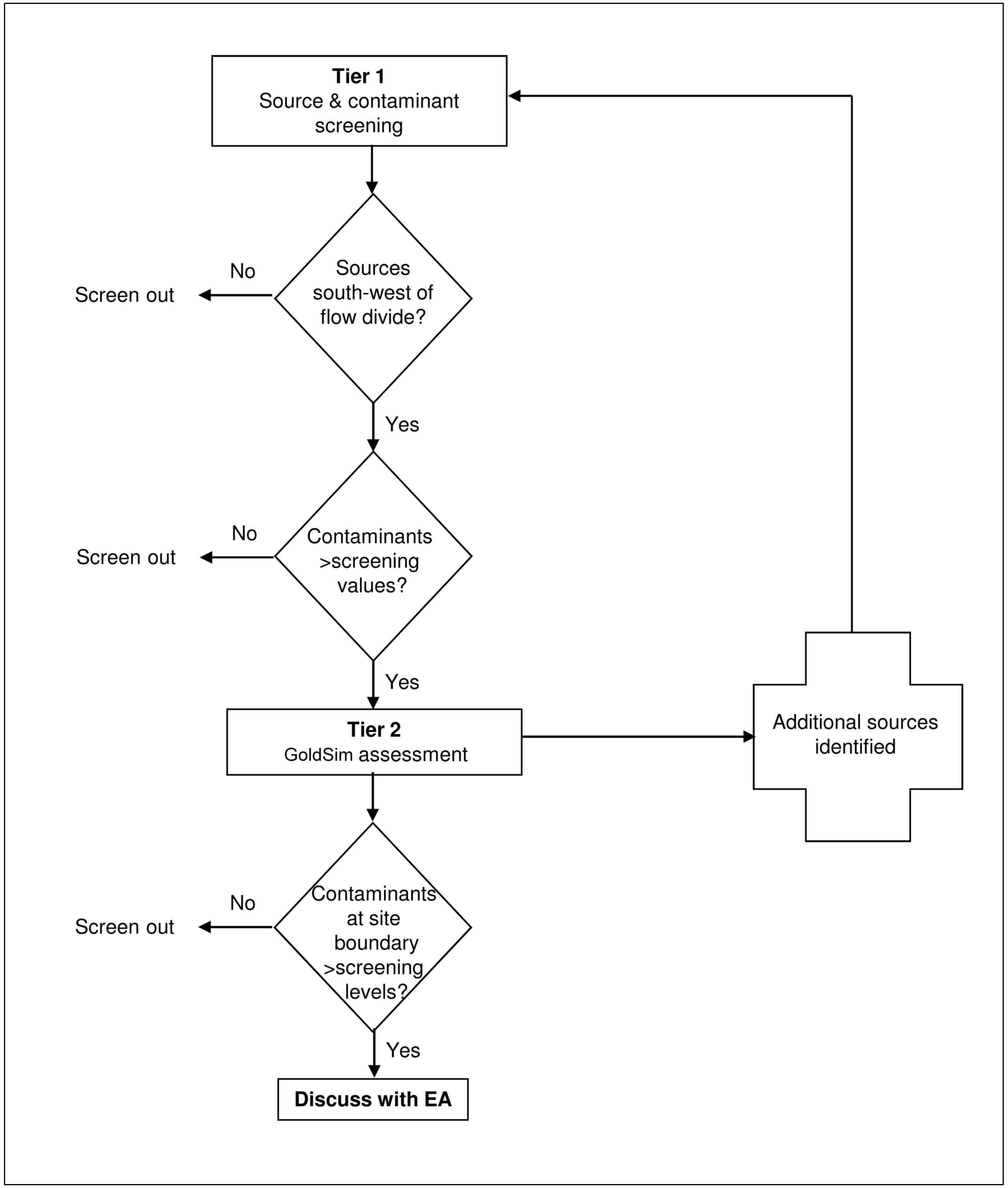
15.I.5 Golder, 2010b. Hinkley Point A Groundwater Monitoring (August 2010). Project No 10514270148.500.

15.I.6 EA, 2003. Review of the Fate and Transport of Selected Contaminants in the Soil Environment.

15.I.7 Allot Atkins Mouchel (1988). Hinkley point ‘C’ Power Station Geotechnical Studies, Geotechnical Summary Report – Chapter 7. Report Ref: HPC 1101/57

15.I.8 Golder Associates. Hinkley Point A Groundwater Monitoring (July 2009). October 2009

15.I.9 Golder Associates. Factual Letter Report on the Contaminated Land Intrusive Ground Investigation at the Hinkley Point A Site (May 2010).



KEY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

TIERED ASSESSMENT PROCESSED AND PASSED

FIGURE NO:	REVISION:
FIGURE 15.I.1	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	NTS

SCALE BAR

KEY

DEWATERING BEST ESTIMATE GROUNDWATER CONTOURS (mAOD)

GROUNDWATER FLOW DIVIDE

PARTICLE TRACES FROM **HPA** SITE

DRY CELLS

NO FLOW CELLS

DRAIN CELLS

DEEP PUMPING STATIONS EXCAVATIONS DEWATERED TO -25m OD

NULEAR ISLAND NORTH DEWATERED TO -12.5m OD

NULEAR ISLAND NORTH DEWATERED TO -4.2m OD

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

DEWATERING EFFECTS ON HINKLEY POINT A SITE

FIGURE NO:		REVISION:
FIGURE 15.I.2		01
DATE: SEPT 2011	DRAWN: C.Y.	SCALE: NOT TO SCALE

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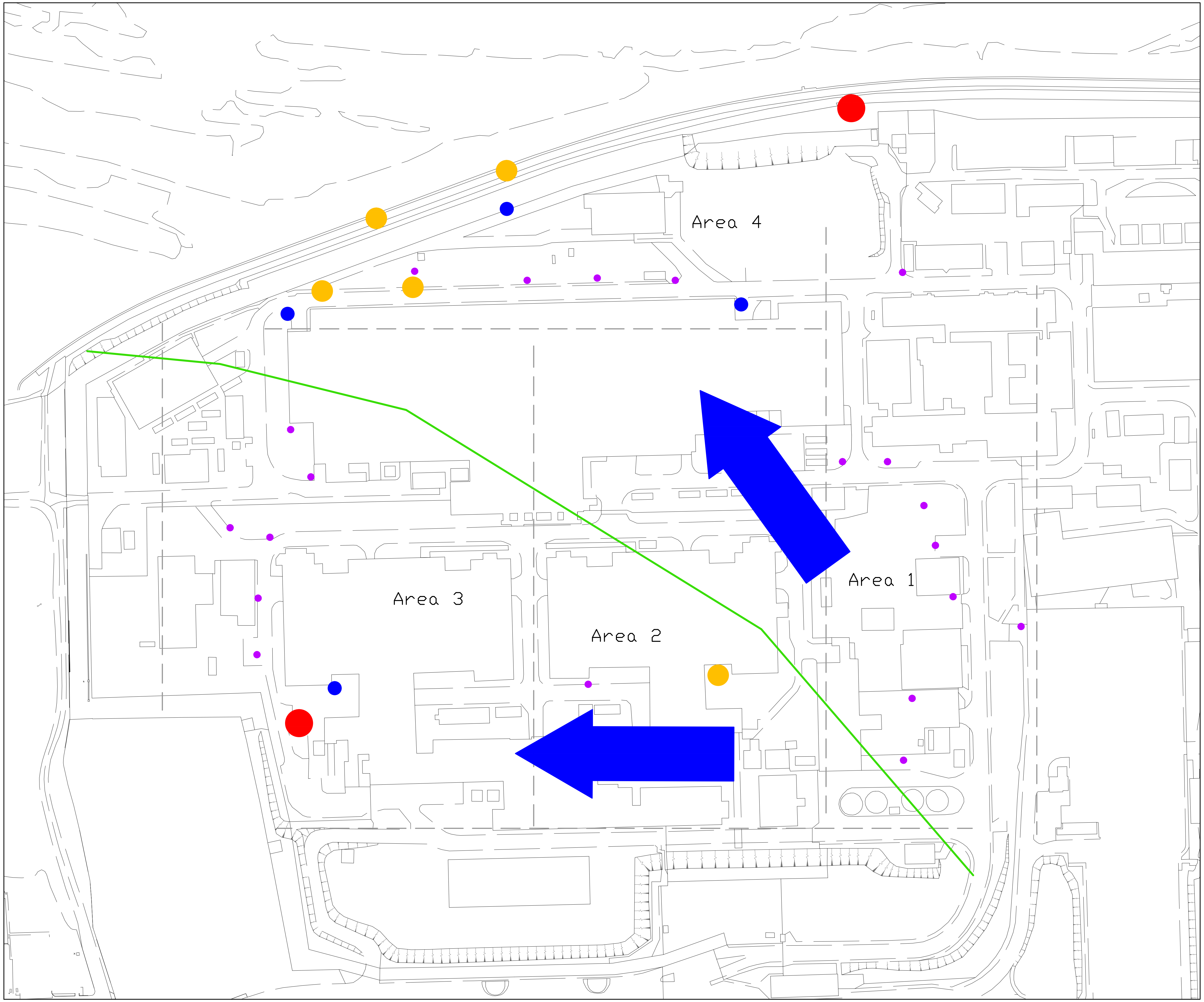

KEY

GROSS BETA ACTIVITY IN JANUARY 2009
GROSS BETA ACTIVITY (Bq/L)

- <0.5
- 0.5 - 1.0
- 1.0 - 5.0
- 5.0 - 20.0

GROUNDWATER FLOW DIRECTION

EXTENT OF 5 YEAR DEWATERING CAPTURE ZONE

NOTE: GROSS BETA ACTIVITY HAS BEEN DETECTED AT LARGER CONCENTRATIONS RELATIVE TO BACKGROUND IN SOME BOREHOLES ADJACENT TO KNOWN SOURCES IN AREAS 2 & 3. GROSS BETA ACTIVITIES IN AREA 1 WERE CLOSE TO, OR BELOW, THE DETECTION LIMIT.

N E S W

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

SR-90 SOURCES ON HINKLEY POINT A

FIGURE NO:	REVISION:
FIGURE 15.I.3	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	1:1,750@A3

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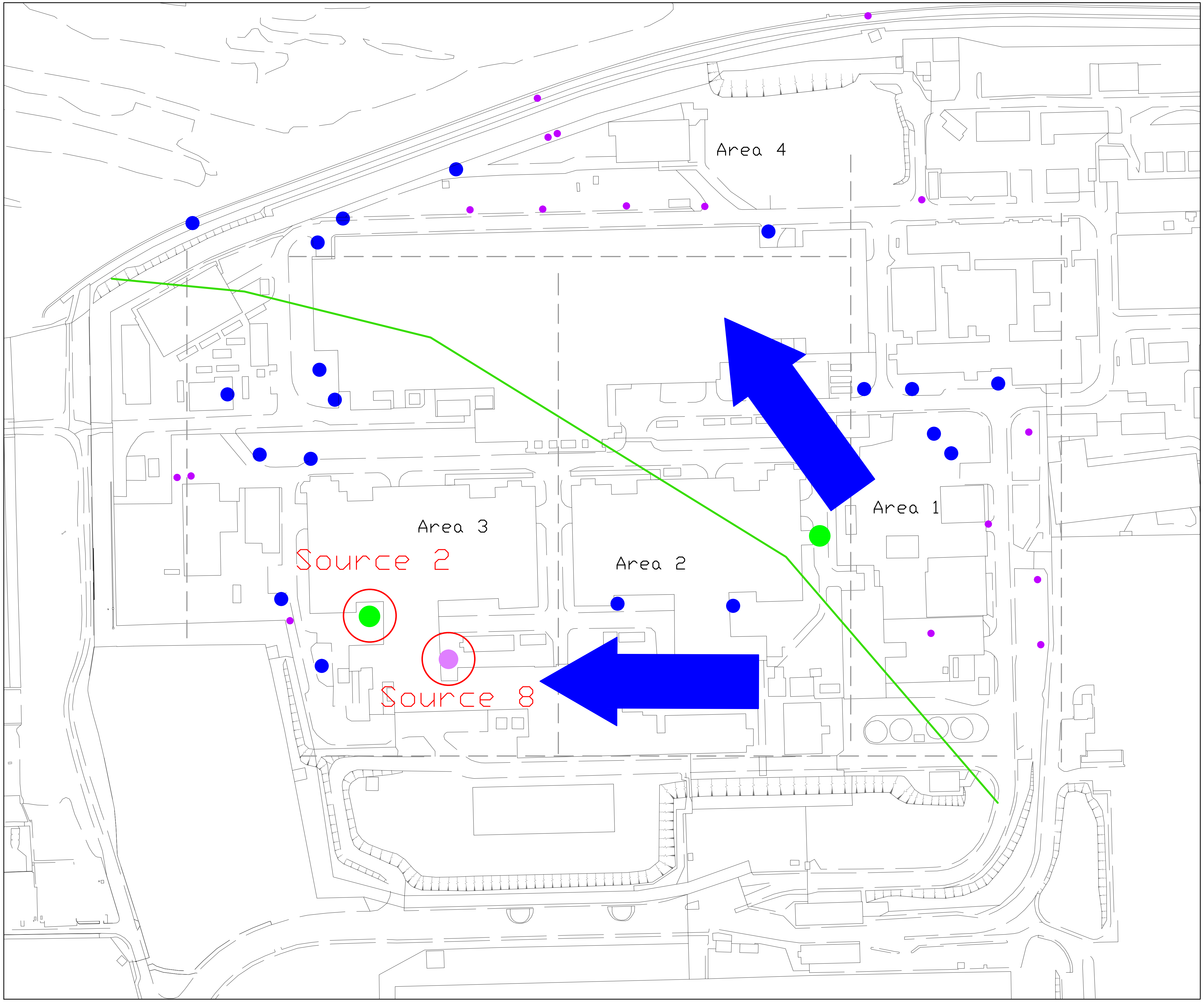

KEY

H-3 ACTIVITY IN JANUARY 2009
H-3 ACTIVITY (Bq/L)

<10

10 - 100

100 - 1000

1910 Bq/L (NOT IN SERCO DATA)

GROUNDWATER FLOW DIRECTION

EXTENT OF 5 YEAR DEWATERING CAPTURE ZONE

NOTE: IN JANUARY 2009 LARGER TRITIUM ACTIVITIES (>100Bq/L) WERE DETECTED IN AREAS 2 & 3 (RCA). IN AREA 1 BOREHOLES NORTH OF THE AEDL HAVE TRITIUM ACTIVITY UP TO 40Bq/L, BOREHOLES TO THE SOUTH OF THE AEDL HAVE <10Bq/L TRITIUM ACTIVITY.

DOCUMENT:
HINKLEY POINT C PROJECT
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FIGURE TITLE:
H-3 SOURCES ON HINKLEY POINT A

FIGURE NO:	REVISION:
FIGURE 15.I.4	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	1:1,750@A3

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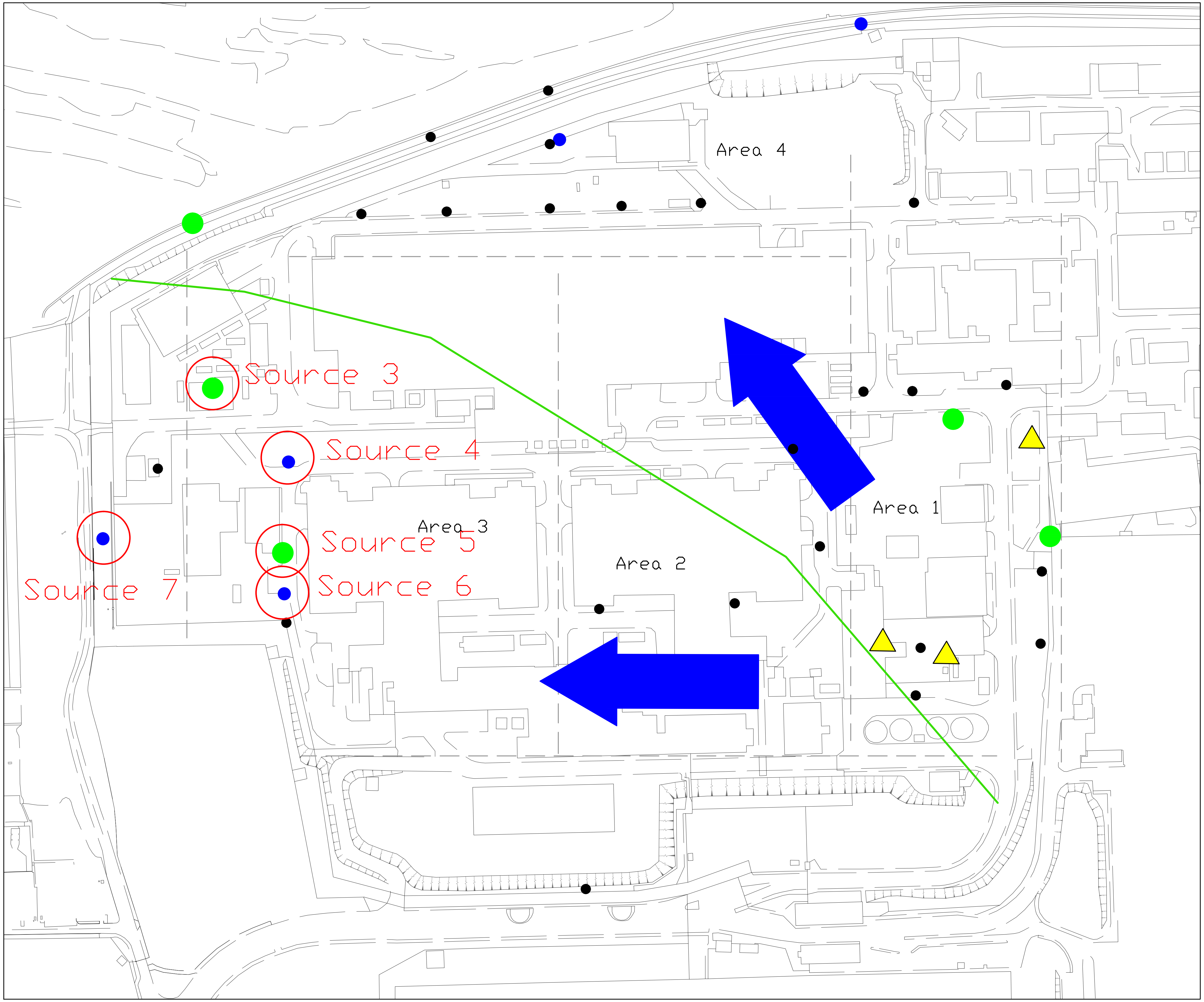

KEY

TPH CONCENTRATIONS IN JANUARY 2009
TPH CONCENTRATION (ug/L)

- <10
- 11 - 100
- 101 - 1000
- 1001 - 10000
- FREE PRODUCT

GROUNDWATER FLOW DIRECTION

EXTENT OF 5 YEAR DEWATERING CAPTURE ZONE

NOTE: IN JANUARY 2009 AREAS OF HYDROCARBON CONTAMINATION WERE PRESENT IN AREAS 1 & 3 AND TO A LESSER EXTENT IN AREA 4. NO TPH CONTAMINATION WAS PRESENT IN AREA 2 BOREHOLES.

N E S W

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:
TPH SOURCES ON HINKLEY POINT A (REPRESENTED AS NAPHTHALENE)

FIGURE NO:	REVISION:
FIGURE 15.I.5	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	1:1,750@A3

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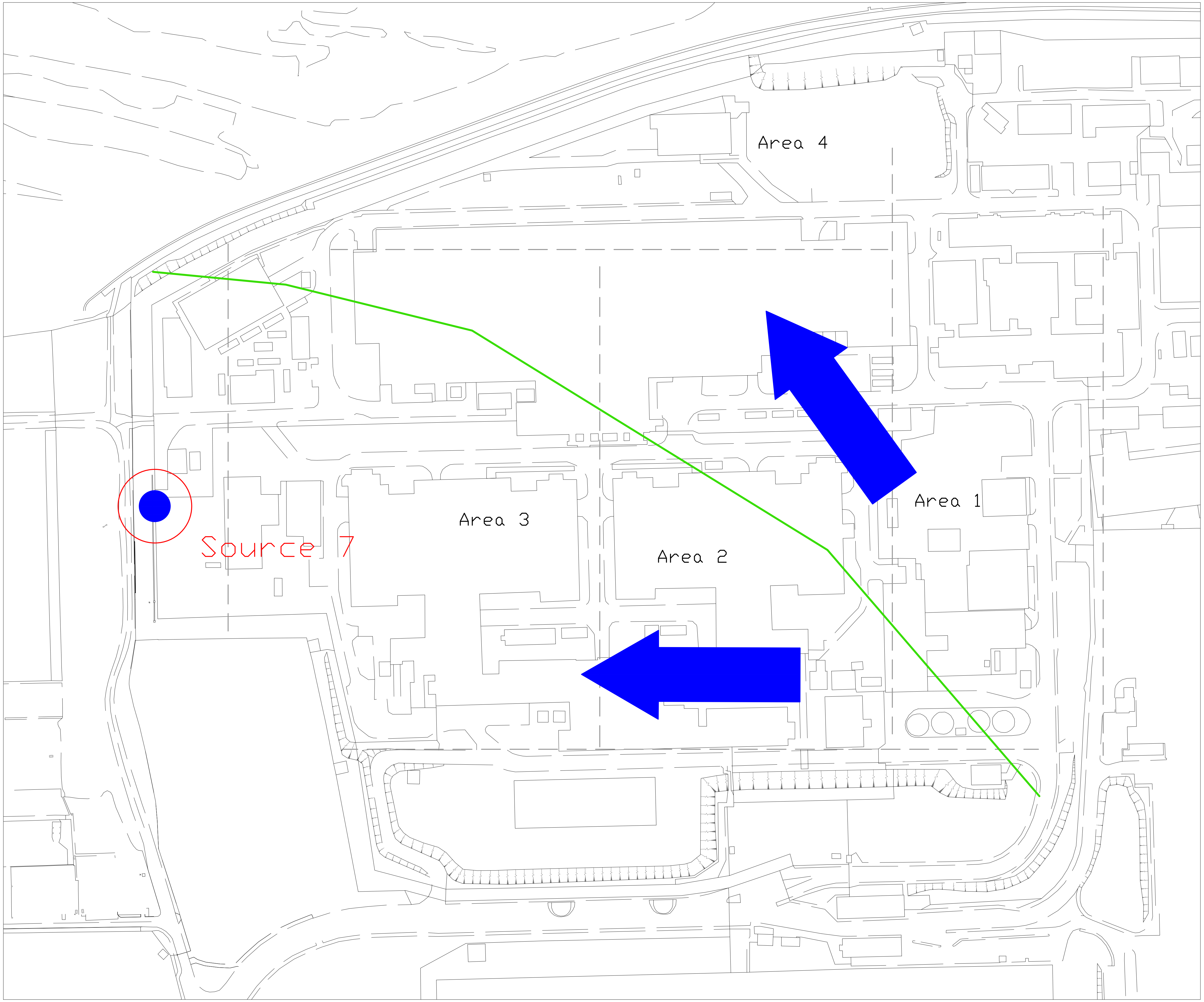

KEY

Hg CONCENTRATION - 0.039mg/l

Groundwater Flow Direction

Extent of 5 Year Dewatering Capture Zone

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

HG SOURCES IN HINKLEY POINT A

FIGURE NO:		REVISION:
FIGURE 15.I.6		01
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SEPT 2011	C.Y	1:1,750@A3

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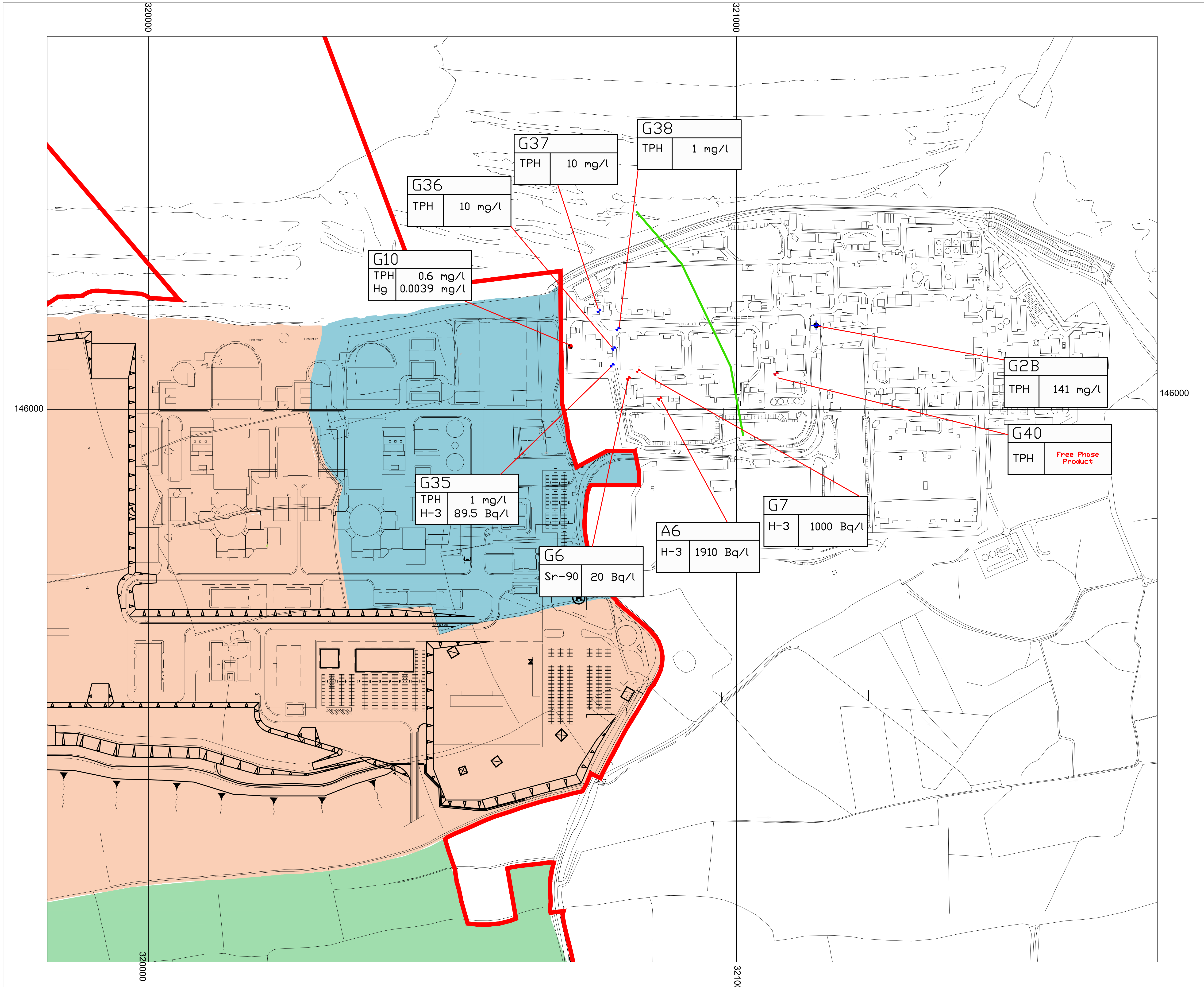

KEY

- HINKLEY POINT C DEVELOPMENT SITE BOUNDARY
- BUILT DEVELOPMENT AREA WEST
- BUILT DEVELOPMENT AREA EAST
- SOUTHERN CONSTRUCTION PHASE AREA
- GROUNDWATER MONITORING BOREHOLES
- CAPTURE ZONE/GROUNDWATER DIVIDE

BOREHOLE ID	
CONTAMINANT	CONCENTRATION

N
W E
S

eDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

GROUNDWATER CONTAMINANT CAPTURE ZONE/DIVIDE

FIGURE NO:		REVISION:
FIGURE 15.I.7		01
DATE:	DRAWN:	SCALE:
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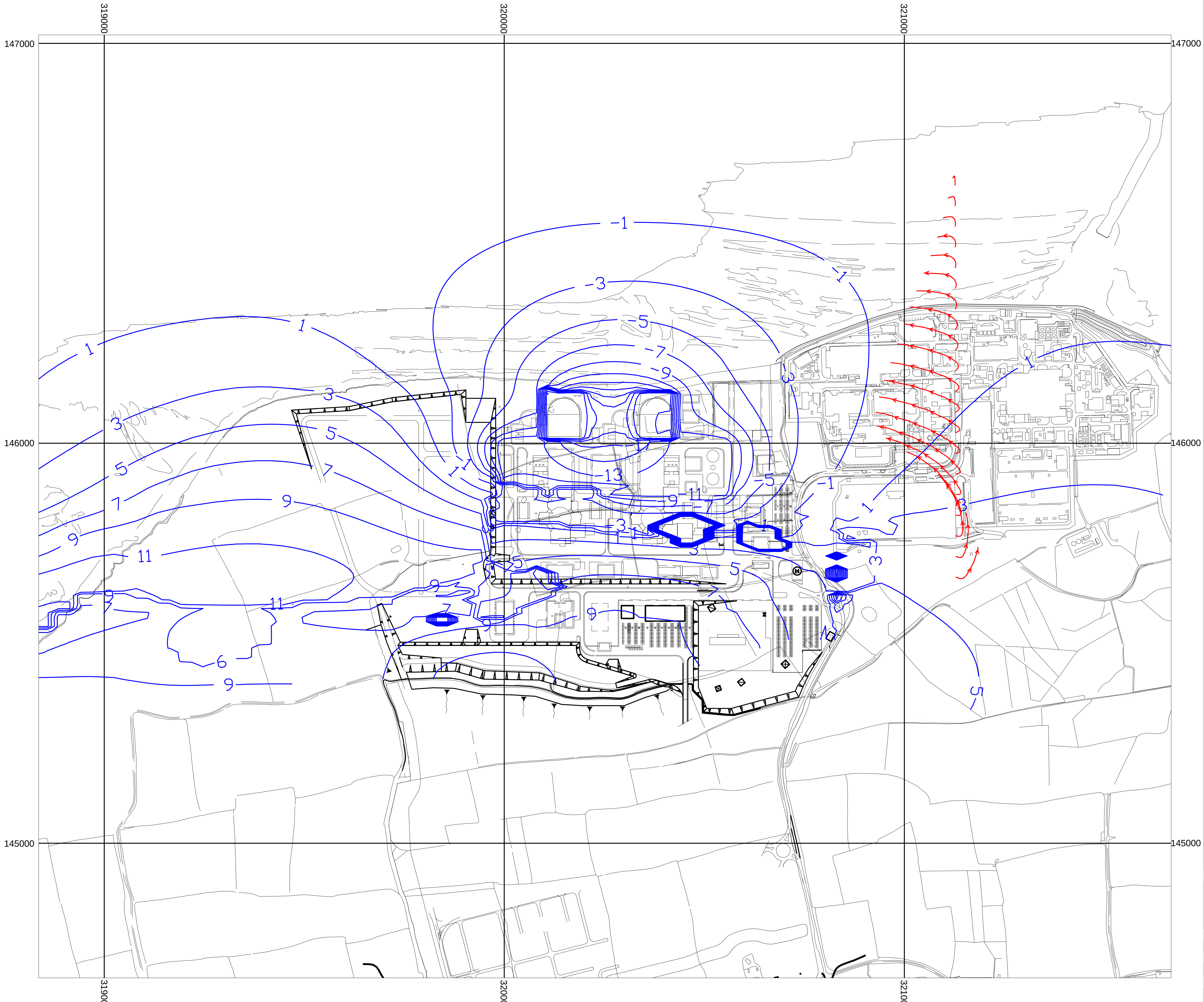

KEY

MODELLED GROUNDWATER CONTOURS(mAOD)

DEWATERING PHATLINES

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

PLAN SHOWING PATHLINES FROM EAST OF HPA SITE UNDER DEWATERING CONDITIONS

FIGURE NO:	REVISION:
FIGURE 15.I.8	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	1:9,000@A3

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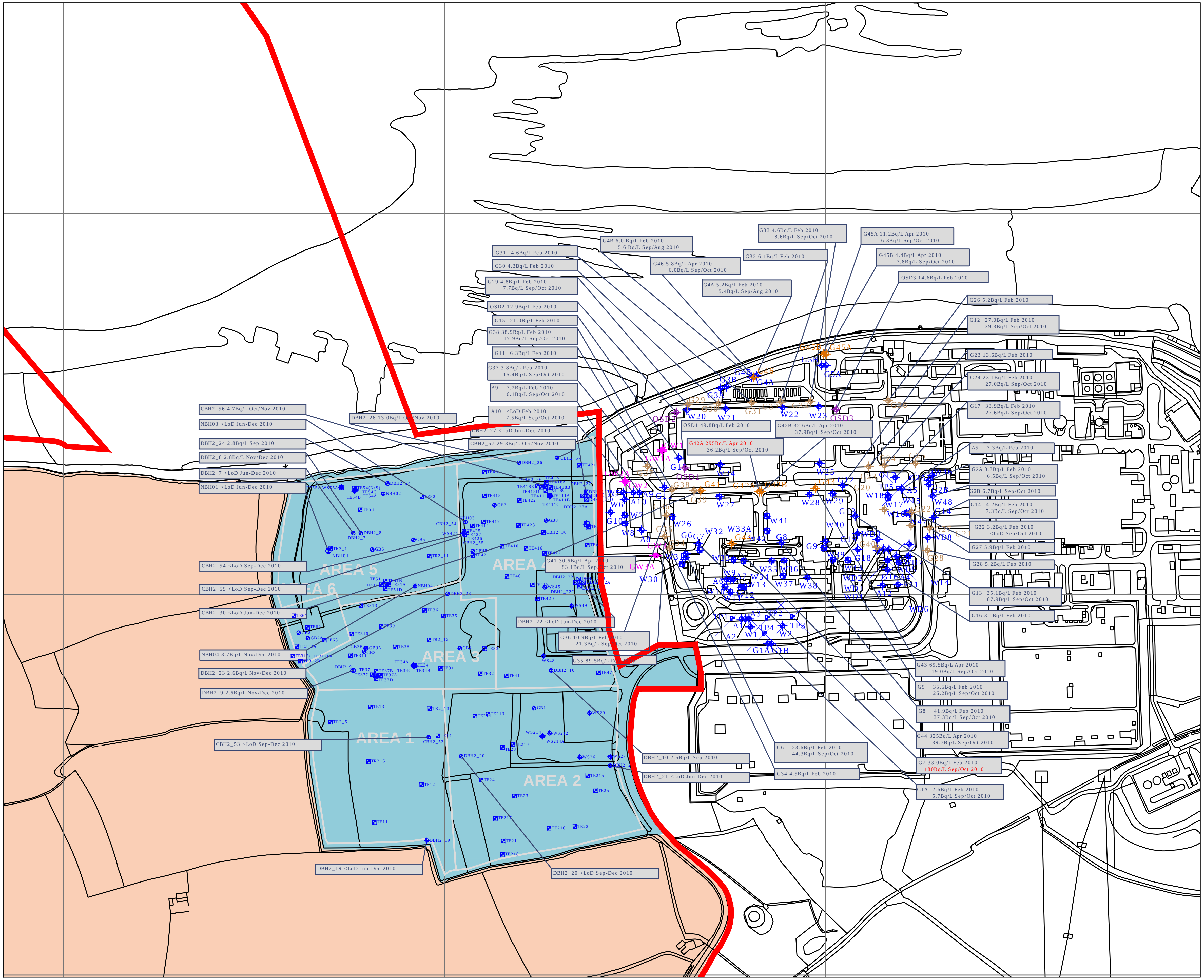

KEY

- HINKLEY POINT C REDEVELOPMENT SITE BOUNDARY
- BUILT DEVELOPMENT AREA WEST
- SOUTHERN CONSTRUCTION PHASE AREA

- TRIAL PIT
- GROUNDWATER MONITORING BOREHOLE

REFERENCE REPORT: BE015 CEGB (1989) HINKLEY POINT A POWER STATION SOMERSET REPORT ON GROUNDWATER INVESTIGATION VOLUME 1. REPORT REF 1182

- BOREHOLE

REFERENCE REPORT: BE020/BE027 SERCO (2005) INTERPRETATIVE REPORT OF THE COMBINED PHASE 2 AND 3 CONTAMINATED LAND INVESTIGATION AT HINKLEY POINT A POWERSTATION. REPORT FOR BRITISH NUCLEAR GROUP. REF SA/ENV/0779/ISSUE 1

- GROUNDWATER MONITORING BOREHOLE

REFERENCE REPORT: MX01/01 SERCO 2010, SUMMARY INTERPRETIVE LAND QUALITY REPORT FOR HINKLEY POINT A: VOLUME 1 AND VOLUME 2. MAGNOX SOUTH (REF: SERCO/TAS/E03666/001.)

- BACKFILLED SHALLOW SAMPLING POINT

REFERENCE REPORT: AMEC REPORT 15011/TR/00161 PREL D SUMMARY OF GROUNDWATER ANALYSIS RESULTS FOR THE BUILT DEVELOPMENT AREA EAST AND SOUTHERN CONSTRUCTION PHASE AREA (MAXIMUM RECORDED CONCENTRATION)

- CABLE PERCUSSIVE AND ROTARY BOREHOLES
- TRIAL PIT
- HAND EXCAVATED PIT
- WINDOWLESS SAMPLING BOREHOLE

REFERENCE REPORT: GOLDER ASSOCIATES FACTUAL LETTER REPORT ON THE CONTAMINATED LAND INTRUSIVE GROUND INVESTIGATION AT THE HINKLEY POINT A SITE (09514270307.500)

- CABLE PERCUSSIVE AND ROTARY BOREHOLES

NOTE: <LoD INDICATES CONCENTRATION BELOW LABORATORY LIMIT OF DETECTION (VARIABLE BY SAMPLE).ANALYTICAL DATA UNCERTAINTY FACTOR NOT REPORTED FOR CLARITY REASONS. CONCENTRATIONS RECORDED IN LAND DRAIN OUTFALLS NOT INCLUDED AS NOT RELEVANT TO GROUNDWATER QUALITY.DATA COLLATED FROM GOLDER LTD REPORTS REFERENCE 09514270167.503 (MARCH 2010), 09514270307.500 (MAY 2010) AND 10514270148.500 (AUGUST 2010). DATA FOR BUILT DEVELOPMENT AREA EAST (BDAE) DERIVED FROM REPORT 15011/TR/00161 PREL D: "SUMMARY OF GROUNDWATER QUALITY RADIOCHEMICAL ANALYSIS RESULTS FOR THE BUILT DEVELOPMENT AREA EAST AND SOUTHERN CONSTRUCTION PHASE AREA". FOR AMEC DATA MAXIMUM RECORDED CONCENTRATION ONLY REPORTED.

EDF ENERGY

DOCUMENT:

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ENVIRONMENTAL STATEMENT
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FIGURE TITLE:

GROUNDWATER H-3 CONCENTRATIONS 2010

FIGURE NO:	REVISION:
FIGURE 15.I.9	01

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SEPT 2011	C.Y	1:1,500@A0

SCALE BAR
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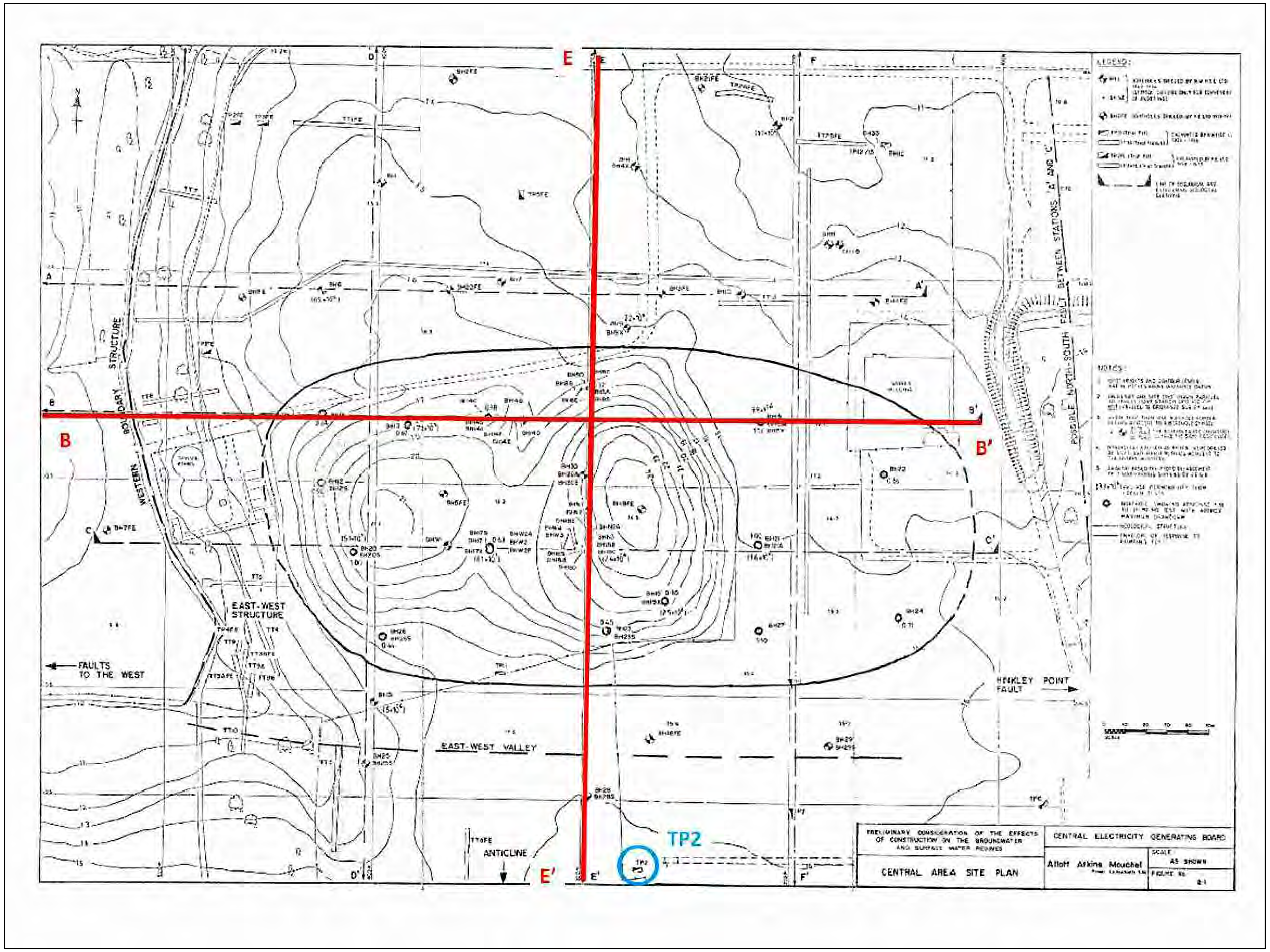
KEY

SEE DETAIL WITHIN FIGURE



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ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

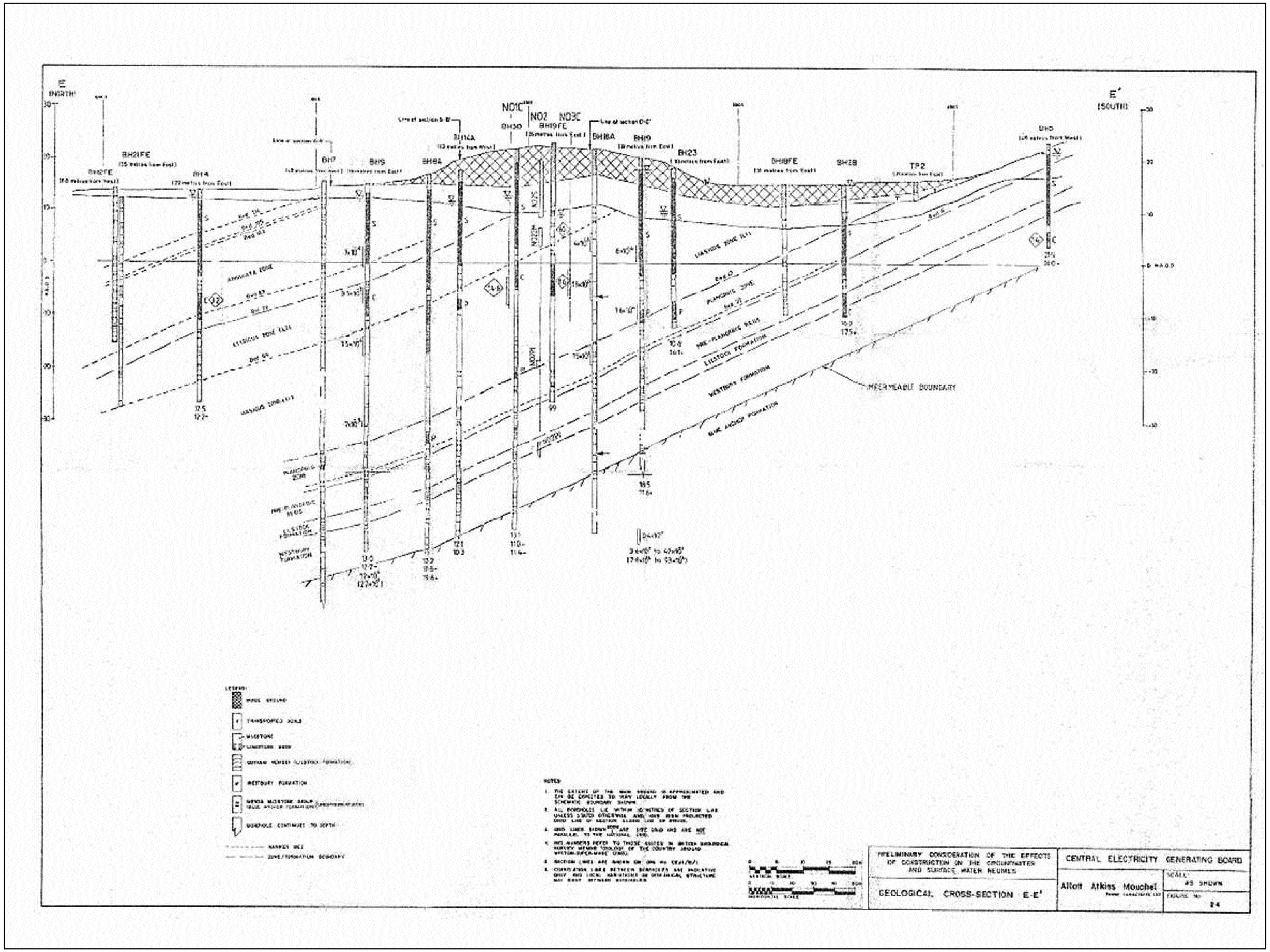
FIGURE TITLE:

LOCATION OF CROSS SECTIONS (AFTER ALLOTT ATKINS MOUCHEL,1988)

FIGURE NO:	REVISION:
FIGURE 15.I.10	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	SEE FIGURE

SCALE BAR



KEY

SEE KEY WITHIN FIGURE

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

CROSS SECTION E (AFTER ALLOTT ATKINS MOUCHEL,1988)

FIGURE NO:	REVISION:
FIGURE 15.I.11	01

DATE:	DRAWN:	SCALE:
SEPT 2011	C.Y	SEE FIGURE

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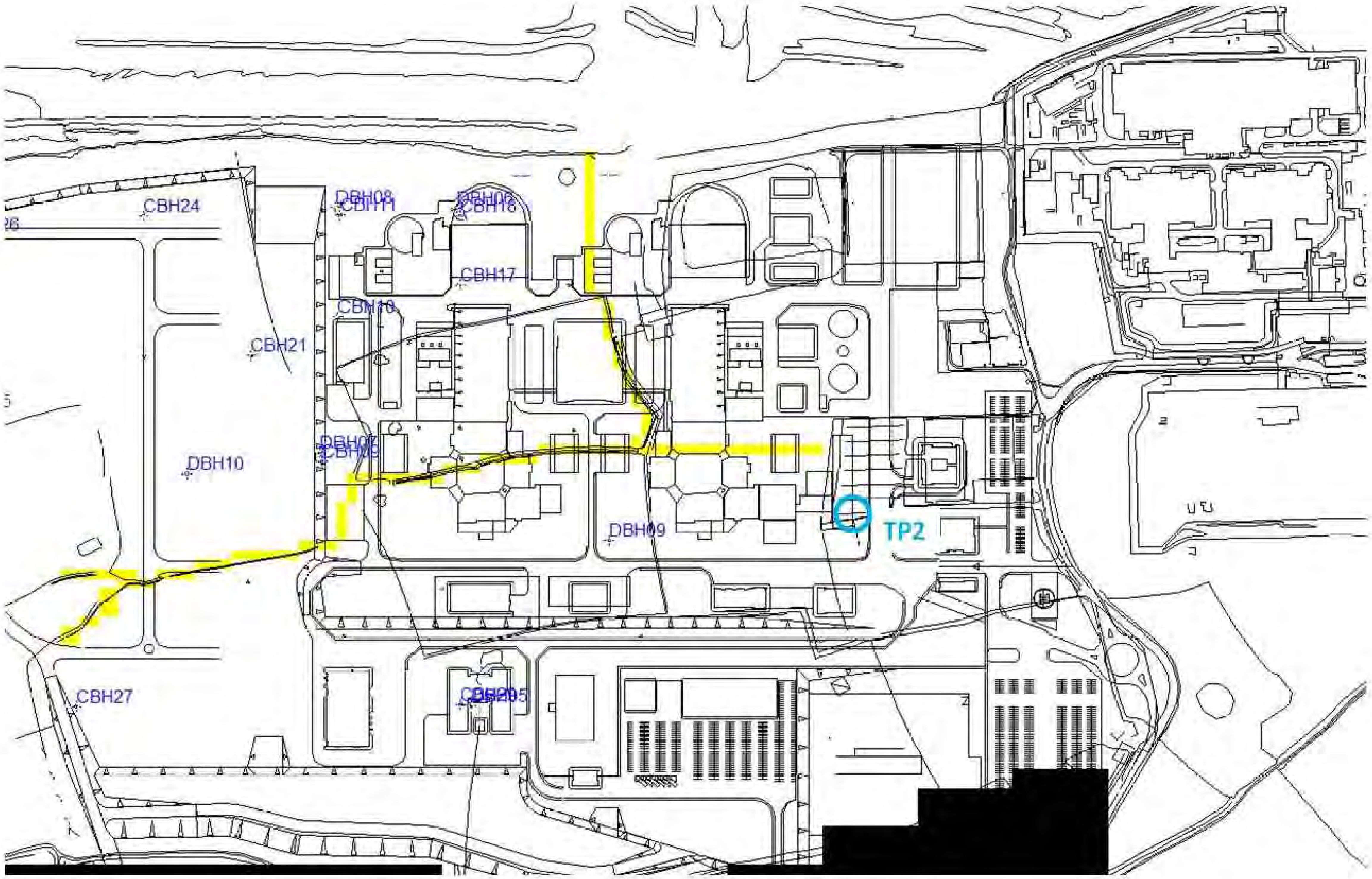

KEY

- MODEL DRAIN CELLS
- BOREHOLE LOCATION
- TRIAL PIT LOCATION

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:
LOCATION OF TP2 IN CURRENT CONTEXT
(AFTER ALLOTT ATKINS MOUCHEL,1988)

FIGURE NO:		REVISION:
FIGURE 15.I.12		01
DATE: SEPT 2011	DRAWN: C.Y	SCALE: NTS

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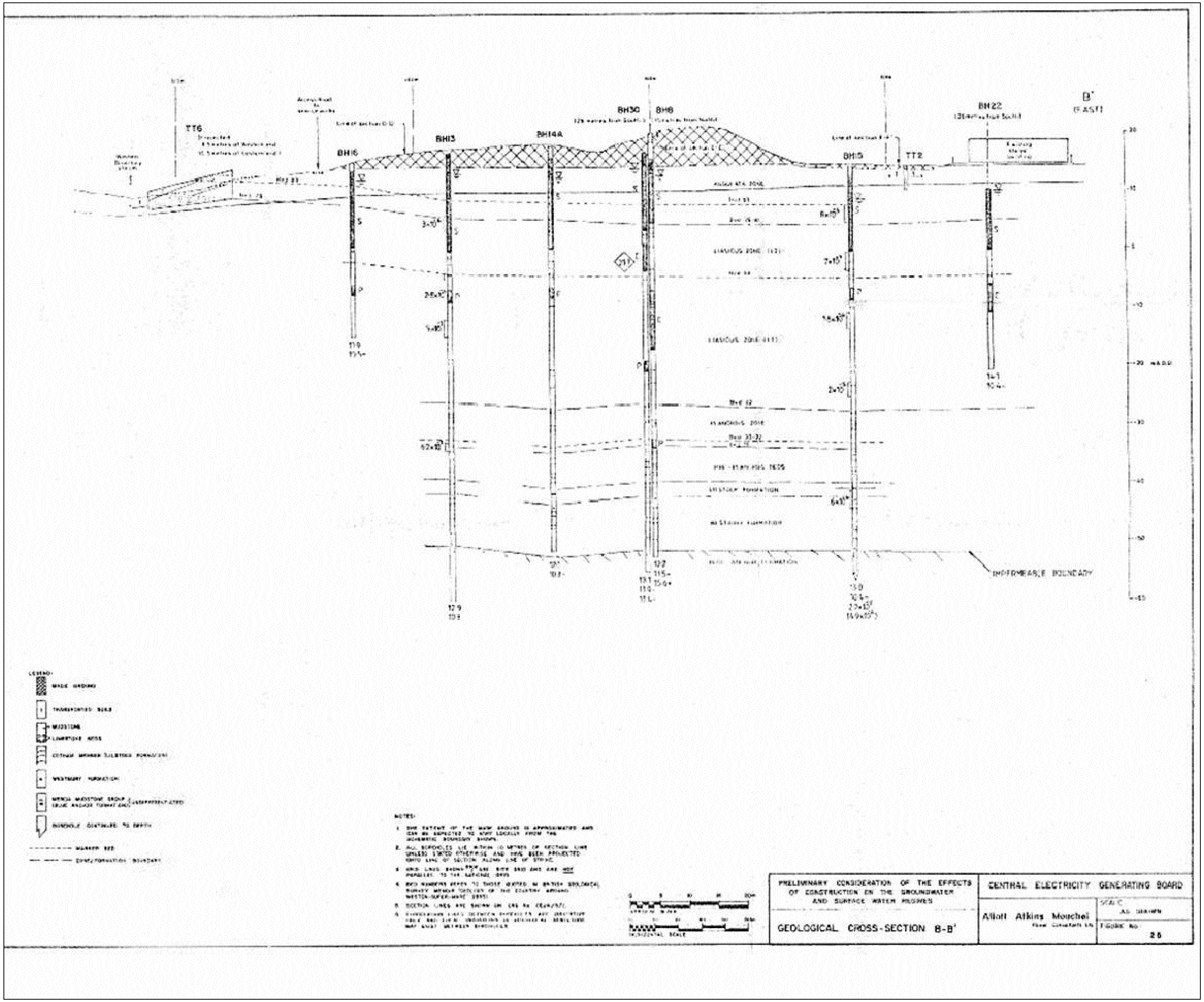
KEY

SEE LEGEND WITHIN FIGURE



DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 15

FIGURE TITLE:

CROSS SECTION B (AFTER ALLOTT ATKINS MOUCHEL,1988)

FIGURE NO: FIGURE 15.I.13

REVISION: 01

DATE: SEPT 2011

DRAWN: C.Y

SCALE: SEE FIGURE

SCALE BAR

APPENDIX 16A PHOTOGRAPHS

Plates 16.1 and 16.2: Photographs illustrating the catchment characteristics of Hinkley Point C Drainage Ditch. The top photo is taken from west of the source looking east northeast and the bottom photo is taken from directly north of the source, which is located in the hedgerow in the middle distance of the photograph.

Plates 16.3 and 16.4: Photographs of Holford Stream. The top photo is taken immediately upstream of C182 looking upstream. The bottom photo shows the downstream face of the old sluice where Holford Stream converges with West Brook.

Plates 16.5 and 16.6: Photographs of Holford Stream vegetation. The top photo is taken immediately downstream of C182. The bottom photo illustrates the dense channel and riparian vegetation that is characteristic of many of the watercourses in the area.

Plates 16.7 and 16.8: Photographs showing Bum Brook. The top photo is looking downstream at its confluence with Bailey's Brook. The bottom photo shows the aforementioned ford.

Plates 16.9 and 16.10: Photographs of Bum Brook. The top photo is looking upstream from C182. The bottom photo is looking downstream from C182.

Plates 16.11 and 16.12: Photographs of Stogursey Brook. The top photo is looking upstream from C182. The bottom photo is looking downstream from C182.

Plates 16.13 and 16.14: Photographs of East and West Brook. The top photo is of West Brook immediately downstream from the Bum Brook bifurcation. The bottom photo shows the confluence of East Brook (left of shot) with West Brook.

Plates 16.15 and 16.16: Photograph of East Brook immediately upstream of its confluence with West Brook (top photo) and riparian vegetation in West Brook.

Plates 16.17 and 16.18: Photographs of Great Arch Sluice upstream face (top photo) and outfall on the foreshore (bottom photo).

Plates 16.19 and 16.20: Great Arch Sluice Inspection chamber at low tide (top photo) and high tide (bottom photo).

Plates 16.21 and 16.22: Photographs of Rhyne East looking towards Cole Lane Sluice (top photo) and Cole Lane Sluice (bottom photo).

APPENDIX 16B WATER QUALITY DATA SUMMARY GRAPHS

Appendix 16B1 Terrestrial Surface Water Suspended Solids Data – Overall Mean Data for Each Monitoring Site.

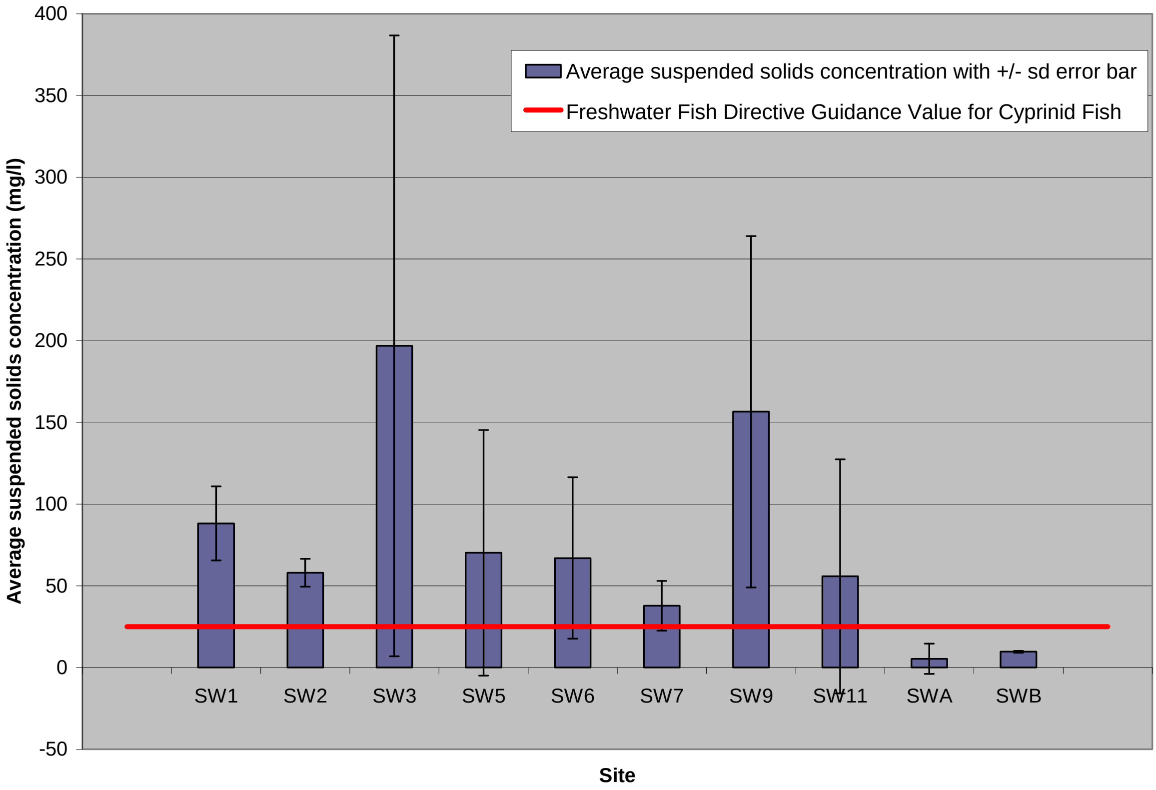


Figure Notes:

Standard deviations are presented as error bars for each site.

Appendix 16B2 Terrestrial Surface Water Ammonia Data – Overall Mean Data for Each Monitoring Site.

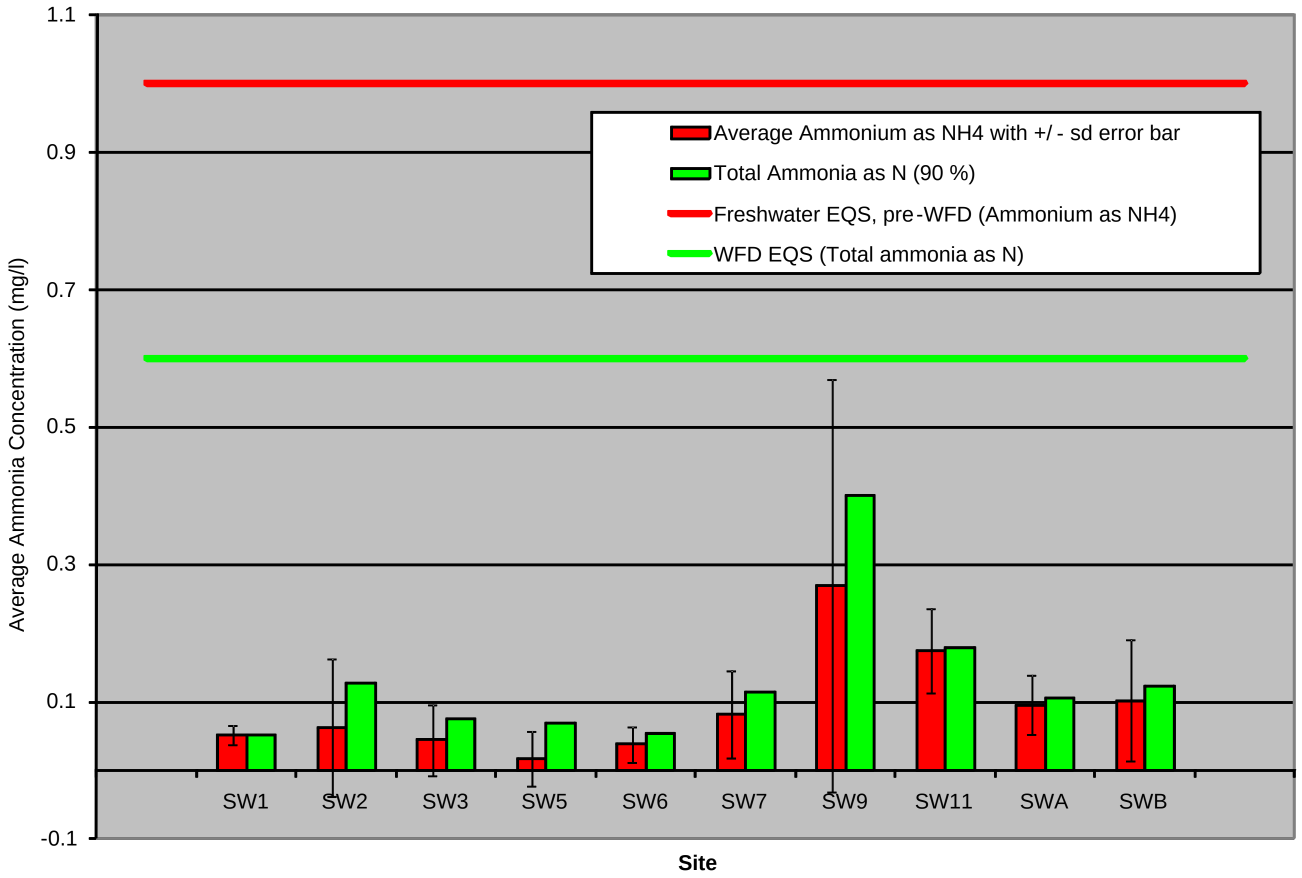


Figure notes:
Standard deviations are presented as error bars for each site.

Appendix 16B3 Terrestrial Surface Water BOD Data – Overall Mean Data and 90th Percentile Data for Each Monitoring Site.

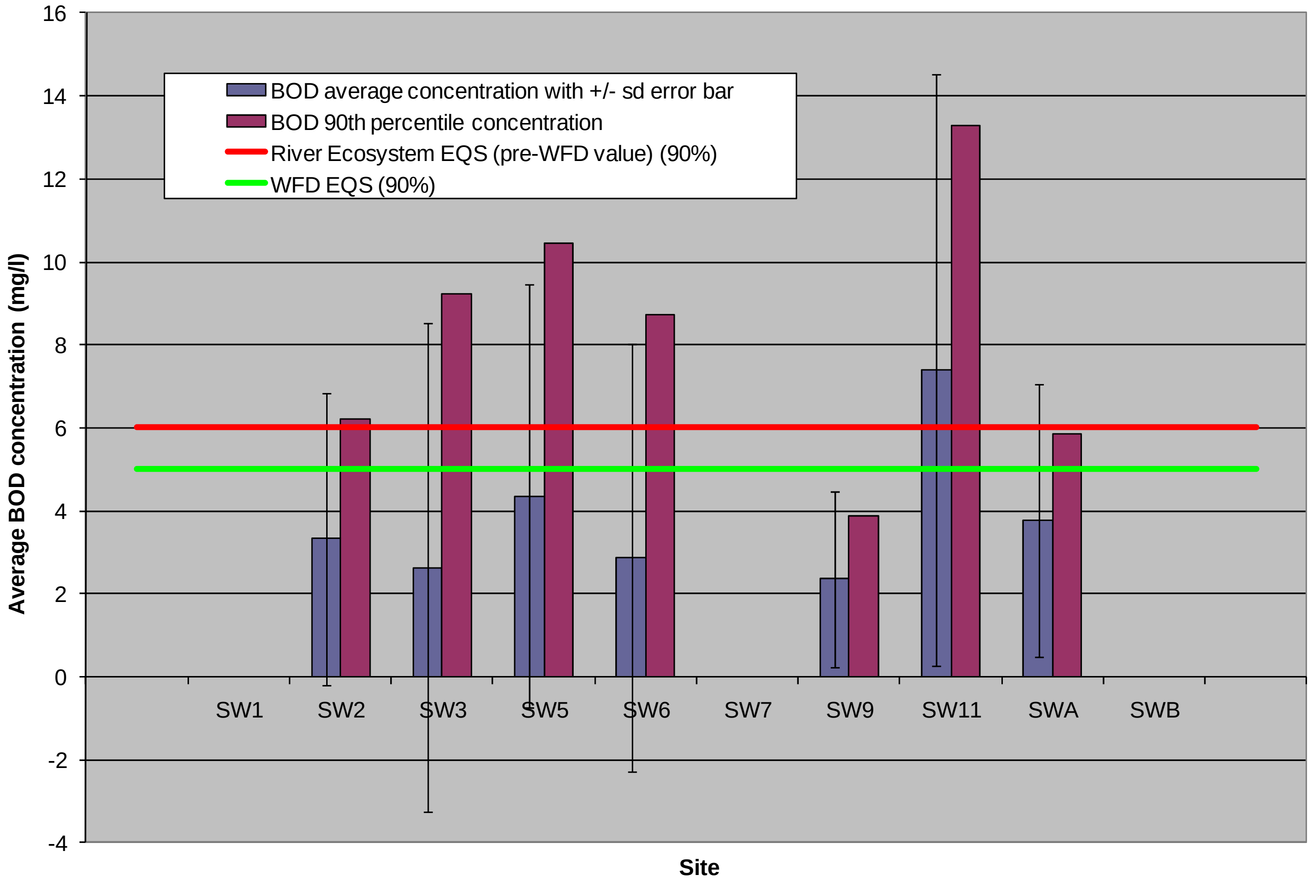


Figure notes:
Standard deviations are presented as error bars for each site.

APPENDIX 16C: ENVIRONMENT AGENCY STOGURSEY BROOK WATER QUALITY DATA

Summary Environment Agency Water Quality Data for Stogursey Brook at Grid Ref X: 317800 Y: 142400

		2002			2003			2004			2005			2006			2007		
Determinant	Units	Mean	St Dev	Class	Mean	St Dev	Rating	Mean	St Dev	Rating	Mean	St Dev	Rating	Mean	St Dev	Rating	Mean	St Dev	Rating
Nitrates*	mg/L			5			5			5			5			5			5
Phosphates*	mg/L			5			5			5			5			5			5
Biochemical Oxygen Demand	mg/L	1.84	1.26		1.6	0.56		1.92	0.76		2.35	1.55		2.27	1.47		n/a	n/a	
Ammonia[1]	mgN/L	0.11	0.12	A	0.09	0.06	B	0.11	0.11	A	0.24	0.45	B	0.25	0.42	B	n/a	n/a	B
Dissolved Oxygen[2]	% Saturation	101.24	18.95	B	97.43	20.12	B	91.38	20.82	C	86.65	18.41	C	96.42	30.97	D	n/a	n/a	C
Un-ionised Ammonia	mgN/L	0	0.00191		0	0.00153		0	0.00202		0.01	0.01		0.01	0.01		n/a	n/a	
pH acid	pH Units	8.09	0.26		8.01	0.26		7.94	0.32		7.97	0.34		8	0.46		n/a	n/a	
pH alkali	pH Units	8.09	0.26		8.01	0.26		7.94	0.32		7.97	0.34		8	0.46		n/a	n/a	
Hardness	mg/L CaCO3	386			399			394			331			331			n/a	n/a	
Dissolved Copper	ug/L	1.23	2.18		0.58	1.19		3.24	1.75		4.56	3.43		4.79	3.01		n/a	n/a	
Total Zinc	ug/L	6.37	15.65		2.37	5.81		20.86	36.8		19.84	35.04		21.4	31.11		n/a	n/a	

* - Nutrients classified from class 1 (very low) to class 6 (excessively high)

1 and 2 - Chemistry classification from class F (Bad) to A (Very Good)

APPENDIX 16D: WFD WATERBODY TABLE FOR STOGURSEY BROOK

Waterbody Category and Map Code.:	River - R84	**Surveillance site:** No
Waterbody ID and Name:	GB108052021340	STOGURSEY BK
National Grid Reference:	ST 19542 43410	
Current Overall Status	Poor	
Status Objective (Overall):	Good by 2015	(For Protected Area Objectives see Annex D)
Status Objective(s):	Good Ecological Status by 2015	
Justification if overall objective is not good status by 2015:		
Protected Area Designation:	Natura 2000 (Habitats and/or Birds Directive), Nitrates Directive	
SSSI (Non-N2K) related:	No	
Hydromorphological Designation:	Not Designated A/HMWB	
Reason for Designation:		
Downstream Waterbody ID:	GB540805210900	

Ecological Status

Current Status (and certainty that status is less than good) Poor (Quite Certain - WoE)

Biological elements

Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Invertebrates	Good	Good	
Phytobenthos	Poor (Very Certain)	Good	

Supporting elements

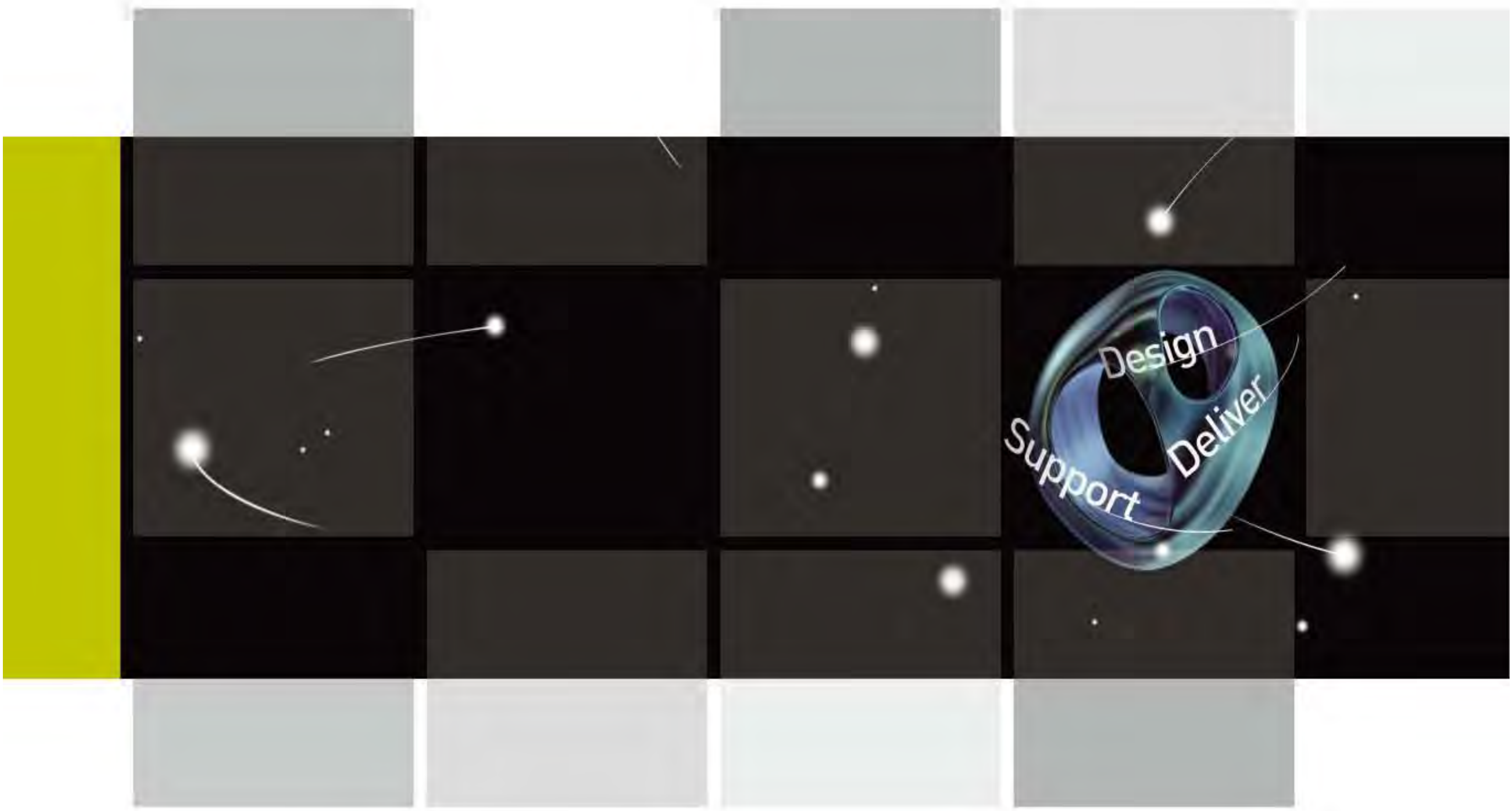
Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Ammonia (Phys-Chem)	Good	Good	
Dissolved Oxygen	High	High	
pH	High	High	
Phosphate	Poor (Very Certain)	Good	
Temperature	High	High	
Copper	High	High	
Zinc	High	High	
Ammonia (Annex 8)	Good	Good	

Supporting conditions

Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Quantity and Dynamics of Flow	Supports Good	Supports Good	
Morphology	Supports Good	Supports Good	

Chemical Status	
Current Status (and certainty that status is less than good)	Does not require assessment

APPENDIX 16E: SUMMARY OF TERRESTRIAL SURFACE WATER QUALITY NON-RADIOCHEMICAL ANALYSIS RESULTS REPORT



Summary of Terrestrial Surface Water Quality Non-Radiochemical Analysis Results (Campaigns 1-6 including WFD)

15011/TN/00102
Issue 02 - Final
August 2010

CONTENTS

1.0 INTRODUCTION

The surface watercourses that currently drain the proposed Built Development Area West are formed from an i nterconnected series of agricultural drainage ditches. These watercourses ultimately discharge water to the foreshore at Hinkley Point through an unnamed watercourse that flows along the boundary between the proposed Built Development Area West and the Built Development Area East.

There are no historical water quality data available for the surface watercourses draining the proposed development area. To characterise the baseline terrestrial surface water quality environment, a m onitoring programme was carried out in 2009. Following the third monitoring campaign the geographical scope of the monitoring area was extended to include those additional watercourses that drain the Southern Construction Phase Area.

This report includes comparison to recently implemented Environmental Quality Standards (EQS) under the Water Framework Directive[1] (WFD) and supercedes the previous summary report entitled 'Summary of Terrestrial Surface Water Quality Non-Radiochemical Analysis Results (Campaigns 1-6)[2]'.

2.0 SUMMARY OF MONITORING PROGRAMME

2.1 Monitoring programme

Terrestrial surface water quality monitoring was undertaken on surface freshwater features (unnamed field ditches and streams) on the Built Development Area West land. Water sample collection and r ecording of *in-situ* water quality parameters such as pH, dissolved oxygen and temperature was undertaken on an approximately monthly basis commencing in January 2009. Six campaigns were undertaken in total, as discussed with the Environment Agency during a consultation meeting held in December 2008. The dates of the 6 sampling campaigns are provided in Table 1 .

Following campaign number 3 in April 2009, the geographical scope of the monitoring area was increased, to cover the Southern Construction Phase Area. As a result, during campaigns 4, 5 and 6, three additional sample locations were added to ensure that a comprehensive baseline of the water quality conditions on the Southern Construction Phase Area was also established.

The locations of the freshwater surface monitoring points are presented in Appendix A. The additional monitoring points on the Southern Construction Phase Area are marked as the surface watercourse sampling sites (SW): SWA (Bum Brook); SWB (Holford Stream); and, SWC (unnamed watercourse).

Table 1 Dates of sampling campaign visits.

Sampling campaign number	Date of sampling visit	Replicate details
1	26th January 2009	No replicate taken
2	2nd – 3rd March 2009	Duplicate taken at SW7
3	14th – 15th April 2009	Duplicate taken at SW9
4	18th – 19th May 2009	Duplicate taken at SW6
5	9th June 2009	Duplicate taken at SWA Additional field blank.
6	15th July 2009	Duplicate taken at SWB

2.2 Southern Construction Phase Area freshwater features

Bum Brook flows from west to east along the southern boundary of the Southern Construction Phase Area land. Bum Brook joins Storgursey Brook approximately 400 m downstream of the Southern Construction Phase Area where it becomes Mill Stream. Sampling site SWA was located at the point at which Bum Brook deviates from the Southern Construction Phase Area boundary i.e. the most downstream point adjacent to the Southern Construction Phase Area land. At SWA, Bum Brook had a wide (approximately 3 to 4 m), shallow channel (approximately 0.3 m in depth), a pebbled bed and a moderate flow velocity (estimated to be approximately 0.25 m/s).

Holford Stream flows eastwards across the Southern Construction Phase Area before flowing from west to north-east between North Moor and Wick Moor. The SWB monitoring site was located on Holford Stream at the approximate point at which the stream crosses the Southern Construction Phase Area boundary. The stream at SWB was shallow (approximately 0.4 m) with no observable flow during the site visits and discoloured with suspended sediments. Bum Brook, and in particular Holford Stream, are important water supply streams to the Bridgwater Bay Site of Special Scientific Interest (SSSI).

The designation of the Bridgwater Bay SSSI[3] is due largely to the communities of plants and invertebrates that are associated with a network of ditches and ponds. Due to the water dependent nature of the SSSI, Holford Stream may be viewed as highly sensitive to potential water quality impacts.

The SWC monitoring site was located on an unnamed drainage ditch close to the Southern Construction Phase Area. This unnamed drainage ditch was found to be dry, or with insufficient water to sample, during every one of the sampling visits, therefore no samples were taken at this site.

2.3 Sample collection

The sample collection methodology and handling of samples was undertaken according to the methods described in the British Standard for Water Quality Sampling[4]. Water samples were collected in 1 litre glass bottles. Where access allowed, samples were collected by direct placement of the sampling bottle below the surface of the stream or ditch facing in an upstream direction. Where direct access to the waters edge was restricted (due to bramble bushes for example), the sample was collected by use of a stainless steel sampling bailer fixed to a pole before transferring to the testing bottles.

In all cases, the sampling procedures ensured that cross-contamination and disturbance of the stream or ditch bed or bank side sediments was prevented. Two subsequent samples were collected at the same time from each sampling location for radiological analysis (radiological analysis results have been reported separately). A record of the sampling activities was undertaken using field record sheets whilst on-site.

Water samples were packaged in coolboxes, refrigerated and couriered to a UKAS/Mcerts accredited laboratory within approximately 24 hours of sampling.

In order to test the validity of the data, quality-assurance duplicate samples were taken during sampling visits 2 to 6 inclusive. Duplicate samples were taken at the same time and labelled in a standard way i.e. the testing laboratory would have no indication that the samples were duplicates. An additional 'field blank' (consisting of ultra-pure water) was prepared during sampling campaign 5 and submitted for analysis, to act as further quality assurance of the laboratory testing. The locations at which the duplicate samples were taken, are given in Table 1 .

2.4 Chemical analysis suite

The suite of chemical analyses employed during the surface water monitoring campaigns covers a wide range of chemical parameters to assist in assessing the water quality status of individual surface watercourses and are presented in Table 2.

Table 2 Terrestrial surface water chemical analysis suite.

Determinant	MRV	Units
Suspended solids (@105^{o}C)	5	mg/l
Biochemical Oxygen Demand (BOD) 5 day ATU	2	mg/l
Total Petroleum Hydrocarbons (TPH) (C_8-C_{35})	10	µg/l
Zinc (total)	5	µg/l
Boron (dissolved and total)	5	µg/l
Chloride	1	mg/l
Ammoniacal nitrogen	0.01	mg/l
Nitrate (as N)	1	mg/l
Total hardness ($CaCO_3$)	10	mg/l
Sodium	0.1	mg/l

Table notes: MRV is the 'Minimum Reporting Value'

Note that testing of 'total boron' was added to the suite of analysis after terrestrial campaign 3 that subsequent data may be compared to Environmental Quality Standard (EQS) values with greater confidence.

2.5 *In-situ* water quality monitoring

In-situ water quality monitoring was undertaken at each sampling location on each monitoring visit. Given the shallow nature of the ditches and streams, only surface readings were possible.

At each site, pH, dissolved oxygen (as % saturation and mg/l) and temperature were recorded using pre-calibrated field meters and probes.

For the first campaign (January 2009), the reliability of the *in-situ* measurements of pH was questioned and a malfunctioning pH probe was suggested as a possible cause of unsatisfactory results. In response, an electronic pH probe (Hanna Instrument 98107 pH ep model type) and a Quanta-G Dissolved Oxygen meter were deployed during the second and subsequent sampling campaigns. All field measuring equipment was pre-calibrated prior to use as per the manufacturers' guidelines. The pH results from the first campaign have been discounted and where pH results are required for subsequent comparison against WFD EQSs for example, a proxy pH value has been used, specifically the mean value across all other campaigns.

3.0 FRESHWATER ENVIRONMENTAL QUALITY STANDARDS

The water quality guidance values that have been used to examine the data from the terrestrial surface water monitoring campaign are detailed in Table 3. The suite of water quality parameters was determined in consultation with the Environment Agency in December 2008 and allows comparison with freshwater EQS values and those of the Water Supply (Water Quality) Regulations 2000[5] Drinking Water Standards (DWS).

In December 2009, Directions[6&7] were issued by the UK government to the Environment Agency which allowed revised water quality environmental standards developed by UKTAG (United Kingdom Technical Advisory Group) for the WFD to be implemented. The WFD EQS values are presented in Table 3 alongside previous standards.

Bum Brook and H olford Stream discharge into the WFD[1] waterbody named 'Stogursey Brook' (see Appendix D for the waterbody table for Stogursey Brook, taken from Annex B of the South West River Basin District Management Plan[8]). The Stogursey Brook waterbody is currently at overall 'Poor' WFD standard with the objective of reaching 'Good Ecological Status' by 2015. A number of water chemistry elements are specifically listed in the Stogursey Brook waterbody table as supporting elements to the status description (where data has allowed specific characterisation) and t hese have been use d, together with the target status of 'Good' to define appropriate EQSs (see Appendix D and Table 3). In each case, the highest available status score has been chosen, given that the WFD dictates no deterioration of any component water quality parameter should occur. Thus the EQS most likely to be used as a regulatory threshold (by the Environment Agency) has been selected for monitoring data assessment purposes. The drainage ditches in the north of the study area discharge directly to the foreshore, but for the purposes of this assessment they have been compared to the Stogursey Brook WFD EQS standards.

The determination of WFD EQSs for Total Ammonia, Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO) are linked to Alkalinity, as set out in the WFD Directions, 2009. In order to allow comparison with the WFD standards Alkalinity has been retrospectively calculated as it has not been determined by sample analysis during the monitoring campaign. Alkalinity has been calculated using hardness and pH values and standard equations for dissociation. It should also be noted that many of the EQS values listed relate to annual mean values or percentile values. Comparison of the Hinkley Point freshwater data with EQS values of this type should be co nsidered with caution, given that annual mean figures and percentiles are derived from a limited number of sampling campaigns.

Table 3 Guideline Water Quality Standards used to assess the water quality of terrestrial surface water features at Hinkley Point.

Determinand	Units	Minimum Reporting Value	Screening Value				
			Pre-WFD		WFD		
			DWS	Freshwater EQS	WFD Type	Waterbody & Status	WFD Standard~
Total Zinc	(µg/l)	5	5000[6]	75-500[2 AI*] (300-2000)[P]	Hardness related	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	125 [AI*]
Total Boron	(µg/l)	5	1000[1 I]	2000[2 AI]	-	-	-
Dissolved Boron	(µg/l)	5	1000[1 I#]	2000[2 AI#]	-	-	-
Sodium	(mg/l)	0.1	200[1]	170 [A^]	-	-	-
Ammonium, NH_4	(mg/l)	0.01	0.5[1]	1[12]	-	-	-
Ammonium as N	(mg/l)	-	-	-	-	-	-
Total Ammonia as N	(mg/l)	0.1	-	1.3[4]	Alkalinity related	Stogursey Brook - Good[CPrP]	0.6[@]
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]	-	-	-
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a
BOD	(mg/l)	2	-	6 [4]	Alkalinity related	Stogursey Brook - Good[PrP]	5 (90%)[@]
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-
Nitrate	(mg/l)	1	50[1]	-	-	-	-
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Alkalinity related	Stogursey Brook - High[CPrP]	70 (10%)[@]
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-	-

Notes to Table 3:

Derived Ammonia values are based upon calculations as presented in: Canadian Council of Ministers of the Environment (2010). Canadian water quality guidelines for the protection of aquatic life: Ammonia. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

~	WFD Standards are derived from ‘The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive)(England and Wales) Directions 2009.
1	The Water Supply (Water Quality) Regulations 2000.
2	National Environmental Quality Standards (EQS) - For List II substances. Source DoE Circulat 7/89.
3	Environment Agency Non-Statutory (Operational) Environmental Quality Standards. Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis.
4	River Ecosystem Classification (RE3) - The Surface Waters (River Ecosystem)(Classification) Regulations 1994 (90th percentile)
6	The Water Supply (Water Quality) Regulations 1989. N.B These Regulations were superseded by the 2000 regulations therefore there is currently no UK DWS for zinc and / or Total Petroleum Hydrocarbons.
7	The Surface Waters (Abstraction) for Drinking Water (Classification) Regulations 1996. DW1 treatment (i.e simple physical treatment and disinfection) limit.
12	2006 / 44/ EC Fish Directive, Cyprinid Fish Guideline.
a	Point of Monitoring / Complaince may be at samples leaving treatment works or at other supply point e.g consumers taps.
*	Hardness related (Zinc toxicity is influenced by hardness. Specific EQS values (mg/l zinc) are given for different hardness ranges within the legislation. By comparing to the hardness value, the appropriate EQS concentration has been selected).
@	Alkalinity related. By comparing to the alkalinity value, the appropriate EQS concentration has been determined. Note that alkalinity has been calculated for the purposes of this report.
A	Annual Average;T - Total; P - 90% of results; I - Imperative value; G - Guideline Value
^	Non statutory / proposed EQS, but EQS never adopted in UK. Therefore value quoted is for guidance only.
#	No statutory EQS for dissolved Boron - adopted Total Boron value
-	Analysis not undertaken or not relevant
C	Current WFD status;
Pr	Predicted WFD status by 2015.

4.0 RESULTS

Summary results from the chemical analyses (non-radiological) of collected water samples are presented in Appendix B. Sections 4.1 and 4.2 compare the analytical results to:

- Environmental Quality Standards and Drinking Water Standard values set prior to the implementation of the WFD; and
- Environmental Quality Standard values set by the Water Framework Directive and implemented by the River Basin District Directions 2009[6&7].

4.1 Results compared against Pre-Water Framework Directive EQS values

The data across all campaigns indicate that all tested parameters for monitoring sites within the Built Development Area land are within a normal range for lowland freshwater systems and below the DWS and EQS guidelines with the occasional exception of suspended solids and BOD. There was also one individual exceedance of the ammonium DWS, recorded at SW9 during the March 2009 campaign.

Data for the additional sampling locations associated with the Southern Construction Phase Area also indicated the majority of parameters to be within a normal range for lowland freshwater systems and below the freshwater EQS and DWS guidelines. The only exception was BOD which was equal to the 6 mg/l freshwater EQS standard in Bum Brook (SWA) during the May 2009 campaign.

Discrete terrestrial surface water data for suspended solids, BOD and ammonia collected during the 2009 monitoring campaign are presented in Figure 1, Figure 3 and Figure 5 respectively. Mean data for suspended solids, BOD and ammonia (for each monitoring site) are presented in Figure 2, Figure 4 and Figure 6 respectively. The data show a broad consistency of all other parameters (i.e. within a normal expected range) across all sampling locations and between different sampling visits.

The number of sampling locations that were dry at the time of sampling increased through the spring and into the summer sampling campaigns and reflects the ephemeral nature of the drainage ditches. During the July sampling visit, there were only three sampling locations that had sufficient water depth to allow samples to be collected (SW6, SWA and SWB). The locations that were found to be dry during each sampling visit are presented in Table 4 below.

Table 4 Sampling locations that were found to be dry during sampling visits.

Campaign 4 (April)	Campaign 5 (June)	Campaign 6 (July)
SW2	SW2	SW1
SW9	SW7	SW2
SW11	SW9	SW3
SWC	SW11	SW5
	SWC	SW7
		SW9
		SW11
		SWC

All duplicate samples yielded similar laboratory data results, which provides confidence in the quality of the laboratory analysis. The field blank sample yielded analytical results that were all below the limits of detection. These data are presented in Appendix B.

During campaign 5, the sample taken from Bum Brook, SWA (and replicate SWAA) was found to have a relatively low concentration of sodium, a relatively high concentration of nitrate and a relatively low hardness value (compared to other sample results during this campaign). Consideration of the location of this stream and the flow in Bum Brook, which at the time of sampling was found to be greater than that in the other surface water features, may help to explain these observations. Bum Brook flows along the southern boundary of the SSA land and is the most southerly of all the water features sampled. The upstream catchment area is likely to be larger than most of the other water features discussed, given that many of the other water features are slow flowing, stagnant or dry. The catchment area for Bum Brook is agricultural land and it is likely that some nitrates from agricultural fertilisers (both recently and historically applied) will contribute to concentrations measured in Bum Brook. The increased distance from the sea and the larger flow volumes (relative to other water features) may have the effect of diluting any contributions of sodium and any divalent salts (e.g. calcium and magnesium, that are responsible for water hardness) from groundwater contributions and/or sea spray. Although results from Bum Brook are broadly consistent across the three sampling campaigns in which it was sampled, the observations noted above were most pronounced during campaign 5.

A summary of the *in-situ* readings are presented in Appendix C. The pH results across all sampling campaigns ranged from 6.80 to 8.30 pH units, which represented a range of conditions from close to neutral to slightly basic. All pH readings across the site fall within EQS limits and are typical of lowland freshwater watercourses.

A wide range of dissolved oxygen concentrations, ranging from 21.2 % (2.4 mg/l at 11.3 ^{o}C) to 96.3 % (11.3 mg/l at 8.5 ^{o}C) was recorded across the six campaigns. This is to be ex pected in shallow, slow flowing, freshwater watercourses. The minimum and maximum values for each campaign are presented in Appendix C. Localised reductions in dissolved oxygen concentrations may occur where shallow water depths (which may result in increased temperature), stagnant flow and elevated BOD concentrations prevail. Conversely, increases in dissolved oxygen concentrations may result from the photosynthetic action of algal and submerged macrophyte populations for example. The drainage watercourses within the Built Development Area West are not considered suitable to support fish populations due to their ephemeral nature and comparisons to dissolved oxygen environmental quality standards for the protection of fish are not appropriate. The inclusion of EQS values for all sampling location points in the summary tables, presented in Appendix B is for information purposes only.

Holford Stream and Bum Brook may support fish populations of limited abundance and diversity, due to the constraints of the physical fish habitat quality. The fish species likely to be present are sticklebacks, cyprinid species and eels. For these watercourses it is therefore appropriate to compare the field data from the relevant sampling sites with dissolved oxygen standards for cyprinid fish (2006/44/EC)[9]. This comparison is presented in the summary results table (Appendix B) and Table 5. Comparison of dissolved oxygen results with EQS percentile values should be made with caution, given that the results for Holford Stream and Bum Brook are based on a limited data set i.e. only three *in-situ* measurements. The comparison with the Freshwater Fish EQS values suggest that baseline dissolved oxygen concentrations are low within both Holford Stream and B um Brook (note that dissolved oxygen concentrations within Bum Brook meet 100 percentile guideline and imperative standards).

Table 5 Comparison of *in-situ* dissolved oxygen (DO) concentrations for Holford stream and Bum Brook with standards specified in Directive 2006/44/EC

DO EQS (Cyprinid Waters)	Holford Stream, mg/l (mean value +/- st. dev. bracketed)	Bum Brook, mg/l (mean value +/- st. dev. bracketed)
>=8$^{50\ G}$	3.8 ^{50*} (4.52 +/- 0.86)	7.3 ^{50*} (7.05 +/- 2.25)
>=5$^{100\ G}$	5.3 ^{100*} (4.52 +/- 0.86)	9.2 ^{100*} (7.05 +/- 2.25)
>=7$^{50\ I}$	3.8 ^{50*} (4.52 +/- 0.86)	7.3 ^{50*} (7.05 +/- 2.25)

Table notes:
^{50} 50 percentile value
^{100} 100 percentile value
^{G} Guideline value
^{I} Imperative value
* Based upon 3 *in-situ* measurements

4.2 Results compared against Water Framework Directive EQS values

All the ditches that flow across the Built Development Area i.e. all watercourses other than Holford Stream and Bum Brook, drain to the foreshore and do not flow into a WFD freshwater waterbody unit. Comparison of all data has been made with WFD EQSs for completeness (see Appendix B for summary of results).

The concentration of dissolved oxygen from all locations was found to be below the EQS values set by the WFD. A comparison of the dissolved oxygen data from Holford Stream and Bum Brook with the WFD Environmental Quality Standard is presented in Table 6. Comparison of dissolved oxygen results with EQS percentile values (WFD EQS is a 10 percentile value) should be made with caution, given that the results for Holford Stream and Bum Brook are based on a limited data set i.e. only three *in-situ* measurements. The comparison with the WFD EQS values, which is consistent with the discussions above, suggest that baseline dissolved oxygen concentrations are low within both Holford Stream and Bum Brook. Dissolved oxygen concentrations within all other watercourses may be expected to be low, given the shallow depths and ephemeral nature of these drainage ditches.

Table 6 Comparison of *in-situ* dissolved oxygen (DO) concentrations for Holford Stream and Bum Brook with standards specified in the Water Framework Directive

DO EQS, % saturation	Holford Stream, mg/l	Bum Brook, mg/l
70[10 ^]	36 [10*]	51.4 [10*]

Table notes:
[10] 10 percentile value
[*] Based upon 3 *in-situ* measurements

New EQS values introduced for pH and temperature under the WFD, have allowed the *In-situ* results to be compared against revised statutory limits. The pH and temperature values at all sites were found to fall within the normal range specified under the WFD EQS.

Recorded concentrations of ammonia were found to be below the WFD EQS at all sites. The ammonia concentrations recorded at SW9, which exhibited a single elevated ammonium concentration when compared to the drinking water standard, were below those standards set by the WFD.

BOD concentrations did not meet the EQS set by the WFD at locations SW2, SW3, SW5, SW6, SW11 and SWA (Bum Brook). BOD results are presented in Figure 3 and Figure 4.

Sections 4.3, 4.4 and 4.5 present further detail with regards to suspended solids, BOD and ammonia, which have all been found to exhibit elevated concentrations relative to some or all Environmental Quality Standards.

4.3 Suspended solids

At all sites within the Built Development Area West, suspended solids were consistently recorded at concentrations in excess of the Freshwater EQS (see Figures 1 and 2). The mean suspended solids concentrations for all sites on the Built Development Area was found to be greater than the EQS value. The maximum recorded value for suspended solids, was 492 mg/l at SW3.

There were no exceedances on the Southern Construction Phase Area, with regard to suspended solids concentrations.

The WFD does not include a suspended solids EQS.

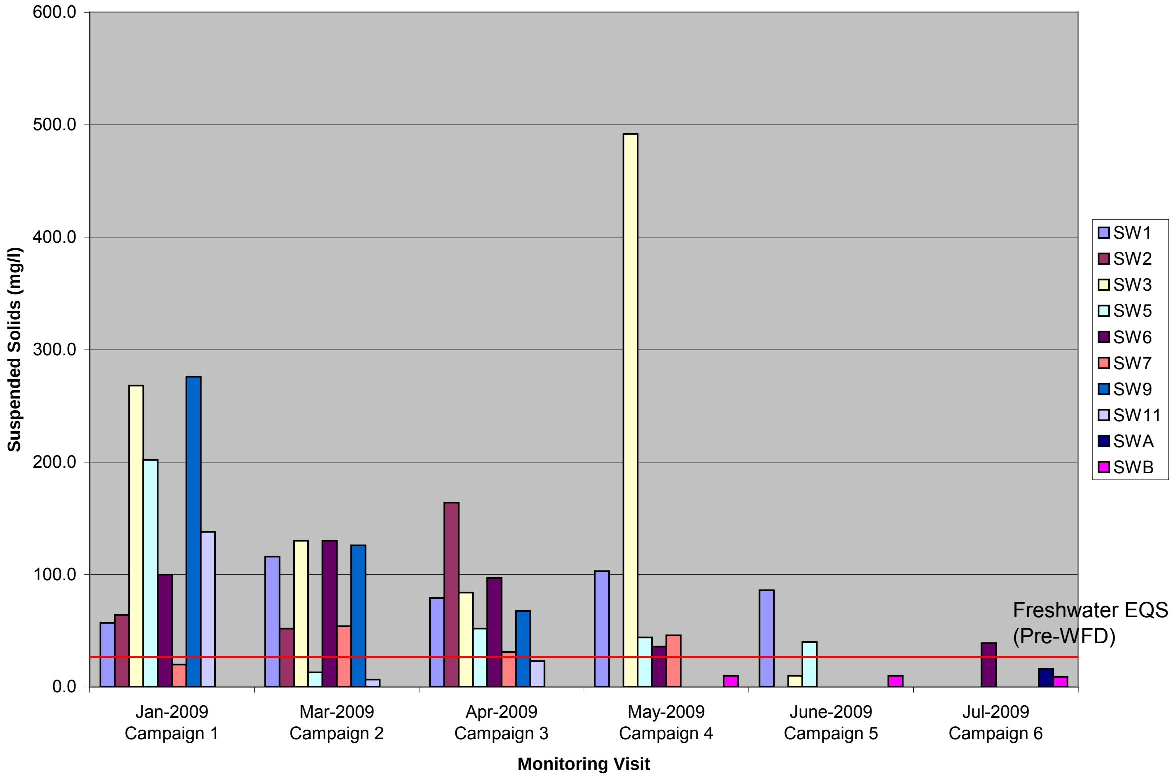


Figure 1 Terrestrial surface water suspended solids data.

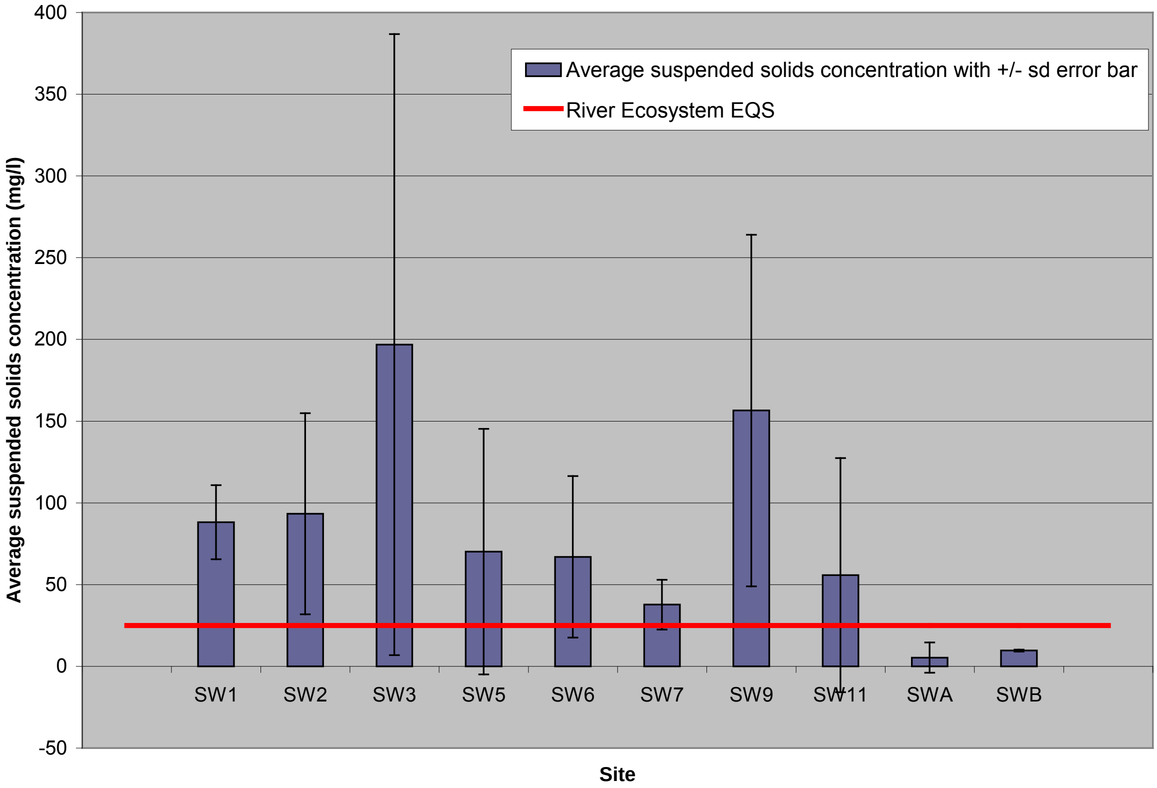


Figure 2 Terrestrial surface water suspended solids data – overall mean for each monitoring site. Standard deviations are presented as error bars for each site.

4.4 Biochemical oxygen demand

A number of individual samples were found to exceed the freshwater EQS (both pre- WFD and WFD) for BOD (see Figures 3 and 4). The maximum recorded value for BOD across all campaigns (value of 15.6 mg/l) was recorded at SW11 during the January sampling campaign.

The pre- WFD freshwater EQS for BOD is taken from the Surface Waters (River Ecosystem) (Classification) Regulations 1994[10]. The adopted class for comparison purposes is Class RE3. In order to compare against the EQS value as intended, the 90th percentile of the BOD data should not exceed 6 mg/l. The 90th percentile data is presented on Figure 4, which shows that sites SW3, SW5, SW6 and SW11 recorded results above the EQS threshold. All these sites are associated with the Built Development Area West.

The WFD EQS for BOD is the same for all sample sites i.e. 5 mg/l as a 90th percentile. The WFD EQS is also shown on Figure 4. The revision of the EQS under the WFD means that SWA (Bum Brook) also fails the new standard.

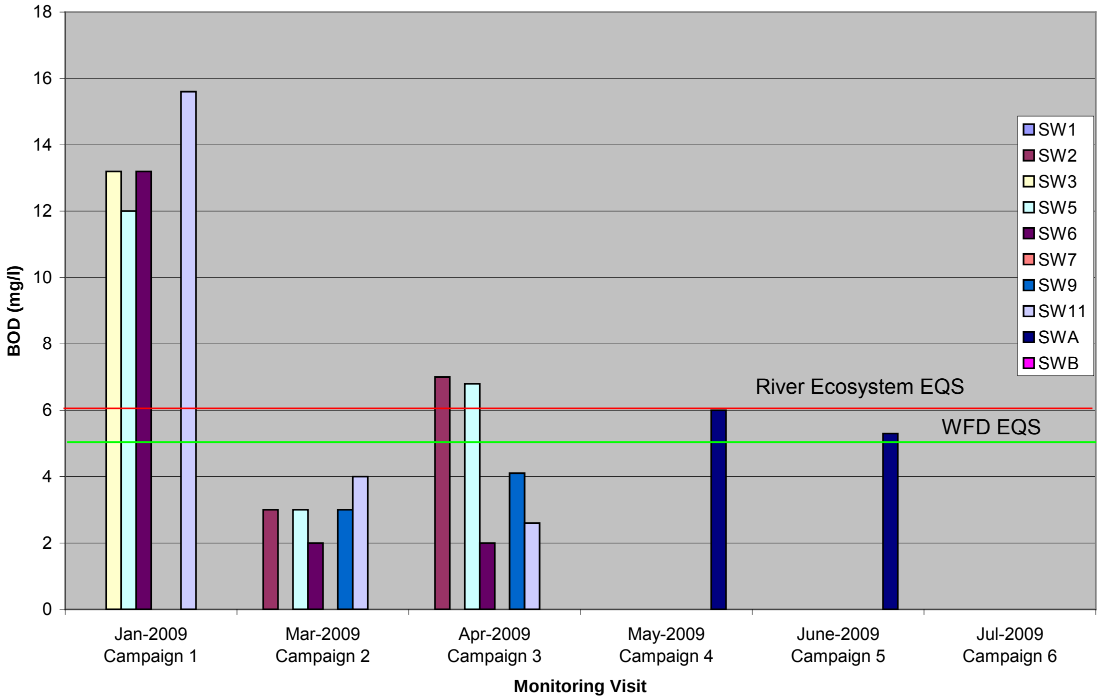


Figure 3 Terrestrial surface water BOD data.

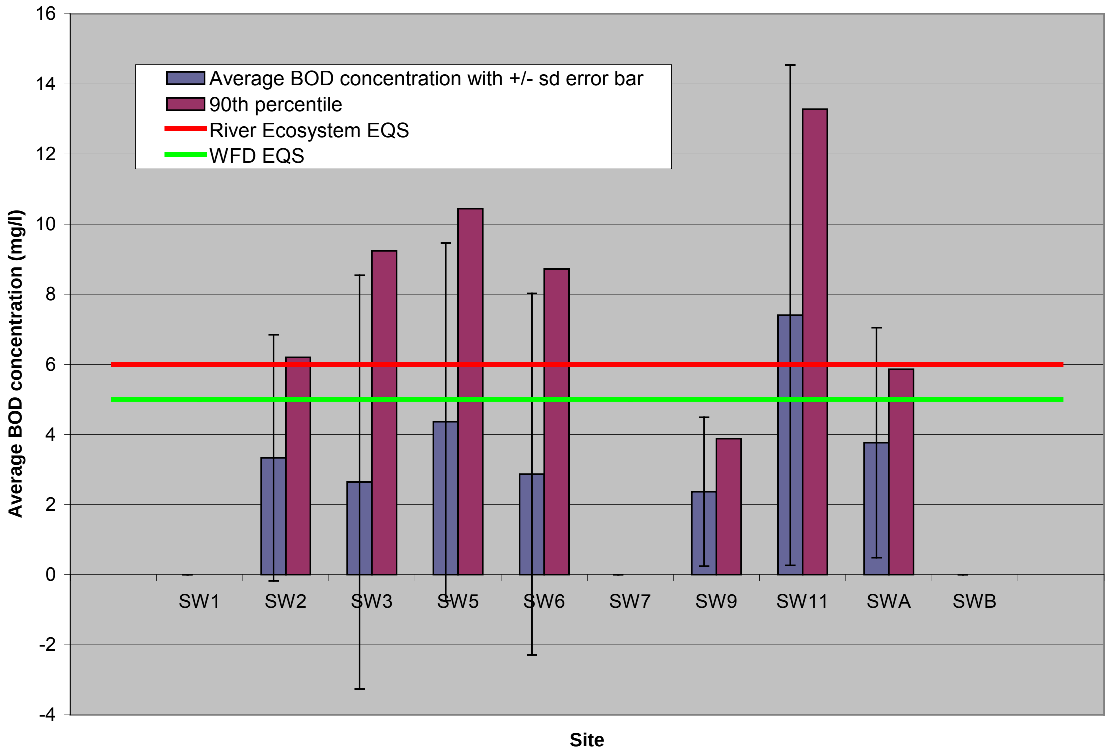


Figure 4 Terrestrial surface water BOD data – overall mean and 90th percentile data for each monitoring site. Standard deviations are presented as error bars for each site.

4.5 Ammonia

One exceedance of ammonium, with a value of 0.62 mg/l (exceeds DWS value of 0.5 mg/l, but below the lowest pre- WFD freshwater EQS of 1.0 mg/l) was recorded at SW9 during the March sampling campaign (see Figure 5 and Figure 6).

The DWS for ammonium is taken from the Water Supply (Water Quality) Regulations 2000. In order to compare against the ammonia threshold as intended, the 90th percentile of the ammonia data should not exceed 0.5 mg/l. The 90th percentile data is presented on Figure 6, which shows SW9 as being in excess of the drinking water standard.

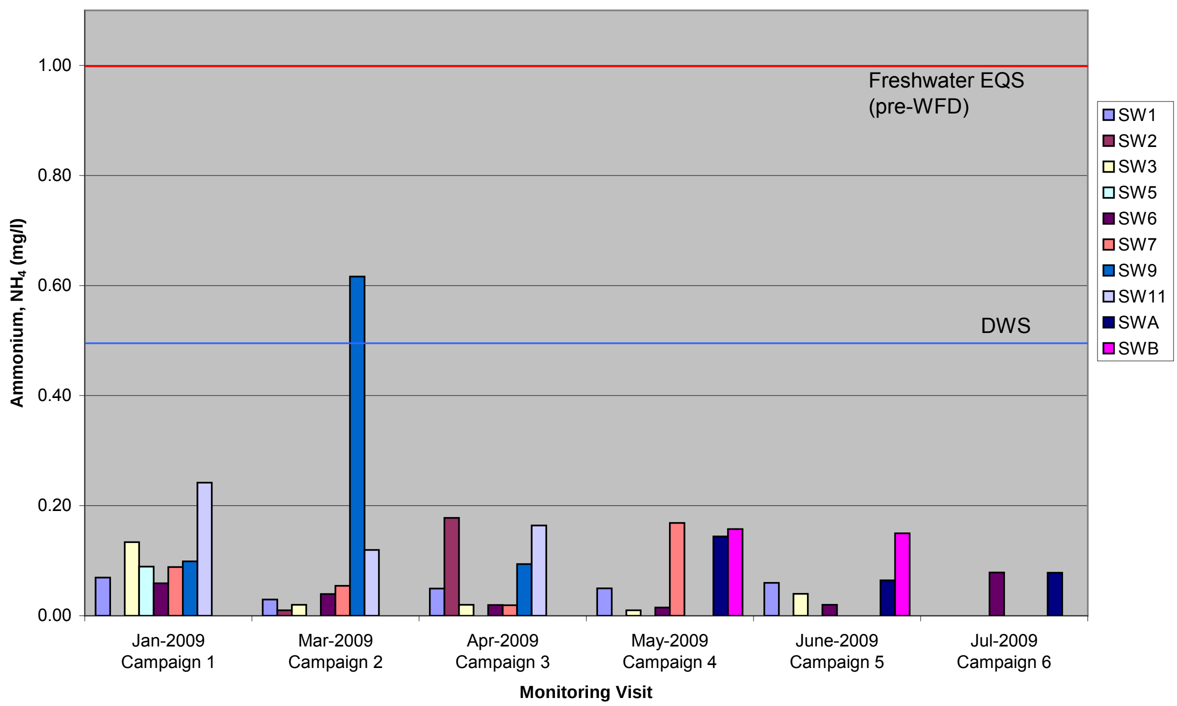


Figure 5 Terrestrial surface water ammonium data.

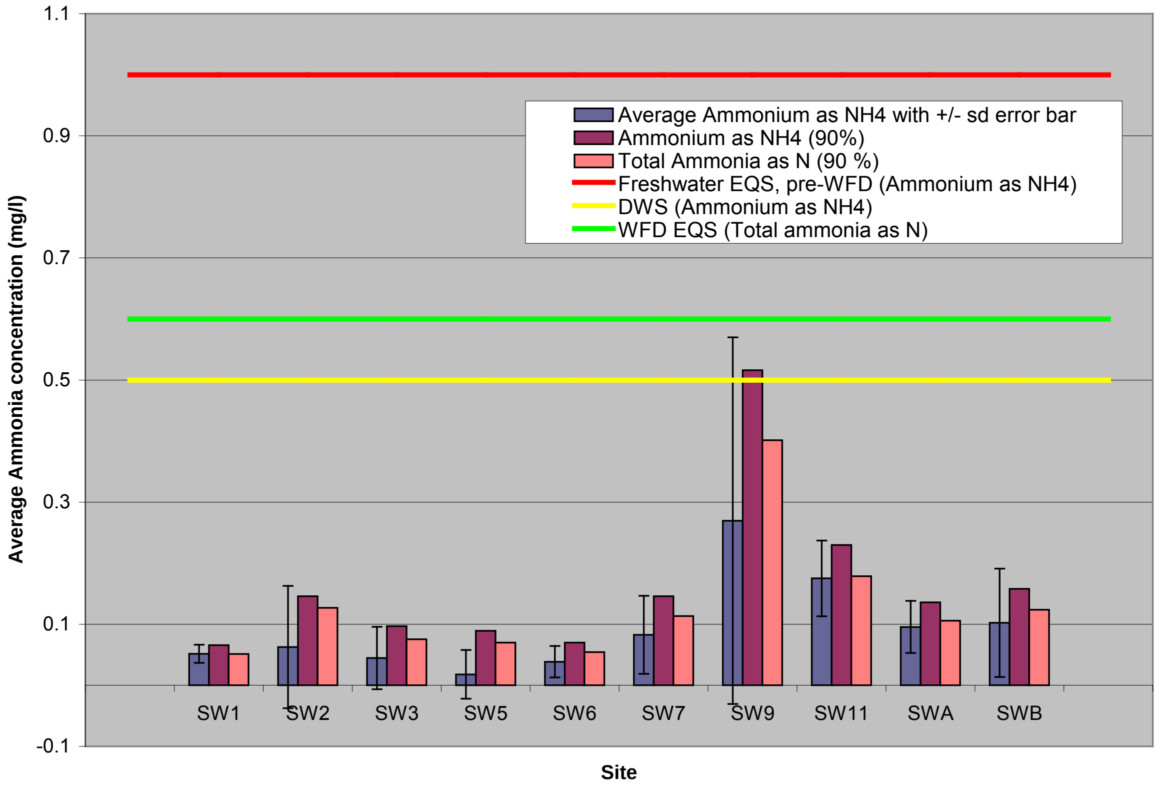


Figure 6 Terrestrial surface water ammonia data. Comparison with pre-WFD and WFD standards are presented.

Ammonia concentrations do not exceed the EQS set by the WFD, at any of the monitoring locations. The WFD EQS (90th percentile, Total Ammonia as N) has been included on Figure 6 to allow a visual comparison between Ammonia thresholds. The WFD EQS is determined by reference to the WFD Directions and the Stogursey Brook predicted current and predicted quality status for Ammonia (within the South West River Basin Management Plan). The WFD Directions set standards based on alkalinity ranges and the Stogursey Brook predicted status by 2015 is one of 'Good Status' for Ammonia. These factors combine to dictate a WFD EQS of 0.6 mg/l (Total Ammonia as N).

5.0 CONCLUSIONS

The terrestrial surface watercourses on the Built Development Area West land and the Southern Construction Phase Area were generally turbid and slow flowing and often contained deposits of cut vegetation from agricultural activities on the surrounding fields. The threshold level exceedances that have been found for various parameters are considered typical for this type of watercourse.

Baseline dissolved oxygen concentrations are low within both Holford Stream and Bum Brook, the only two watercourses that are considered to be able to support fish populations and which are within the catchment area of the Stogursey Brook WFD waterbody.

Elevated concentrations of BOD and suspended solids were a regular occurrence across the sampling programme. Elevated concentrations of these parameters commonly occur in shallow, heavily sedimented surface waters, particularly in field drainage ditches associated with agricultural land. Temporal variation in BOD, in watercourses of this type may be attributable to a range of factors including prevailing weather conditions (e.g. rainfall) and inputs of organic matter (e.g. cut vegetation). Temporal variation in suspended solids concentrations may be attributable to re-suspension of fine bed sediments.

The single occurrence of elevated ammonia may be due to an isolated instance of agricultural runoff or development of low dissolved oxygen concentrations. It should be noted that the elevated ammonia reading is relative to the DWS and is therefore a precautionary comparison benchmark to adopt for this type of watercourse i.e. these field drainage ditches will not be used for drinking water. All ammonia data is found to be below the revised thresholds presented within the Water Framework Directive.

In summary, the water quality results are representative of what would be expected for shallow, agricultural drainage ditches that typically show wide variation in water quality and flow characteristics which may depend for example, on rainfall intensity and associated surface drainage from surrounding fields.

6.0 REFERENCES

[1] Water Framework Directive (2000/60/EC). Directive 2000/60/EC of the European Parliament and of the Council of 23rd October 2000 Establishing a Framework for Community Action in the Field of Water Policy.

[2] AMEC (2009). Summary of Terrestrial Surface Water Quality Non-Radiochemical Analysis Results (Campaigns 1-6). EDF Reference 15011TN00079 BPE C 151209.

[3] Bridgwater Bay SSSI citation, English Nature. Accessed via www.english-nature.org.uk 15/10/2009.

[4] British Standard for Water Quality Sampling. BS EN ISO 5667: 2006

[5] The Water Supply (Water Quality) Regulations 2000. Statutory Instrument 2000 No. 3184

[6] River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2009.

[7] River Basin Districts Surface Water and Groundwater Classification (Water Framework Directive) (England and Wales) Direction 2009.

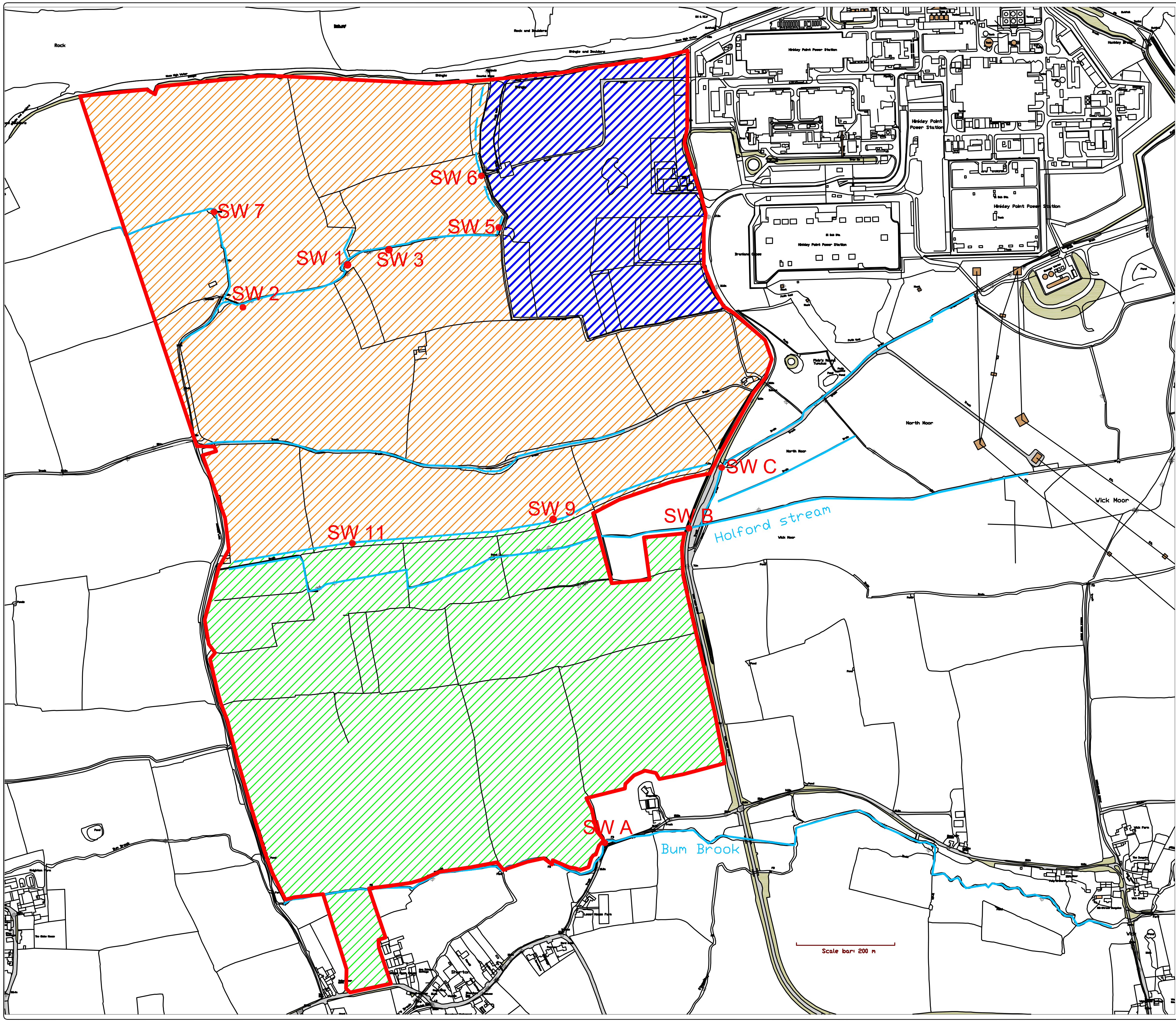
[8] Environment Agency (2009). South West River Basin Management Plan.

[9] Directive 2006/44/EC on the quality of fresh waters needing protection or improvement in order to support fish life

[10] Surface Waters (River Ecosystem)(Classification) Regulations 1994.

APPENDIX A

Sampling location plan



FOR DISCUSSION

Legend

- Built Development Area West
- Built Development Area East
- Southern Construction Phase Area
- Study Area Boundary
- Surface Water Feature
- Surface Water Sampling Location

Rev	Date	Description	By	Des
C	26.11.09	Issue 03 For EDF Comment	RW	RW
B	16.11.09	Issue 02 For EDF Comment	RW	RW
A	16.10.09	Issue 01 For EDF Comment	RW	RW

Overview

N
W E
S

Client
EDF

Project
Summary of Terrestrial Surface Water Quality
Non-Radiochemical Analysis Results

Title
SURFACE WATER SAMPLING LOCATION PLAN

Drawn	Checked	Approved
RW	RS	JB

Date	Sheet size
November 2009	A3

Drawing Number	Rev	Scale
15011/TN/00102 App A	C	SEE SCALE BAR

APPENDIX B

Summary results of chemical analysis

Note: Where duplicate samples have been taken, the mean of the original and duplicate has been considered for statistical interpretation. Where a sample result is below the limit of detection, this value has been substituted with < and a zero value has been used for calculation purposes.

Determinand	Units	Minimum Reporting Value	Screening Value: Pre-WFD		Screening Value: WFD			Surface Water Sampling Campaign																	
			DWS	Freshwater EQS	WFD Type	Waterbody & Status (Stogursey Brook)	WFD standard	Jan-2009 Campaign 1	Mar-2009 Campaign 2	Apr-2009 Campaign 3	May-2009 Campaign 4	June-2009 Campaign 5	Jul-2009 Campaign 6	Mean (+/-) Stand dev			Minimum	Maximum	5th Percentile	10th Percentile	50th Percentile	90th Percentile	95th Percentile	98th Percentile	Coefficient of variation
SW1																									
Total Zinc	(µg/l)	5	5000[6]	75-500[2 AT*] (300-2000)[P]	Mean hardness 430 i.e. >250	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	125 [AT*]	52.8	45.0	53.2	102	101	D	70.8	(+/-)	28.2	45.0	102	-	-	-	101.52	-	-	0.40
Total Boron	(µg/l)	5	1000[1 T]	2000[2 AT]	-	-	-	-	-	-	-	28.0	D	28.0	(+/-)	n/a	28.0	28.0	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000[1 T#]	2000[2 AT#]	-	-	-	17.0	13.0	17.0	51.0	6.00	D	20.8	(+/-)	17.5	6.00	51.0	-	-	-	n/a	-	-	0.84
Sodium	(mg/l)	0.1	200[1]	170 [A^]	-	-	-	43.6	32.3	30.1	59.0	67.2	D	46.4	(+/-)	16.3	30.1	67.2	-	-	-	n/a	-	-	0.35
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.07	0.03	0.05	0.05	0.06	D	0.1	(+/-)	0.0	0.0	0.1							
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	0.05	0.02	0.04	0.04	0.05	D	0.0	(+/-)	0.0	0.0	0.1				0.05			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	0.0002	0.0002	0.0003	0.0001	0.0001	D	0.0	(+/-)	0.0	0.0	0.0							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				0.0002	0.0003	0.0004	0.0001	0.0001	D	0.0	(+/-)	0.0	0.0	0.0							
Ammonium as N	(mg/l)	-	-	-				0.05	0.02	0.04	0.04	0.05	D	0.0	(+/-)	0.0	0.0	0.1							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				0.07	0.03	0.05	0.05	0.06	D	0.05	(+/-)	0.01	0.0	0.1				0.07			
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	<	<	<	<	<	D	<	(+/-)	n/a	<	<	-	-	-	n/a	-	-	n/a
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	51.3	49.0	44.3	90.0	48.7	D	56.7	(+/-)	18.8	44.3	90.0	-	-	-	n/a	-	-	0.33
Nitrate	(mg/l)	1	50[1]	-	-	-	-	18.2	19.0	10.4	8.00	11.0	D	13.3	(+/-)	4.96	8.00	19.0	-	-	-	n/a	-	-	0.37
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	57.0	116	79.0	103	86.0	D	88.2	(+/-)	22.7	57.0	116	-	-	-	n/a	-	-	0.26
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	226	415	379	331	798	D	430	(+/-)	218	226	798	-	-	-	n/a	-	-	0.51
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	<	<	<	<	<	D	<	(+/-)	n/a	<	<	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	7.325	7.8	7.6	7.1	6.80	D	7.33	(+/-)	0.40	6.80	7.80	6.86	-	-	n/a	7.76		0.05
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	9.30	9	11	11	12	D	10.51	(+/-)	1.37	8.82	12.01	-	-	-			12	
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High[CPrP]	70 (10%)	79.6	72.3	14.4	21.2	53.8	D	48.26	(+/-)	29.45	14.40	79.60	-	17	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-		9.10	8.36	5.17	2.35	5.70	D	6.14	(+/-)	2.70	2.35	9.10	-	-	6	-	-	-	-
SW2																									
Total Zinc	(µg/l)	5	5000[6]	75-500[2 AT*] (300-2000)[P]	Mean hardness 380 i.e. >250	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	125 AT*	50.3	43.0	69.0	D	D	D	54.1	(+/-)	13.4	43.0	69.0	-	-	-	65.26	-	-	0.25
Total Boron	(µg/l)	5	1000[1 T]	2000[2 AT]	-	-	-	-	-	-	D	D	D		n/a		0.0	0.0	-	-	-		-	-	n/a
Dissolved Boron	(µg/l)	5	1000[1 T#]	2000[2 AT#]	-	-	-	<	35.0	48.0	D	D	D	27.7	(+/-)	24.8	<	48.0	-	-	-	n/a	-	-	0.90
Sodium	(mg/l)	0.1	200[1]	170 [A^]	-	-	-	43.6	43.8	60.4	D	D	D	49.3	(+/-)	9.65	43.6	60.4	-	-	-	n/a	-	-	0.20
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	<	0.01	0.18	D	D	D	0.06	(+/-)	0.10	<	0	-	-	-	0.15	-	-	1.60
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	-	0.01	0.14	D	D	D	0.05	(+/-)	0.08	0.0	0.1				0.13			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	-	0.0001	0.0016	D	D	D	0.00	(+/-)	0.00	0.0	0.0							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				-	0.0001	0.0019	D	D	D	0.00	(+/-)	0.00	0.0	0.0							
Ammonium as N	(mg/l)	-	-	-				-	0.01	0.14	D	D	D	0.05	(+/-)	0.08	0.0	0.1							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				-	0.01	0.18	D	D	D	0.06	(+/-)	0.10	0.0	0.2							
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	<	3.00	7.00	D	D	D	3	(+/-)	3.51	<	7.00	-	-	-	6.20	-	-	1.05
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	52.2	75.0	142.00	D	D	D	89.7	(+/-)	46.7	52.2	142	-	-	-	n/a	-	-	0.52
Nitrate	(mg/l)	1	50[1]	-	-	-	-	16.9	14.0	<5	D	D	D	10.3	(+/-)	9.05	<	16.9	-	-	-	n/a	-	-	0.88
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	64.0	52.0	164.00	D	D	D	93.3	(+/-)	61.5	52.0	164	-	-	-	n/a	-	-	0.66
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	202	455	483.00	D	D	D	380	(+/-)	155	202	483	-	-	-	n/a	-	-	0.41
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	<	<	<	D	D	D	<	(+/-)	n/a	0	0	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	7.70	7.70	7.70	D	D	D	7.70	(+/-)	0.00	8	8	7.70	-	-	-	7.70	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	8.60	8.49	12.51	D	D	D	9.87	(+/-)	2.29	8	13	-	-	-	-	-	12	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High[CPrP]	70 (10%)	63.9	96.3	51.2	D	D	D	70.47	(+/-)	23.26	51	96	-	54	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-		7.50	11.3	5.45	D	D	D	8.09	(+/-)	2.98	5	11	-	-	8	-	-	-	-
SW3																									
Total Zinc	(µg/l)	5	5000[6]	75-500[2 AT*] (300-2000)[P]	Mean hardness 507 i.e. >250	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	125 AT*	68.3	58.0	55.2	119	103	D	80.7	(+/-)	28.6	55.2	119	-	-	-	112.60	-	-	0.36
Total Boron	(µg/l)	5	1000[1] T	2000[2] AT	-	-	-	-	-	-	-	85.0	D	85.0	(+/-)	n/a	85.0	85.0	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000[1] T[#]	2000[2] AT[#]	-	-	-	5.00	39.0	30.0	84.0	65.0	D	44.6	(+/-)	30.7	5.00	84.0	-	-	-	n/a	-	-	0.69
Sodium	(mg/l)	0.1	200[1]	170 A^	-	-	-	44.0	31.9	28.9	100.9	60.3	D	53.2	(+/-)	29.4	28.9	101	-	-	-	n/a	-	-	0.55
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.13	0.02	0.02	0.01	0.04	D	0.04	(+/-)	0.05	0.01	0.13	-	-	-	0.10	-	-	1.14
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	0.10	0.02	0.02	0.01	0.03	D	0.03	(+/-)	0.04	0.01	0.10				0.08			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	0.0006	0.0002	0.0002	0.0000	0.0001	D	0.00	(+/-)	0.00	0.00	0.00							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				0.0008	0.0002	0.0002	0.0000	0.0001	D	0.00	(+/-)	0.00	0.00	0.00							
Ammonium as N	(mg/l)	-	-	-				0.10	0.02	0.02	0.01	0.03	D	0.03	(+/-)	0.04	0.01	0.10							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				0.13	0.02	0.02	0.01	0.04	D	0.04	(+/-)	0.05	0.01	0.13							
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	13.2	<	<	<	<	D	2.64	(+/-)	5.90	<	13.2	-	-	-	9.24	-	-	2.24
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	52.1	49.0	45.9	92.0	49.2	D	57.6	(+/-)	19.3	45.9	92.0	-	-	-	n/a	-	-	0.34
Nitrate	(mg/l)	1	50[1]	-	-	-	-	18.2	17.0	5.15	<	<	D	8.07	(+/-)	8.96	<	18.2	-	-	-	n/a	-	-	1.11
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	268	130	84	492	10	D	197	(+/-)	190	10.0	492	-	-	-	n/a	-	-	0.97
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	277	420	385	667	787	D	507	(+/-)	212	277	787	-	-	-	n/a	-	-	0.42
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	<	<	<	<	<	D	<	(+/-)	n/a	0	0	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	8	8	8	7	7	D	7.50	(+/-)	0.35	7	8	7.12	-	-	-	7.88	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	10	9	11	11	12	D	10.52	(+/-)	1.33	9	12	-	-	-	-	-	12	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High[CPrP]	70 (10%)	78	82	58	22	65	D	60.92	(+/-)	23.66	22	82	-	36	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-		9	9	6	2	7	D	6.82	(+/-)	2.75	2	9	-	-	7	-	-	-	-

Note: Where duplicate samples have been taken, the mean of the original and duplicate has been considered for statistical interpretation. Where a sample result is below the limit of detection, this value has been substituted with < and a zero value has been used for calculation purposes.

Determinand	Units	Minimum Reporting Value	Screening Value: Pre-WFD: DWS	Screening Value: Pre-WFD: Freshwater EQS	Screening Value: WFD: WFD Type	Screening Value: WFD: Waterbody & Status (Stogursey Brook)	Screening Value: WFD: WFD standard	Surface Water Sampling Campaign: Jan-2009 Campaign 1	Mar-2009 Campaign 2	Apr-2009 Campaign 3	May-2009 Campaign 4	June-2009 Campaign 5	Jul-2009 Campaign 6	Mean (+/-) Stand dev			Minimum	Maximum	5th Percentile	10th Percentile	50th Percentile	90th Percentile	95th Percentile	98th Percentile	Coefficient of variation
SW5																									
Total Zinc	(µg/l)	5	5000^{6}	75-500^{2} AT* (300-2000)P	Mean hardness 400 i.e. >250	Stogursey Brook - High^{CPr} Note only 'good' standard presented in WFD directions.	125 AT*	28.0	48.9	61.1	80.0	81.0	D	59.8	(+/-)	22.3	28.0	81.0	-	-	-	80.59	-	-	0.37
Total Boron	(µg/l)	5	1000^{1} T	2000^{2} AT	-	-	-	-	-	-	-	125	D	125	(+/-)	n/a	125	125	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000^{1} T$^{\#}$	2000^{2} AT$^{\#}$	-	-	-	<	130	116	165	110	D	104	(+/-)	62.0	<	165	-	-	-	n/a	-	-	0.60
Sodium	(mg/l)	0.1	200^{1}	170 A^	-	-	-	44.1	39.9	42.5	75.4	81.7	D	56.7	(+/-)	20.1	39.9	81.7	-	-	-	n/a	-	-	0.35
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.09	<	<	<	<	D	0.02	(+/-)	0.04	<	0.09	-	-	-	0.06	-	-	2.24
Total Ammonia as N	(mg/l)	-	-	1.3^{4}	Type 7	Stogursey Brook - Good^{CPrP}	0.6	0.07	-	-	-	-	D	0.01	(+/-)	0.03	0.1	0.1				0.07			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good^{CPrA}	n/a	0.0004	-	-	-	-	D	0.00	(+/-)	0.00	0.0	0.0				0.00			
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025^{12I}				0.0005	-	-	-	-	D	0.00	(+/-)	0.00	0.0	0.0				0.00			
Ammonium as N	(mg/l)	-	-	-				0.07	-	-	-	-	D	0.01	(+/-)	0.03	0.1	0.1				0.07			
Ammonium as NH_4	(mg/l)	-	0.5^{1}	1^{12}				0.09	-	-	-	-	D	0.02	(+/-)	0.04	0.1	0.1				0.09			
BOD	(mg/l)	2	-	6^{4}	Type 7	Stogursey Brook - Good^{PrP}	5 (90%)	12.0	3.00	6.80	<	<	D	4.36	(+/-)	5.10	<	12.0	-	-	-	10.44	-	-	1.17
Chloride	(mg/l)	1	250^{1a}	250^{3} A	-	-	-	51.5	50.3	60.0	97.0	58.3	D	63.4	(+/-)	19.2	50.3	97.0	-	-	-	n/a	-	-	0.30
Nitrate	(mg/l)	1	50^{1}	-	-	-	-	16.2	10.8	<	<	<	D	5.40	(+/-)	7.65	<	16.2	-	-	-	n/a	-	-	1.42
Suspended Solids	(mg/l)	5	-	25^{12}	-	-	-	202	13.0	52.0	44.0	40.0	D	70.2	(+/-)	75.1	13.0	202	-	-	-	n/a	-	-	1.07
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	282	287	258	443	729	D	400	(+/-)	198	258	729	-	-	-	n/a	-	-	0.50
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10^{6}	50^{7}	-	-	-	<	<	<	<	<	D	<	(+/-)	n/a	0	0	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10^{1}	6-9^{I}	n/a	Stogursey Brook - High^{CPrP}	6 (5%) 9 (95%)	7	8	8	7	7	D	7.40	(+/-)	0.35	7	8	7.02		-	-	7.78	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High$^{CPrP\ A}$	25 (98%)	12	8	14	11	13	D	11.64	(+/-)	2.04	8	14	-	-	-	-		14	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High^{CPrP}	70 (10%)	130	79	63	31	70	D	74.70	(+/-)	36.15	31	130	-	43	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8^{G12} 100%>5^{G12} 50%>7^{I12}	-	-		14	9	6	3	7	D	8.11	(+/-)	3.95	3	14	-	-	7	-	-	-	-
SW6											(average)														
Total Zinc	(µg/l)	5	5000^{6}	75-500^{2} AT* (300-2000)P	Mean hardness 443 i.e. >250	Stogursey Brook - High^{CPr} Note only 'good' standard presented in WFD directions.	125 AT*	42.5	36.6	41.1	60.0	144	149	78.8	(+/-)	52.9	36.6	149	-	-	-	146.25	-	-	0.67
Total Boron	(µg/l)	5	1000^{1} T	2000^{2} AT	-	-	-	-	-	-	-	160	162	161	(+/-)	1.41	160	162	-	-	-	n/a	-	-	0.01
Dissolved Boron	(µg/l)	5	1000^{1} T$^{\#}$	2000^{2} AT$^{\#}$	-	-	-	65.0	160	154	182	139	216	153	(+/-)	50.5	65.0	216	-	-	-	n/a	-	-	0.33
Sodium	(mg/l)	0.1	200^{1}	170 A^	-	-	-	43.5	35.2	46.2	98.7	92.2	69.5	64.2	(+/-)	26.8	35.2	98.7	-	-	-	n/a	-	-	0.42
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.06	0.04	0.02	0.02	0.02	0.08	0.04	(+/-)	0.03	0	0	-	-	-	0.07	-	-	0.67
Total Ammonia as N	(mg/l)	-	-	1.3^{4}	Type 7	Stogursey Brook - Good^{CPrP}	0.6	0.05	0.03	0.02	0.01	0.02	0.06	0.03	(+/-)	0.02	0	0				0.05			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good^{CPrA}	n/a	0.0004	0.0003	0.0005	0.0000	0.0001	0.0011	0.00	(+/-)	0.00	0	0							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025^{12I}				0.0005	0.0004	0.0006	0.0000	0.0001	0.0014	0.00	(+/-)	0.00	0	0							
Ammonium as N	(mg/l)	-	-	-				0.05	0.03	0.02	0.01	0.02	0.06	0.03	(+/-)	0.02	0	0							
Ammonium as NH_4	(mg/l)	-	0.5^{1}	1^{12}				0.06	0.04	0.02	0.01	0.02	0.08	0.04	(+/-)	0.03	0	0							
BOD	(mg/l)	2	-	6^{4}	Type 7	Stogursey Brook - Good^{PrP}	5 (90%)	13.2	2.00	2.00	<	<	<	2.87	(+/-)	5.16	<	13.2	-	-	-	8.72	-	-	1.80
Chloride	(mg/l)	1	250^{1a}	250^{3} A	-	-	-	52.4	49.4	61.5	109	60.7	176	84.8	(+/-)	49.6	49.4	176	-	-	-	n/a	-	-	0.58
Nitrate	(mg/l)	1	50^{1}	-	-	-	-	15.5	9.64	<	<	<	<	4.19	(+/-)	6.76	<	15.5	-	-	-	n/a	-	-	1.61
Suspended Solids	(mg/l)	5	-	25^{12}	-	-	-	100	130	97.0	36.0	<	39.0	67.0	(+/-)	49.4	<	130	-	-	-	n/a	-	-	0.74
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	282	325	313	503	778	455	443	(+/-)	186	282	778	-	-	-	n/a	-	-	0.42
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10^{6}	50^{7}	-	-	-	<	<	<	<	<	<	<	(+/-)	n/a	0	0	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10^{1}	6-9^{I}	n/a	Stogursey Brook - High^{CPrP}	6 (5%) 9 (95%)	8	8	8	7	7	8	7.58	(+/-)	0.48	7	8	6.93	-	-	-	8.10	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High$^{CPrP\ A}$	25 (98%)	13	9	11	12	13	16	12.19	(+/-)	2.26	9	16	-	-	-	-	-	15	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High^{CPrP}	70 (10%)	82	88	78	30	73	58	68.32	(+/-)	21.16	30	88	-	44	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8^{G12} 100%>5^{G12} 50%>7^{I12}	-	-		9	10	9	3	8	6	7.39	(+/-)	2.52	3	10	-	-	8	-	-	-	-
SW7									(average)																
Total Zinc	(µg/l)	5	5000^{6}	75-500^{2} AT* (300-2000)P	Mean hardness 238 i.e. 100-250	Stogursey Brook - High^{CPr} Note only 'good' standard presented in WFD directions.	75 AT*	63.1	40.0	51.7	42.0	D	D	49.2	(+/-)	10.6	40.0	63.1	-	-	-	59.71	-	-	0.22
Total Boron	(µg/l)	5	1000^{1} T	2000^{2} AT	-	-	-	-	-	-	-	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000^{1} T$^{\#}$	2000^{2} AT$^{\#}$	-	-	-	12.0	62.0	47.0	52.0	D	D	43.3	(+/-)	21.7	12.0	62.0	-	-	-	n/a	-	-	0.50
Sodium	(mg/l)	0.1	200^{1}	170 A^	-	-	-	50.3	30.2	41.4	89.1	D	D	52.7	(+/-)	25.6	30.2	89.1	-	-	-	n/a	-	-	0.49
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.09	0.06	0.02	0.17	D	D	0.08	(+/-)	0.06	0.02	0.17	-	-	-	0.15	-	-	0.77
Total Ammonia as N	(mg/l)	-	-	1.3^{4}	Type 7	Stogursey Brook - Good^{CPrP}	0.6	0.07	0.04	0.02	0.13	D	D	0.07	(+/-)	0.05	0.02	0.13				0.11			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good^{CPrA}	n/a	0.0008	0.0004	0.0007	0.0011	D	D	0.00	(+/-)	0.00	0.00	0.00							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025^{12I}				0.0009	0.0005	0.0008	0.0013	D	D	0.00	(+/-)	0.00	0.00	0.00							
Ammonium as N	(mg/l)	-	-	-				0.07	0.04	0.01	0.13	D	D	0.06	(+/-)	0.05	0.01	0.13							
Ammonium as NH_4	(mg/l)	-	0.5^{1}	1^{12}				0.09	0.05	0.02	0.17	D	D	0.08	(+/-)	0.06	0.02	0.17							
BOD	(mg/l)	2	-	6^{4}	Type 7	Stogursey Brook - Good^{PrP}	5 (90%)	<	<	<	<	D	D	<	(+/-)	n/a	n/a	n/a	-	-	-	n/a	-	-	n/a
Chloride	(mg/l)	1	250^{1a}	250^{3} A	-	-	-	76.8	64.5	96.7	183	D	D	105	(+/-)	53.5	64.5	183	-	-	-	n/a	-	-	0.51
Nitrate	(mg/l)	1	50^{1}	-	-	-	-	6.76	<	<	<	D	D	1.69	(+/-)	3.38	<	6.76	-	-	-	n/a	-	-	2.00
Suspended Solids	(mg/l)	5	-	25^{12}	-	-	-	20.0	54.0	31.0	46.0	D	D	37.8	(+/-)	15.2	20.0	54.0	-	-	-	n/a	-	-	0.40
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	188	244	273	249	D	D	238	(+/-)	35.9	188	273	-	-	-	n/a	-	-	0.15
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10^{6}	50^{7}	-	-	-	<	<	<	<	D	D	<	(+/-)	n/a	n/a	n/a	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10^{1}	6-9^{I}	n/a	Stogursey Brook - High^{CPrP}	6 (5%) 9 (95%)	8	8	8	8	D	D	7.87	(+/-)	0.33	8	8	7.55	-	-	-	8.24	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High$^{CPrP\ A}$	25 (98%)	8	8	12	14	D	D	10.40	(+/-)	3.46	8	14	-	-	-	-	-	14	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High^{CPrP}	70 (10%)	30	44	67	28	D	D	42.33	(+/-)	18.18	28	67	-	28	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8^{G12} 100%>5^{G12} 50%>7^{I12}	-	-		4	5	7	3	D	D	4.72	(+/-)	1.93	3	7	-	-	4	-	-	-	-
SW9										(average)															
Total Zinc	(µg/l)	5	5000^{6}	75-500^{2} AT* (300-2000)P	Mean hardness 241 i.e. 100-250	Stogursey Brook - High^{CPr} Note only 'good' standard presented in WFD directions.	75 AT*	68.5	53.8	54.6	D	D	D	59.0	(+/-)	8.29	53.8	68.5	-	-	-	65.75	-	-	0.14
Total Boron	(µg/l)	5	1000^{1} T	2000^{2} AT	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000^{1} T$^{\#}$	2000^{2} AT$^{\#}$	-	-	-	<	69.0	53.5	D	D	D	40.8	(+/-)	36.2	<	69.0	-	-	-	n/a	-	-	0.89
Sodium	(mg/l)	0.1	200^{1}	170 A^	-	-	-	25.9	18.8	24.6	D	D	D	23.1	(+/-)	3.76	18.8	25.9	-	-	-	n/a	-	-	0.16
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.10	0.62	0.10	D	D	D	0.27	(+/-)	0.30	0	0.62	-	-	-	0.52	-	-	1.11
Total Ammonia as N	(mg/l)	-	-	1.3^{4}	Type 7	Stogursey Brook - Good^{CPrP}	0.6	0.08	0.48	0.07	D	D	D	0.21	(+/-)	0.23	0	0.48				0.40			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good^{CPrA}	n/a	0.0006	0.0028	0.0010	D	D	D	0.00	(+/-)	0.00	0	0.00							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025^{12I}				0.0008	0.0034	0.0012	D	D	D	0.00	(+/-)	0.00	0	0.00							
Ammonium as N	(mg/l)	-	-	-				0.08	0.48	0.07	D	D	D	0.21	(+/-)	0.23	0	0.48							
Ammonium as NH_4	(mg/l)	-	0.5^{1}	1^{12}				0.10	0.62	0.09	D	D	D	0.27	(+/-)	0.30	0	0.62							
BOD	(mg/l)	2	-	6^{4}	Type 7	Stogursey Brook - Good^{PrP}	5 (90%)	<	3.00	4.10	D	D	D	2.37	(+/-)	2.12	<	4.10	-	-	-	3.88	-	-	0.90
Chloride	(mg/l)	1	250^{1a}	250^{3} A	-	-	-	26.4	22.6	33.8	D	D	D	27.6	(+/-)	5.68	22.6	33.8	-	-	-	n/a	-	-	0.21
Nitrate	(mg/l)	1	50^{1}	-	-	-	-	<	<	<	D	D	D	<	(+/-)	n/a	n/a	n/a	-	-	-	n/a	-	-	n/a
Suspended Solids	(mg/l)	5	-	25^{12}	-	-	-	276	126	68	D	D	D	157	(+/-)	108	67.5	276	-	-	-	n/a	-	-	0.69
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	150	236	336	D	D	D	241	(+/-)	92.7	150	336	-	-	-	n/a	-	-	0.39
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10^{6}	50^{7}	-	-	-	<	<	<	D	D	D	<	(+/-)	n/a	<	n/a	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10^{1}	6-9^{I}	n/a	Stogursey Brook - High^{CPrP}	6 (5%) 9 (95%)	8	8	8	D	D	D	7.75	(+/-)	0.15	8	8	7.62		-	-	7.89	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High$^{CPrP\ A}$	25 (98%)	7	7	9	D	D	D	7.73	(+/-)	0.93	7	9	-	-	-	-	-	9	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High^{CPrP}	70 (10%)	24	32	64	D	D	D	39.77	(+/-)	21.09	24	64	-	25	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8^{G12} 100%>5^{G12} 50%>7^{I12}	-	-		3	4	7	D	D	D	4.60	(+/-)	2.50	3	7	-		4	-	-	-	-

Note: Where duplicate samples have been taken, the mean of the original and duplicate has been considered for statistical interpretation. Where a sample result is below the limit of detection, this value has been substituted with < and a zero value has been used for calculation purposes.

Determinand	Units	Minimum Reporting Value	Screening Value: Pre-WFD: DWS	Screening Value: Pre-WFD: Freshwater EQS	Screening Value: WFD: WFD Type	Screening Value: WFD: Waterbody & Status (Stogursey Brook)	Screening Value: WFD: WFD standard	Surface Water Sampling Campaign: Jan-2009 Campaign 1	Mar-2009 Campaign 2	Apr-2009 Campaign 3	May-2009 Campaign 4	June-2009 Campaign 5	Jul-2009 Campaign 6	Mean (+/-) Stand dev			Minimum	Maximum	5th Percentile	10th Percentile	50th Percentile	90th Percentile	95th Percentile	98th Percentile	Coefficient of variation
SW11																									
Total Zinc	(µg/l)	5	5000[6]	75-500[2] AT* (300-2000)P	Mean hardness 276 i.e. >250	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	125 AT*	48.1	74.5	69.2	D	D	D	63.9	(+/-)	14.0	48.1	74.5	-	-	-	73.44	-	-	0.22
Total Boron	(µg/l)	5	1000[1] T	2000[2] AT	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000[1] T[#]	2000[2] AT[#]	-	-	-	<	53.0	46.0	D	D	D	33.0	(+/-)	28.8	<	53.0	-	-	-	n/a	-	-	0.87
Sodium	(mg/l)	0.1	200[1]	170 A^	-	-	-	25.6	17.0	25.0	D	D	D	22.5	(+/-)	4.81	17.0	25.6	-	-	-	n/a	-	-	0.21
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	0.24	0.12	0.17	D	D	D	0.18	(+/-)	0.06	0.12	0.24	-	-	-	0.23	-	-	0.35
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	0.19	0.09	0.13	D	D	D	0.14	(+/-)	0.05	0.09	0.19				0.18			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	0.0023	0.0005	0.0045	D	D	D	0.00	(+/-)	0.00	0.00	0.00							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				0.0028	0.0006	0.0055	D	D	D	0.00	(+/-)	0.00	0.00	0.01							
Ammonium as N	(mg/l)	-	-	-				0.19	0.09	0.13	D	D	D	0.14	(+/-)	0.05	0.09	0.19							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				0.24	0.12	0.16	D	D	D	0.18	(+/-)	0.06	0.12	0.24							
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	15.6	4.00	2.60	D	D	D	7.40	(+/-)	7.14	2.60	15.6	-	-	-	13.28	-	-	0.96
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	25.9	26.0	31.4	D	D	D	27.8	(+/-)	3.15	25.9	31.4	-	-	-	n/a	-	-	0.11
Nitrate	(mg/l)	1	50[1]	-	-	-	-	<	<	<	D	D	D	<	(+/-)	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	138	6.50	23.0	D	D	D	55.8	(+/-)	71.6	6.50	138	-	-	-	n/a	-	-	1.28
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	172	276	379	D	D	D	276	(+/-)	103.5	172	379	-	-	-	n/a	-	-	0.38
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	<	<	<	D	D	D	<	(+/-)	n/a	<	n/a	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	7.90	8	8	D	D	D	7.90	(+/-)	0.40	7.5	8.3	7.54	-	-	-	8.26	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	7.50	8	10	D	D	D	8.37	(+/-)	1.02	7.5	9.5	-	-	-	-		9	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High[CPrP]	70 (10%)	25	52	49	D	D	D	42.03	(+/-)	14.46	25.4	51.6	-	30	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-		3	6	6	D	D	D	4.90	(+/-)	1.61	3.1	6.1	-	-	6	-	-	-	-
SWA												(average)													
Total Zinc	(µg/l)	5	5000[6]	75-500[2] AT* (300-2000)P	Mean hardness 247 i.e. 100-250	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	75 AT*	-	-	-	86.0	55.2	195	112	(+/-)	73.2	55.2	195	-	-	-	172.88	-	-	0.65
Total Boron	(µg/l)	5	1000[1] T	2000[2] AT	-	-	-	-	-	-	-	18.5	28	23.3	(+/-)	6.72	18.5	28.0	-	-	-	n/a	-	-	0.29
Dissolved Boron	(µg/l)	5	1000[1] T[#]	2000[2] AT[#]	-	-	-	-	-	-	14.0	14.5	51	26.5	(+/-)	21.2	14.0	51.0	-	-	-	n/a	-	-	0.80
Sodium	(mg/l)	0.1	200[1]	170 A^	-	-	-	-	-	-	60.9	28.7	18.2	35.9	(+/-)	22.2	18.2	60.9	-	-	-	n/a	-	-	0.62
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	-	-	-	0.15	0.07	0.08	0.10	(+/-)	0.05	0.07	0.15	-	-	-	0.14	-	-	0.46
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	-	-	-	0.12	0.05	0.06	0.08	(+/-)	0.04	0.05	0.12				0.11			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	-	-	-	0.0046	0.0005	0.0014	0.00	(+/-)	0.00	0.00	0.00							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				-	-	-	0.0055	0.0006	0.0018	0.00	(+/-)	0.00	0.00	0.01							
Ammonium as N	(mg/l)	-	-	-				-	-	-	0.11	0.05	0.06	0.07	(+/-)	0.03	0.05	0.11							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				-	-	-	0.14	0.06	0.08	0.10	(+/-)	0.04	0.06	0.14							
BOD	(mg/l)	2	-	6[4]	Type 3	Stogursey Brook - Good[PrP]	5 (90%)	-	-	-	6.00	5.30	0	3.77	(+/-)	3.28	0.00	6	-	-	-	5.86	-	-	0.87
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	-	-	-	70.0	28.1	30	42.9	(+/-)	23.5	28.1	70.0	-	-	-	n/a	-	-	0.55
Nitrate	(mg/l)	1	50[1]	-	-	-	-	-	-	-	23.0	38.6	18	26.6	(+/-)	10.7	18.1	38.6	-	-	-	n/a	-	-	0.40
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	-	-	-	<	<	16	5.33	(+/-)	9.24	<	16.0	-	-	-	n/a	-	-	1.73
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	-	-	-	220	336	186	247	(+/-)	78.6	186	336	-	-	-	n/a	-	-	0.32
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	-	-	-	<	<	<	<	(+/-)	n/a	0	0	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	-	-	-	8.20	7.60	7.90	7.90	(+/-)	0.30	8	8	7.63	-	-	-	8.17	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	-	-	-	14.2	14.8	16.2	15.07	(+/-)	1.02	14	16		-	-	-		16	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 3	Stogursey Brook - High[CPrP]	70 (10%)	-	-	-	45.4	75.4	93.4	71.40	(+/-)	24.25	45	93	-	51.4	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-					4.69	7.28	9.17	7.05	(+/-)	2.25	5	9	-	-	7.3	-	-	-	-
SWB													(average)												
Total Zinc	(µg/l)	5	5000[6]	75-500[2] AT* (300-2000)P	Mean hardness 529 i.e. >250	Stogursey Brook - High[CPr] Note only 'good' standard presented in WFD directions.	125 AT*	-	-	-	57.0	109	157	108	(+/-)	49.8	57	157	-	-	-	147.08	-	-	0.46
Total Boron	(µg/l)	5	1000[1] T	2000[2] AT	-	-	-	-	-	-	-	109	189	149	(+/-)	56.6	109	189	-	-	-	n/a	-	-	0.38
Dissolved Boron	(µg/l)	5	1000[1] T[#]	2000[2] AT[#]	-	-	-	-	-	-	137	82.0	265	161	(+/-)	93.6	82	265	-	-	-	n/a	-	-	0.58
Sodium	(mg/l)	0.1	200[1]	170 A^	-	-	-	-	-	-	83.5	81.0	73.8	79.4	(+/-)	5.03	74	83.5	-	-	-	n/a	-	-	0.06
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	-	-	-	0.16	0.15	<	0.10	(+/-)	0.09	<	0.16	-	-	-	0.16	-	-	0.87
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	-	-	-	0.12	0.12	D	0.08	(+/-)	0.07	0.1	0.1				0.12			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	-	-	-	0.0019	0.0002	D	0.00	(+/-)	0.00	0.0	0.0							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				-	-	-	0.0023	0.0003	D	0.00	(+/-)	0.00	0.0	0.0							
Ammonium as N	(mg/l)	-	-	-				-	-	-	0.12	0.12	D	0.08	(+/-)	0.07	0.1	0.1							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				-	-	-	0.16	0.15	D	0.10	(+/-)	0.09	0.1	0.2							
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	-	-	-	<	<	<	<	(+/-)	n/a	<	<	-	-	-	n/a	-	-	n/a
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	-	-	-	185	47.1	90.0	107	(+/-)	70.6	47	185	-	-	-	n/a	-	-	0.66
Nitrate	(mg/l)	1	50[1]	-	-	-	-	-	-	-	<	<	<	<	(+/-)	n/a	<	<	-	-	-	n/a	-	-	n/a
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	-	-	-	10	10	9	9.7	(+/-)	0.58	9	10.0	-	-	-	n/a	-	-	0.06
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	-	-	-	369	821	398	529	(+/-)	253.0	369	821	-	-	-	n/a	-	-	0.48
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	-	-	-	<	<	<	<	(+/-)	n/a	<	<	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	-	-	-	8	7	7	7.35	(+/-)	0.45	7	8	6.95	-	-	-	7.76	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	-	-	-	13	14	16	13.48	(+/-)	1.35	13	16	-	-	-	-		16	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High[CPrP]	70 (10%)	-	-	-	36	51	38	43.25	(+/-)	8.02	36	51	-	36	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-					4	5	4	4.52	(+/-)	0.86	4	5	-	-	3.8	-	-	-	-
SWC																									
Total Zinc	(µg/l)	5	5000[6]	75-500[2] AT*	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Total Boron	(µg/l)	5	1000[1] T	2000[2] AT	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000[1] T[#]	2000[2] AT[#]	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Sodium	(mg/l)	0.1	200[1]	170 A^	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	-	-	-	D	D	D		n/a		n/a	n/a				n/a			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	-	-	-	D	D	D		n/a		n/a	n/a							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				-	-	-	D	D	D		n/a		n/a	n/a							
Ammonium as N	(mg/l)	-	-	-				-	-	-	D	D	D		n/a		n/a	n/a							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				-	-	-	D	D	D		n/a		n/a	n/a							
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Nitrate	(mg/l)	1	50[1]	-	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)	-	-	-	D	D	D		n/a		n/a	n/a	n/a	-	-	-	-	-	-
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	-	-	n/a	-
Dissolved Oxygen	% saturation	0 (In-situ)	-	-	Type 7	Stogursey Brook - High[CPrP]	70 (10%)	-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	-	-	-	-
Dissolved Oxygen	mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	-	-		-	-	-	D	D	D		n/a		n/a	n/a	-	-	-	-	-	-	-

Note: Where duplicate samples have been taken, the mean of the original and duplicate has been considered for statistical interpretation. Where a sample result is below the limit of detection, this value has been substituted with < and a zero value has been used for calculation purposes.

Determinand	Units	Minimum Reporting Value	Screening Value: Pre-WFD: DWS	Pre-WFD: Freshwater EQS	WFD: WFD Type	WFD: Waterbody & Status (Stogursey Brook)	WFD: WFD standard	Surface Water Sampling Campaign: Jan-2009 Campaign 1	Mar-2009 Campaign 2	Apr-2009 Campaign 3	May-2009 Campaign 4	June-2009 Campaign 5	Jul-2009 Campaign 6	Mean (+/-) Stand dev	Minimum	Maximum	5th Percentile	10th Percentile	50th Percentile	90th Percentile	95th Percentile	98th Percentile	Coefficient of variation
SWF (Field Blank)																							
Total Zinc	(µg/l)	5	5000[6]	75-500[2] AT* (300-2000)P	n/a	n/a	n/a	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Total Boron	(µg/l)	5	1000[1] T	2000[2] AT	-	-	-	-	-	-	-	-	-	n/a	n/a	n/a	-	-	-	n/a	-	-	n/a
Dissolved Boron	(µg/l)	5	1000[1] T[#]	2000[2] AT[#]	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Sodium	(mg/l)	0.1	200[1]	170 A^	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Total Ammonia as NH_4	(mg/l)	0.01	-	-	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Total Ammonia as N	(mg/l)	-	-	1.3[4]	Type 7	Stogursey Brook - Good[CPrP]	0.6	-	-	-	-	-	D	n/a	<	n/a				n/a			
Un-ionised ammonia as N	(mg/l)	-	-	-	('Specific Pollutant' - Annex 8)	Stogursey Brook - Good[CPrA]	n/a	-	-	-	-	-	D	n/a	<	n/a							
Un-ionised ammonia as NH_3	(mg/l)	-	-	0.025[12I]				-	-	-	-	-	D	n/a	<	n/a							
Ammonium as N	(mg/l)	-	-	-				-	-	-	-	-	D	n/a	<	n/a							
Ammonium as NH_4	(mg/l)	-	0.5[1]	1[12]				-	-	-	-	-	D	n/a	<	n/a							
BOD	(mg/l)	2	-	6[4]	Type 7	Stogursey Brook - Good[PrP]	5 (90%)	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Chloride	(mg/l)	1	250[1a]	250[3 A]	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Nitrate	(mg/l)	1	50[1]	-	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Suspended Solids	(mg/l)	5	-	25[12]	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Total Hardness	(mg/l as $CaCO_3$)	10	-	-	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	10[6]	50[7]	-	-	-	-	-	-	<	-	-	n/a	<	n/a	-	-	-	n/a	-	-	n/a
pH	pH units	0 (In-situ)	6.5-10[1]	6-9[I]	n/a	Stogursey Brook - High[CPrP]	6 (5%) 9 (95%)										-	-	-		-	-	
Temperature	°C	n/a	-	-	Cyprinid	Stogursey Brook - High[CPrP A]	25 (98%)										-	-	-		-	-	
Dissolved Oxygen	% saturation or mg/l	0 (In-situ)	-	50%>8[G12] 100%>5[G12] 50%>7[I12]	Type 7	Stogursey Brook - High[CPrP]	70 (10%)										-	-	-		-	-	

Duplicate Analyses (Comparison of the laboratory analyis undertaken on replicate samples)

Determinand	Units	Minimum Reporting Value	SW6	SW6A (replicate of SW6)				SW6 average	SW7	SW7A (replicate of SW7)	SW7 average	SW9	SW9A (replicate of SW9)	SW9 average	SWA	SWAA (replicate of SWA)	SWA average
Total Zinc	(µg/l)	5	57.0	63.0	60.0	41.0	39.0	40.0	57.0	52.2	54.6	55.3	55.0	55.2	167	146	157
Total Boron	(µg/l)	5	-	-	-	-	-	-	-	-	-	17.0	20.0	18.5	193	185	189
Dissolved Boron	(µg/l)	5	171	192	182	65.0	59.0	62.0	51.0	56.0	53.5	14.0	15.0	14.5	259	270	265
Sodium	(mg/l)	0.1	104.4	93.0	98.7	30.5	29.8	30.2	23.4	25.7	24.6	28.6	28.9	28.7	70.1	77.5	73.8
Ammonia	(mg/l)	0.01	0.02	0.01	0.02	0.03	0.08	0	0.07	0.12	0	0.08	0.05	0.07	0.19	0.21	0
BOD	(mg/l)	2	<	<	<	0.0	0.0	0	4.20	4.00	4.10	4.60	6.00	5.30	<	<	<
Chloride	(mg/l)	1	109	109	109	64.0	65.0	64.5	34.6	33.0	33.8	26.4	29.8	28.1	91.1	88.8	90.0
Nitrate	(mg/l)	1	<	<	<	<	<	<	<	<	<	37.1	40.2	38.6	<	<	<
Suspended Solids	(mg/l)	5	25.0	47.0	36.0	56.0	52.0	54.0	69.0	66.0	67.5	<	<	<	7.00	11.0	9.00
Total Hardness	(mg/l as $CaCO_3$)	10	513	493	503	245	242	244	331	340	336	329	343	336	381	414	398
Total Petroleum Hydrocarbons (C_8-C_{35})	(µg/l)	10	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Key:

Exceeds DWS | Exceeds EQS Fresh | Exceeds WFD

Exceeds both DWS and EQS Fresh

Average of duplicate analyses

Repeat sample

Notes:

1 The Water Supply (Water Quality) Regulations 2000
2 National Environmental Quality Standards (EQS) - For List II substances. Source DoE Circulat 7/89.
3 Environment Agency Non-Statutory (Operational) Environmental Quality Standards.
Source Table B11 Environment Agency EPR H1 Environmental Risk Assessment Part 2 Assessment of point source releases and cost benefit analysis.
4 River Ecosystem Classification (RE3) - The Surface Waters (River Ecosystem)(Classification) Regulations 1994 (90th percentile)
5 Proposed Environmental Quality Standards for Priority Substances and Certain Other Substances (COM2006/397).
6 The Water Supply (Water Quality) Regulations 1989.
N.B These Regulations were superseded by the 2000 regulations therefore there is currently no UK DWS for zinc and / or Total Petroleum Hydrocarbons.
7 The Surface Waters (Abstraction) for Drinking Water (Classification) Regulations 1996. DW1 treatment (i.e simple physical treatment and disinfection) limit.
8 The Surface Waters (Dangerous Substances) (Classification) Regulations 1989
9 The Surface Waters (Dangerous Substances) (Classification) Regulations 1992
10 The Surface Waters (Dangerous Substances) (Classification) Regulations 1997
11 The Surface Waters (Dangerous Substances) (Classification) Regulations 1998
12 2006 / 44/ EC Fish Directive, Cyprinid Fish Guideline.
13 The Private Water Supply Regulations 1991. N.B. These Regulations were superseded by the 2008 regulations therefore there is currently no UK DWS for calcium, magnesium and potassium.
Ammonia calculations as presented in: Canadian Council of Ministers of the Environment (2010). Canadian water quality guidelines for the protection of aquatic life:
Ammonia. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
a Point of Monitoring / Complaince may be at samples leaving treatment works or at other supply point e.g consumers taps.
b The specified compounds are: chloroform, bromomform, dibromochloromethane and bromodichloromethane. quantified in the monitoring process.
c The parametric values applies to the sum of the concentrations of the individual compounds detected and quantified in the monitoring process.
d The specified PAH compounds are: Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-c,d)pyrene and benzo (ghi) pyrene.
* Hardness related (Zinc toxicity is influenced by hardness. Specific EQS values (mg/l zinc) are given for different hardness ranges within the legislation. By comparing to the hardness value, the appropriate EQS concentration has been selected).
A Annual Average; MAC - Maximum Allowable Concentration;T - Total; D - Dissolved; P - 90% of results; I - Imperative value; G - Guideline Value
^ Non statutory / proposed EQS, but EQS never adopted in UK. Therefore value quoted is for guidance only.
\# No statutory EQS for dissolved Boron - adopted Total Boron value
\- Analysis not undertaken
D Watercourse dry during sampling visit
C Current WFD status;
Pr Predicted WFD status by 2015

APPENDIX C

Summary results of *In-situ* analysis

Summary results of *in-situ* analysis

	pH		Dissolved Oxygen	
Campaign number	**pH minimum**	**pH maximum**	**Minimum DO % (mg/l; Temp)**	**Maximum DO % (mg/l; Temp)**
1	Unreliable dataset			
2	7.50	7.90	31.7 % (3.9 mg/l; 7.2 °C)	96.3 % (11.3 mg/l; 8.5 °C)
3	7.60	8.30	47.4 % (5.2 mg/l; 11.2 °C)	78.2 % (8.6 mg/l; 11.1 °C)
4	6.80	8.20	21.2 % (2.4 mg/l; 11.3 °C)	45.4 % (4.7 mg/l; 14.2 °C)
5	6.80	7.60	50.6 % (5.3 mg/l; 13.5 °C)	75.4 % (7.3 mg/l; 14.8 °C)
6	7.40	7.90	37.7 % (3.7 mg/l; 15.8 °C)	93.4 % (9.2 mg/l; 16.2 °C

APPENDIX D

Stogursey Brook WFD Waterbody Table,

Taken from Annex B of the South West River Basin District Management Plan.

Waterbody Category and Map Code.:	River - R84	**Surveillance site:** No
Waterbody ID and Name:	GB108052021340	STOGURSEY BK
National Grid Reference:	ST 19542 43410	
Current Overall Status	Poor	
Status Objective (Overall):	Good by 2015	(For Protected Area Objectives see Annex D)
Status Objective(s):	Good Ecological Status by 2015	
Justification if overall objective is not good status by 2015:		
Protected Area Designation:	Natura 2000 (Habitats and/or Birds Directive), Nitrates Directive	
SSSI (Non-N2K) related:	No	
Hydromorphological Designation:	Not Designated A/HMWB	
Reason for Designation:		
Downstream Waterbody ID:	GB540805210900	

Ecological Status

Current Status (and certainty that status is less than good) Poor (Quite Certain - WoE)

Biological elements

Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Invertebrates	Good	Good	
Phytobenthos	Poor (Very Certain)	Good	

Supporting elements

Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Ammonia (Phys-Chem)	Good	Good	
Dissolved Oxygen	High	High	
pH	High	High	
Phosphate	Poor (Very Certain)	Good	
Temperature	High	High	
Copper	High	High	
Zinc	High	High	
Ammonia (Annex 8)	Good	Good	

Supporting conditions

Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Quantity and Dynamics of Flow	Supports Good	Supports Good	
Morphology	Supports Good	Supports Good	

Chemical Status	
Current Status (and certainty that status is less than good)	Does not require assessment

APPENDIX 18A: NUMERICAL HYDRODYNAMIC MODELLING DEVELOPMENT

CONTENTS

TABLES

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APPENDIX 18A: NUMERICAL HYDRODYNAMIC MODELLING DEVELOPMENT

18A.1 Environmental Regulatory Requirements

18A.1.1 The following text is taken directly from Ref. 18A.1, which provides the current environmental regulatory guidance appropriate to considerations of New Nuclear Build in the UK.

a) Introduction

18A.1.2 *“There are plans to build a number of new nuclear power stations in England and Wales over the next decade or so. All of these power stations will be located on the coast to enable sea water to be used as the prime coolant. At each site, sea water will be extracted, used for cooling, and returned to the sea with temperatures elevated by about 10^{o}C. Flow rates will be of the order of 100 m^{3}/sec (cumecs), so potentially the thermal and consequential ecological impact on the receiving water will be large according to the dilution and dispersion available.*

18A.1.3 *‘This thermal and ecological impact on the receiving waters cannot be avoided, but it must be minimised.*

18A.1.4 *‘Whilst the thermal impact of the discharge is of prime interest, the discharge may have secondary impacts, such as*

- *Changes in speciation of ammonia as a result of the elevated temperatures.*
- *Changes in salinity as a result of the abstraction/discharge regime.*
- *Changes in DO as a result of elevated temperature.;*
- *Discharges of anti-fouling agents and their by-products.*
- *Discharges of other process chemicals.*

18A.1.5 *‘Hydrodynamic modelling forms an essential part of the scheme design. It is needed to ensure that:*

- *The abstraction is located so as to minimise ecological and fisheries impacts, and;*
- *The abstraction and discharge points are located such that interaction between the two is minimised, and;*
- *The impact of the thermal plume is understood and minimised, particularly in sensitive areas, and;*
- *Any secondary impacts are understood and minimised, particularly in sensitive areas.*

18A.1.6 *'This paper aims to outline Agency requirements for the modelling that must be undertaken. It does not attempt to specify in detail the type of model to be used or the modelling runs that are required – the discharger is expected to produce the detailed specification for the modelling. This specification should be agreed with the Agency on a site-by-site basis.*

18A.1.7 *'Note that the use of the term "Mixing Zone" below refers to the part of a body of surface water within which a standard is exceeded. In tidal waters this can be temporally and spatially variable.*

18A.1.8 *'For example, if the particular standard under consideration is a maximum elevation of temperature of no more than 2^{o}C above ambient, then the "Mixing Zone" is the volume of water, in 3-D, within which the water temperature can be reasonably expected to be 2 or more degrees above ambient at some time during the lifetime of the plant. In this example, the "Mixing Zone" is the 3-D envelope around the discharge point encompassing all locations where, when the discharge is at its maximum permitted temperature, the instantaneous temperature elevation may be above 2^{o}C at some time. It will be much larger than any instantaneous zone within which the temperature elevation is 2^{o}C or more.*

18A.1.9 *'Alternatively, if the standard under consideration is a 98%ile temperature of 23^{o}C over a year, then the "Mixing Zone" is the 3-D envelope around the discharge point encompassing all locations where the temperature is predicted to exceed 23^{o}C for more than 2% of the time. The size of this "Mixing Zone" may be small when compared to the worst-case instantaneous impact of the discharge.*

18A.1.10 *'Clearly, the "Zone of Influence" (of elevated temperature) will extend beyond the "Mixing Zone" as it is defined here."*

b) Agency Requirements

18A.1.11 *"Our requirements for the thermal plume modelling (and post-project appraisal) are summarised as follows:*

- *Modelled output to provide information in 3-D.*
- *Model(s) must be suitable for the application(s).*
- *Not limited to the use of one model – different model types can support and complement each other, for example an excess temperature model looking at different discharge temperature elevations, run over relatively short periods for a number of different scenarios, and a long-term absolute temperature model.*
- *Model(s) must be demonstrated to be suitably calibrated and validated – validation against existing thermal plumes if possible, including the use of aerial or satellite imaging.*
- *Model(s) to comply with Agency standards for hydrodynamic model calibration/validation.*
- *Model(s) to be independently audited – audit report(s) to be provided.*

- *Model(s) to be available for use over period of at least 10 years from date of commissioning of the power station, and beyond that for as long as there is(are) no suitable alternative(s) available.*
- *Agency will require access to the model(s) over the lifetime of the power stations.*
- *Output to represent both absolute temperature and excess temperature above background, both in the near/mid-field and in the far-field.*
- *Results to include the effects of tidal currents, residual currents, wind driven currents, turbidity, solar insolation, cloud cover, air temperature, surface cooling including the effect of wind, river flows, river temperature, thermal and saline stratification, seasonal effects (including short-term extreme temperature events), and sedimentation and erosion.*
- *Results to cover a range of plausible scenarios of climate-change driven rises in air and sea temperatures and sea-levels over the planned life-time of the station.*
- *Results from alternative abstraction and discharge locations, including options to discharge near-bed, mid-water-column, or near-surface, and utilising different outfall designs, as appropriate.*
- *Maps to show locations of designations, sensitive waters, relevant sensitive receptors, etc.*
- *Mixing Zones appropriate to the various thermal standards to be presented in 3-D, based on the statistics of the standard (e.g. annual average, maximum, 98%ile).*
- *Where a Mixing Zone relates to an instantaneous statistic (such as maximum value), then as far as is practicable, some indication of the variation of the duration of exceedence over the Mixing Zone.*
- *In addition to the presentation of the overall Mixing Zones, various instantaneous representations of the temperature field are needed to enable an understanding of typical conditions.*
- *Detailed impact assessment inside the Mixing Zones (and outside if considered appropriate) for all relevant receptors (flora and fauna throughout the water column, on and within the sea bed, and in the inter-tidal zone) to be assessed and discussed.*
- *Relevant statistics of the mixing zones: e.g. area, volume, proportion of estuarine cross-section, proportion of time threshold value exceeded.*
- *Post-scheme appraisal within 5 years of commissioning to validate (or not) the model predictions – based on field observations, satellite or aerial imaging, etc.*
- *If necessary, the re-calibration and validation of the model(s) following post-scheme appraisal.*

18A.1.12 *'Our requirements for the modelling of secondary impacts are essentially the same. Any models used will need to incorporate water quality modules suitable for the processes being modelled."*

18A.2 HPC Model Development

a) Organisational Arrangements

18A.2.1 In complying with the guidance set out above, EDF Energy first established an organisational framework within the British EDF Estuarine and Marine Studies (BEEMS) programme of NNB-related studies (see **Volume 2**, **Chapter 19**) which placed an independent and highly expert team in control of both model specification and quality assurance roles.

18A.2.2 A data centre to current best practice standards was established within this framework and a wide variety of studies established in order to secure baseline oceanographic data in the vicinity of Hinkley Point (see **Volume 2, Chapters 17, 18 & 19**). This included an extensive bathymetric survey effort utilising a number of remote sensing techniques and allied ground truthing, resulting in a wide field composite bathymetry.

18A.2.3 A pair of separate, appropriately qualified, contractors were then charged with establishing and developing separate numerical hydrodynamic models, taking best advantage of the physical data that had been, as was continuing to be, gathered in the field. One of these models simulated excess temperatures, the other absolute temperatures.

18A.2.4 Model codes were not accepted into actual use within BEEMS until they had successfully completed the calibration and validation processes, satisfying specific acceptance criteria laid down by the auditing team.

b) Strategy

18A.2.5 The following text is largely derived from Ref. 18A.2.

18A.2.6 The modelling methodology for the proposed HPC cooling water (CW) system adopted the following approach:

- *Stage 1. Setup and validation of 2 different models against field data (hydrodynamics and thermal plume)*
- *Stage 2. Use of the validated models to examine 4 possible options for the CW configuration for HPC.*
- *Stage 2. Review. The preferred CW option on environmental and recirculation grounds was then selected by EDF Energy and then subjected to engineering refinement to produce a proposed design.*
- *Stage 3. Results from modelling the proposed design both alone and in combination with the discharge from HPB*
- *Stage 3 Review*
- *Stage 3a. Results of modelling the final configuration after any required model setup refinement following the Stage 3 review.*

18A.2.7 The critical reviews at Stage 2 and 3 were undertaken to validate that the models were adequate for purpose. At these reviews it was envisaged that refinements to the model setups might be required if significant discrepancies with field observations or between model outputs were found. Changes to model setups would then require a rerun of the appropriate modelling stage.

18A.2.8 The Stage 2 review (Ref. 18A.3) presented an initial evaluation of the results of applying the two different validated models to the four options for the HP C CW configuration. These options were compared on environmental grounds in Ref. 18A.4. A preferred configuration option was then selected by EDF Energy and subjected to engineering refinement to produce a final design. This design was then modelled alone and in combination with the HPB discharge in Stage 3.

18A.2.9 The Stage 3 model outputs were then subject to detailed review. Both models replicated the hydrodynamic conditions well but there remained questions about the quality of the thermal predictions due to the limited thermal calibration data that was then available. To fill this gap, additional time series data on the temperatures recorded at the condenser intakes of the HPB station were obtained from EDF Energy.

18A.2.10 The Stage 3 review did identify thermal validation issues which led to changes to the model setups. These changes improved the thermal performance of the models without changing their hydrodynamic performance. The changes necessitated a rerun of Stage 3 modelling with what was by then the final design for the HPC CW configuration.

c) The models used

18A.2.11 For HPC, two hydrodynamic models have been applied to the problem of modelling flow dispersion from the proposed power station. These were:

- *General Estuarine Transport Model (GETM) version 2.21*
- *Delft3D version 3.27 for the initial work and version 3.28 (July 2010 release) for the latest configurations presented*

18A.2.12 These two numerical models, which have very different approaches, were used to quantify the likely uncertainty around the modelling approach and therefore produce a quantified estimate of the likely thermal impact and an associated estimate of error.

18A.2.13 The GETM model calculates the effect of the power station by running a reference run (without power station), simulating an entire annual cycle, using a full heat gain and loss implementation. Meteorological data from the ECMWF (European centre for medium range weather forecasting) reanalysis data is used to force the model, so that incident radiation, cloud cover, humidity, wind speed and long wave radiation are included. A configuration run is then performed over the annual cycle, with the power station's proposed discharge included. The net effect of the power station is derived by subtracting the reference run from the configuration run. The most significant difference between the runs being that the discharge plume will have an increased temperature and therefore the long wave radiation will be greater, it will also potentially have higher evaporative heat loss, which is humidity and wind speed dependant.

18A.2.14 The modelling of the heat cycle allows full annual runs to be performed, with winds and other meteorological events, so that realistic estimates can be made of the likely plume variability. In order to perform such long runs, yet still maintain, good vertical and horizontal resolution the runs are performed on a parallel processor.

18A.2.15 As noted above, guidelines on thermal plume modelling for New Nuclear Build, produced by the Environment Agency in 2010, require that assessments are made using annual data or simulated data such as model output, stating that:

- *'An appropriate time scale is a year, in order to include seasonal variations in air and water temperatures, and other climatic factors, e.g. wind stress, light climate. Other significant variables which show seasonality include river flow, salinity, pH, and tidal range, and the range of variation in these should be defined and considered in any assessment. As the climate varies between years, a representative ('average') year should be defined from a number of years. An appropriate period in this context would be the last 10 years.'*

18A.2.16 The GETM model has been used to address the requirement of seasonal variability and variability due to climatic factors, wind and river forcing because inevitably, in the course of a year a variety of conditions are experienced. This can be analysed to determine the model (and real sensitivity) to a change in any particular parameter e.g. wind direction. The implications for increased sea temperatures can be understood by investigation of the summer periods.

18A.2.17 In contrast the Delft3D model uses an excess temperature model, to calculate the heat loss directly from the discharge of plume. It is a standard approach and has been used in many models such as Telemac. Such models assume that the heat loss from a plume is a function of the temperature of the water and the air speed. These models because they do not seek to emulate "real" from the outset, usually simulate short conditions and are generally not running on a parallel cluster.

18A.2.18 Table 18A.1 lists the various reports allied with the development of the HPC numerical modelling ensemble.

Table 18A.1: HP Thermal Plume Modelling Reports

Model	BEEMS Report Name	Overview of Contents
Delft3D	TR084: HP Thermal Plume Modelling: Delft3D – Stage 1 Model Calibration and Validation. Ref. 18A.5	Detail of the model grid, setups, validation with observations e.g. Current meters, drifters. Comparison with the thermal plume survey.
Delft3D	TR085: HP Thermal Plume Modelling: Delft3D – Stage 2 Model Results. Ref. 18A.6	Results from the initial four CW configuration options for HPC. Comparison of the relative extent of the plume from a cross shore discharge compared to an offshore one. Meteorological scenarios included. Focus on recirculation estimates.
Delft2D	TR042: HP Thermal Plume Modeling: Delft 2D – Implications of tidal power schemes in the Severn Estuary for Hinkley Point C. Ref. 18A.7	Initial report on the likely impact of the Severn barrage proposals on the HP C plume.
Delft3D	TR121: HP Thermal Plume Modelling: Delft3D – Stage 3 Results. Ref. 18A.8	Includes initial results for HPB, HPC and HP B+C, Also includes results from Geomorphology and Meteorological scenarios; including barrage

Model	BEEMS Report Name	Overview of Contents
		scenarios.
Delft3D	TR182: HP Thermal Plume Modelling: Delft3D – Stage 3a Results with the final cooling water configuration. Ref. 18A.9	Results from the final CW configuration (Twin discharge with 4 intakes on two tunnels for HPC). Includes simulations of HPC, HPB and HPB+C.
GETM	TR102: HP Thermal Plume Modelling: GETM – Stage 1 Model validation and verification. Ref. 18A.10	Details of the setup of the GETM model. Comparison with current meters, drifters and tide gauges. Comparison with the thermal plume surveys.
GETM	TR103: HP Thermal Plume Modelling: GETM Stage 2 Results. Ref. 18A.11	Results from the initial four CW configurations.
GETM	TR177: HP Thermal Plume Modelling: GETM Stage 3a results with the final CW configuration. Ref. 18A.12	Results from GETM runs with the final HPC CW configuration. Includes simulations of HPC, HPB and HPB+C. This report supersedes an earlier report (TR088).
Combined	TR040: HP Thermal Plume Modelling: Stage 2 Review -Initial evaluation of the Stage 2 models. Ref. 18A.3	Initial evaluation of the two models (GETM and Delft3D) with a focus on recirculation estimates of the initial four CW configuration options
Combined	TR135: HP Thermal Plume Modelling: Stage 3 Review - Detailed evaluation of the validation of the two Stage 3 models. Ref. 18A.2	Detailed evaluation of the two Stage 3 thermal plume validations against field data.

d) Conclusions of Stage 3 critical review

18A.2.19 The key question for the Stage 3 review to answer was: *'How accurately is the modelling likely to represent the temperature field of the proposed HPC development and also that of the HPB + HPC combined operation?'*

18A.2.20 Fundamental to answering this question, was the provision of a hydrodynamic model that replicated the areas of interest in the Severn estuary specifically relevant to the areas of proposed CW intake and discharge for HPC.

18A.2.21 Once the hydrodynamic validation criteria were satisfied, then validation against the existing HPB thermal plume was used to quantify the likely accuracy of the model. However, the existing plume at HPB has a number of characteristics that make it very difficult to model and it will behave differently from the likely HPC discharge. This Stage 3 review (Ref. 18A.2) includes an account of the validation and comparison of the models against measurements. More extensive accounts of the setups and validations are given in the modellers' Stage 1 reports (Refs. 18A.5 & 18A.10).

18A.2.22 Subsequent to the work conducted by these modellers, which primarily used observational data collected in field campaigns, a data series on the temperatures recorded at the intake at the HPB station became available. This time series is at daily intervals for two years and for two 15 days periods at one minute intervals, in January 2008 and September 2008.

18A.2.23 In conclusion, Ref. 18A.2 states that:

18A.2.24 *'In relation to the hydrodynamic validation both models performed well against tidal elevations for phase and amplitude. Both models gave good (=<10%) representation of the tidal flows across the intertidal zones, which is a difficult challenge. They also gave a good replication of the flood tides to better than 10% of the maximum currents.*

18A.2.25 *'The two models have very different heat formulations; however, both replicate the neap tide conditions well. For spring tides the GETM model indicates higher plume temperatures than the Delft3D model at the HP B inlet, however due to inadequacies in the representation of the HP B discharge by the GETM model the assessment of accuracy is probably not representative of the larger area in the far field of HP B. In general taking the intake comparison, the thermal plume surveys and the comparative areas of the thermal plumes into account it is likely that the GETM model represents a likely upper limit on the thermal impact of HP C and that for modelling of the HP B plume that the Delft3D model provides estimates closest to the true value. However, the GETM model because it simulates a whole year with its natural meteorological variability is expected to give a better estimate of the plume variability than the Delft3D model.*

18A.2.26 *'The review concludes that the models as now setup are fit for purpose for assessing plume environmental impacts. In the far field it is likely that that the GETM model of HP C predicts mean plume temperatures that are approximately 0.5°C greater than those from the Delft3D model. There is sufficient evidence to be confident that the likely true thermal impact lies between the outputs of the two models and that the median between them is a reasonable estimate of true likelihood.'*

18A.3 Subsequent Development

18A.3.1 These models have subsequently been employed to support:

- *Investigation of a variety of meteorological and geomorphological scenarios, bounding both the potential consequences of other local developments, long term morphological change, and plausible developments in climate.*
- *Estimates of the behaviour of the thermal plumes of both HPC and HPB, alone and in combination, and assessments of their potential effects on local receptors.*
- *Estimates of the behaviour of chemical discharges, and assessments of their potential effects on local receptors.*

18A.3.2 Further details of these assessments may be found in **Volume 2, Chapters 17, 18 & 19** and **Appendix 18B** of this ES, together with their supporting references.

18A.4 Compliance with Guidance

18A.4.1 Table 18A.2 provides a series of statements on compliance with Environment Agency guidance on the numerical modelling need (Ref. 18A.1).

Table 18A.2 Compliance of HPC Numerical Modelling Arrangements with Existing Guidance

EA Requirement	Compliance Statement
Modelled output to provide information in 3-D	Met

EA Requirement	Compliance Statement
Model(s) must be suitable for the application(s)	Met (as demonstrated by the validation reports)
Not limited to the use of one model – different model types can support and complement each other, for example an excess temperature model looking at different discharge temperature elevations, run over relatively short periods for a number of different scenarios, and a long-term absolute temperature model	Met – 2 models produced (using Delft3D and GETM respectively)
Model(s) must be demonstrated to be suitably calibrated and validated – validation against existing thermal plumes if possible, including the use of aerial or satellite imaging	Met – comprehensive validation reports provided
Model(s) to comply with Agency standards for hydrodynamic model calibration/validation	Met
Model(s) to be independently audited – audit report(s) to be provided	Met – Independent audit reviews of model performance provided
Model(s) to be available for use over period of at least 10 years from date of commissioning of the power station, and beyond that for as long as there is(are) no suitable alternative(s) available	Details to be agreed, but models have been setup on that assumption. Data outputs have been secured in long term secure archives and a regime is being developed to ensure that the models will continue to be fit for purpose over the timelines specified in the EA guidelines.
Agency will require access to the model(s) over the lifetime of the power stations	Details to be agreed, but will be met
Output to represent both absolute temperature and excess temperature above background, both in the near/mid-field and in the far-field	Met. Appropriate plume plots provided. Models can be interrogated to produce any required output at any location during the simulated year (2008).
Results to include the effects of tidal currents, residual currents, wind driven currents, turbidity, solar insolation, cloud cover, air temperature, surface cooling including the effect of wind, river flows, river temperature, thermal and saline stratification, seasonal effects (including short-term extreme temperature events), and sedimentation and erosion	Met. The 2 models have different algorithms for evaluating heat loss at the sea surface. The Delft3D model uses wind speed and direction and air temperature whereas the GETM model uses a full suite of meteorological parameters over an annual cycle obtained from a European hindcast meteorological model.
Results to cover a range of plausible scenarios of climate-change driven rises in air and sea temperatures and sea-levels over the planned life-time of the station	Met. The models have been subject to a range of plausible scenarios that are fully described in the modelling reports.
Results from alternative abstraction and discharge locations, including options to discharge near-bed, mid-water-column, or near-surface, and utilising	Met. Results from a full range of CW configuration options provided.

EA Requirement	Compliance Statement
different outfall designs, as appropriate	
Maps to show locations of designations, sensitive waters, relevant sensitive receptors, etc.	Met
Mixing Zones appropriate to the various thermal standards to be presented in 3-D, based on the statistics of the standard (e.g. annual average, maximum, 98%ile)	Met
Where a Mixing Zone relates to an instantaneous statistic (such as maximum value), then as far as is practicable, some indication of the variation of the duration of exceedence over the Mixing Zone	Met. Plume contour plots of annual maximum temperature and annual maximum and mean excess temperatures at the surface and the sea bed provided. Model outputs can be interrogated to provide any additional information upon request
In addition to the presentation of the overall Mixing Zones, various instantaneous representations of the temperature field are needed to enable an understanding of typical conditions	Met; such information is available at any location/ depth on request
Detailed impact assessment inside the Mixing Zones (and outside if considered appropriate) for all relevant receptors (flora and fauna throughout the water column, on and within the sea bed, and in the inter-tidal zone) to be assessed and discussed	Met
Relevant statistics of the mixing zones: e.g. area, volume, proportion of estuarine cross-section, proportion of time threshold value exceeded	Met
Post-scheme appraisal within 5 years of commissioning to validate (or not) the model predictions – based on field observations, satellite or aerial imaging, etc.	Details to be agreed, but will be met
If necessary, the re-calibration and validation of the model(s) following post-scheme appraisal.	Will be met if required

References

18A.1 Environment Agency, 2010. New Nuclear Build: guidance on hydrodynamic modelling requirements.

18A.2 BEEMS Technical Report TR135. Stage 3a review of two models. EDF BEEMS (Cefas).

18A.3 BEEMS Technical Report TR040. HP Thermal Plume Modelling: Stage 2 Review – Initial evaluation of the Stage 2 models. EDF BEEMS (Cefas).

18A.4 BEEMS Technical Report TR068. An initial review of the effects of new nuclear build on the marine ecology of Hinkley Point and Bridgwater Bay. EDF BEEMS (Cefas).

18A.5 BEEMS Technical Report TR084. HP Thermal Plume Modeling: Delft3D – Stage 1 Model Calibration and Validation. EDF BEEMS (ABP Marine Environmental Research Ltd.).

18A.6 BEEMS Technical Report TR085. HP Thermal Plume Modeling: Delft3D – Stage 2 Model Results. EDF BEEMS (ABP Marine Environmental Research Ltd.).

18A.7 BEEMS Technical Report TR042. HP Thermal Plume Modeling: Delft2D – Implications of tidal power schemes in the Severn Estuary for Hinkley Point C. EDF BEEMS *(*ABP Marine Environmental Research Ltd.).

18A.8 BEEMS Technical Report TR121. HP Thermal Plume Modeling. Delft3D – Stage 3 Model Results. EDF BEEMS (ABP Marine Environmental Research Ltd.).

18A.9 BEEMS Technical report TR182. HP Thermal Plume Modelling: Delft3D – Stage 3a Results with the final cooling water configuration. EDF BEEMS (ABP Marine Environmental Research Ltd.).

18A.10 BEEMS Technical Report TR102. HP Thermal Plume Modeling: GETM – Stage 1 Model validation and verification. EDF BEEMS (Bolding and Burchard).

18A.11 BEEMS Technical Report TR103. HP Thermal Plume Modelling: GETM – Stage 2 Results*.* EDF BEEMS (Bolding and Burchard).

18A.12 BEEMS Technical Report TR177. HP Thermal Plume Modelling: GETM Stage 3a results with the final CW configuration. EDF BEEMS (Bolding and Burchard).

APPENDIX 18B: WATER FRAMEWORK ASSESSMENT

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APPENDIX 18B: WATER FRAMEWORK ASSESSMENT

18B.1 Introduction to the Water Framework Directive Assessment

a) Introduction to the Hinkley Point C Project

18B.1.1 NNB Generation Company Limited (part of EDF Energy) is seeking a Development Consent Order (DCO) from the Infrastructure Planning Commission (IPC) to authorise the construction and operation of a new nuclear power station at Hinkley Point (hereafter referred to as Hinkley Point C). The development site is located on the west Somerset coast, 25 km to the east of Minehead and 12km to the north-west of Bridgwater (see **Figure 18B.1**). It is approximately centred on the National Grid Reference (NGR) 320300 145800.

18B.1.2 As well as the new nuclear power station at Hinkley Point, the project includes on-site and off-site associated developments that are proposed to facilitate the development and mitigate a range of potentially significant construction impacts on other environmental aspects, particularly related to traffic and socio-economics (taken together these developments are referred to as the 'Hinkley Point C Project'). The proposed off-site associated developments are located within or adjacent to Combwich, Cannington, Bridgwater and Williton (see **Figure 18B.2**). The on-site associated development includes accommodation for workers during the construction phase of the project. For a full description of the proposals, please refer to **Chapters 3**, **4** and **5**, of **Volumes 2** to **10** of the Environmental Statement (ES).

18B.1.3 The Hinkley Point C development site itself is located in the vicinity of the following Water Framework Directive (WFD) coastal and transitional water bodies (see Section 2):

- Bridgwater Bay; and
- Parrett Estuary.

18B.1.4 Water Framework Directive water bodies in the wider area are presented in **Figure 18B.3** in relation to the Hinkley Point C (HPC) development site. Given the location, nature and scale of the proposed new nuclear development, it is recognised that the proposals may have the potential to affect these water bodies and, therefore, the project needs to comply with measures set out within WFD (Ref. 1).

b) Preliminary Works for the Hinkley Point C Project

i Introduction

18B.1.5 EDF Energy's programme is for the new nuclear power station at Hinkley Point to commence operation by 2020. This timescale is in line with Government policy that encourages early development of new nuclear build to assist in meeting the UK's carbon reduction targets (to help mitigate climate change) and improve the diversity and security of our electricity supplies. In order to facilitate the commencement of operation by 2020, a number of enabling and preliminary works applications have been submitted by EDF Energy to prepare the development site for the new nuclear build. These applications are summarised in the following paragraphs.

ii Site Enabling Works

18B.1.6 A small package of enabling works on the development site is being initiated to facilitate proposed preliminary works (i.e. the site preparation works and temporary jetty). These enabling works include:

- remediation works to remove and reuse materials – including works to remove known areas of asbestos contamination – within a spoil mound and other areas of made ground located within the eastern part of the development site;
- construction of a bat barn to mitigate the impact of demolishing three existing barns (as part of the site preparation works and temporary jetty, see below) within the development site; and
- excavation of two temporary trenches for vibration testing and removal of topsoil for three temporary trial areas for compression testing within the development site.

iii Site Preparation Works

18B.1.7 The site preparation works are proposed by EDF Energy as preliminary works to the Hinkley Point C Project. The key features of the site preparation works are land clearance to remove existing structures and vegetation, earthworks to level the site and create development platforms, drainage works to manage surface water and groundwater that would be generated by dewatering deeper excavations during the earthworks, construction of internal haulage roads and site access points, and commencement of the mobilisation of the main civil works contractor that would be involved in subsequent stages of the construction of the nuclear power station, subject to the grant of a DCO for Hinkley Point C.

18B.1.8 An application for the site preparation works, accompanied by an ES, was made to West Somerset Council under the Town and Country Planning Act (TCPA) in November 2010 and Further Environmental Information was provided in April and July 2011. It should be noted that if a DCO is not granted for Hinkley Point C, then the site preparation works' proposal provides for the removal of all structures installed during the works and reinstatement of the application site.

iv Temporary Jetty

18B.1.9 A temporary jetty is also proposed by EDF Energy as preliminary works to the Hinkley Point C Project (see **Figure 18B.1**). The key features of the development include a jetty extending into Bridgwater Bay, an aggregates storage area, and a service road between the storage area and the existing access road to the Hinkley Point Power Station Complex. The jetty development would support the construction of Hinkley Point C by providing the infrastructure needed to import construction materials, especially bulk materials such as aggregate and cement, directly to site by sea, thus reducing Heavy Goods Vehicle movements on the public road network. It is expected that the jetty development would operate during the construction of Hinkley Point C up to the completion of the second reactor unit. At this point, the jetty would be dismantled and the site restored where it lies outside of the area of permanent works associated with the Hinkley Point C Project.

18B.1.10 EDF Energy applied for consent for the temporary jetty from the Marine Management Organisation (MMO) in December 2010 by way of a Harbour Empowerment Order (HEO) under the Harbours Act 1964 (as amended) and licences under the Food & Environment Protection Act 1985. Following consultation, an Addendum to the Temporary Jetty Development ES was submitted in June 2011. In addition, EDF Energy applied for the Transport and Works Act Order which was submitted to DECC and will allow EDF Energy to compulsorily acquire land required to construct the temporary jetty.

18B.1.11 It should be noted that if a DCO is not granted for Hinkley Point C, then the jetty development's proposal provides for the removal of all infrastructure in the water and on land, and reinstatement of the application site.

18B.1.12 The temporary jetty is also included within the application for Development Consent for Hinkley Point C in the event that the HEO application is unsuccessful. Hence, the temporary jetty's construction, operation, and dismantling and restoration phases are included in this WFD assessment.

c) Hinkley Point C Project

18B.1.13 Full details of the proposed development at Hinkley Point C are presented in **Chapter 2**, **Volume 2** of the ES, and will comprise a range of buildings above ground, sea bed and sub-surface structures and related facilities, including:

- two permanent Nuclear Islands housing the UK EPR reactor buildings and other essential buildings;
- two Conventional Islands incorporating the turbine halls and located adjacent to the Nuclear Islands;
- National Grid 400kV electricity substation to connect to the national grid electricity transmission system;
- an Operational Service Centre;
- a cooling water pumphouse for each UK EPR reactor unit with related infrastructure;
- cooling water intakes and outfall structures located on the sea bed, together with bored tunnels connecting these to the onshore cooling water infrastructure;
- a fish recovery and return system (FRR) comprising a sea bed outfall at the end of a bored tunnel;
- fuel and waste management facilities, transmission infrastructure, staff facilities, administration and storage;
- a Public Information Centre;
- a sea wall incorporating a public footpath;

- access and parking facilities for workers, visitors and deliveries for the main nuclear plant and the National Grid 400 kV substation; and
- landscaped areas (including ecological features and public rights of way (PRoW)).

18B.1.14 The built development will be distributed over a series of level platforms at various elevations. Elsewhere the permanent landform will be in accordance with the topography presented in the landscape restoration proposals.

18B.1.15 The main development platform will accommodate the Nuclear Islands, Conventional Islands, and onshore cooling water infrastructure. This platform will be at an elevation of 14 mAOD. This level has been determined on the basis that it meets safety case requirements which necessitate that the structures accommodated on the platform remain flood free during an extreme (1 in 10,000 year) tidal flood event. The platform elevation also reflects operational requirements and, in particular, the efficient functioning of the open circuit cooling system.

d) Associated Development

18B.1.16 EDF Energy has identified a number of associated developments that are considered necessary to facilitate the construction and, in some instances, the operation of Hinkley Point C and to mitigate potential environmental impacts associated with the project. Full details of the off-site associated developments are presented in **Chapter 2** in **Volumes 3** to **10** of the ES. In the absence of the proposed associated developments, the likely traffic and socio-economic impacts associated with the construction and operation of Hinkley Point C would be significantly greater in the local area. The proposed associated developments include:

- accommodation campuses for up to 1,510 construction workers on-site and in Bridgwater;
- park and ride facilities close to Junctions 23 and the Junction 24 (Somerfield) site close to the M5 motorway, Cannington and Williton;
- freight management facilities, courier consolidation facilities and an induction centre close to Junction 23 of the M5 motorway;
- freight management facilities close to Junction 24 of the M5 motorway (the Somerfield site);
- a bypass around the west of Cannington to minimise the amount of construction traffic using the local road network within the village; and
- refurbishment of the existing Combwich Wharf facility to accommodate the arrival of approximately 180 Abnormal Indivisible Loads and other construction related goods, over a period of approximately six years. A laydown area will also be provided adjacent to Combwich Wharf.

e) Information Available

18B.1.17 The Hinkley Point C Proposed New Nuclear Development DCO application is supported by a large number of documents. The ES to accompany the DCO application, which reports the outcomes of the Environmental Impact Assessment

(EIA) process, comprises 11 volumes providing an introduction and covering the main development, the off-site associated developments, and the cumulative impact assessment.

18B.1.18 In addition to the ES, a report to inform the Habitats Regulations Assessment (HRA) (Ref.18B.2) has also been produced and supports the DCO application. This report examines the effects of the proposed development on the Natura 2000 sites in and around the development sites and the Severn Estuary.

18B.1.19 Furthermore, a large number of surveys and research and assessment studies have been undertaken over a number of years, which provide supporting data and detail to the ES, the HRA and, therefore, to this document. Specifically, technical reports written by the BEEMS project (British EDF Estuarine and Marine Studies) TR184 (Ref. 18B.3), TR186 (Ref. 18B.4), TR163 (Ref. 18B.5), TR197 (Ref. 18B.6) and TR148 (Ref. 18B.7) have been used.

18B.2 The Water Framework Directive Assessment Process

a) Introduction

18B.2.1 In December 2003, the WFD was transposed into national law by means of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Ref. 18B.1. These Regulations provide for the implementation of the WFD from designation of all surface waters (rivers, lakes, transitional (estuarine) and coastal waters, as well as ground waters) as water bodies to achieving good ecological status by 2015. The Environment Agency is the competent authority for implementation of the WFD.

18B.2.2 Unlike the EU Birds and Habitats Directives (EC Directive on the Conservation of Wild Birds 2009/147/EC and EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora 92/43/EEC, respectively), which apply only to designated sites, the WFD applies to all water bodies, including those that are man-made. The consideration of the proposals under the WFD will, therefore, apply to water bodies that have the potential to be impacted by the Hinkley Point C Project proposals.

18B.2.3 Classification schemes for both estuarine and coastal waters out to one nautical mile have been developed in response to WFD. The scheme classifies the status of Transitional and Coastal Waters (TRaC) using information on the ecological, chemical and hydromorphological quality of a body of water. For surface waters there are two separate classifications for water bodies: ecological and chemical. For a water body to be in overall ‘good’ status, both ecological and chemical status must be at least ‘good’.

18B.2.4 Ecological classification comprises:

- the condition of biological elements, for example fish;
- concentrations of supporting physico-chemical elements, for example the oxygen or ammonia levels;
- concentrations of specific pollutants, for example copper; and
- largely undisturbed hydromorphology for high status.

18B.2.5 Ecological status is recorded on the scale of high, good, moderate, poor or bad. 'High' denotes largely undisturbed conditions and the other classes represent increasing deviation from this natural condition, otherwise described as a 'reference condition'. The ecological status classification for the water body, and the confidence in this, is determined from the worst scoring quality element.

18B.2.6 Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the EC Environmental Quality Standards Directive 2008/105/EC1. These chemicals include priority substances, priority hazardous substances, and eight other pollutants carried over from the Dangerous Substance Daughter Directives. Chemical status is recorded as 'good' or 'fail'. The chemical status classification for the water body is determined by the worst scoring chemical.

18B.2.7 For TRaC water bodies that have been designated as heavily modified (HMWB), the Environment Agency must classify according to their ecological potential rather than status. UKTAG have adopted the 'mitigation measures approach' for classifying HMWBs (Ref. 18B.8).

18B.2.8 This approach first assesses whether actions to mitigate the impact of physical modification are in place to the extent that could reasonably be expected. If this mitigation is in place, then the water body may be classified as achieving 'good' or better ecological potential. If this level of mitigation is not in place, then the water body will be classed as 'moderate' or worse ecological potential.

18B.2.9 Before an overall ecological potential classification is applied, the second step is for the results of the mitigation measures assessment to be cross-checked with data from biological and physico-chemical assessments.

18B.2.10 Where the Environment Agency has data for biological quality elements that show signs of damage from pressures other than hydromorphological alterations, for example, if the diatom or phytoplankton status is poor because of nutrient pressures, the ecological potential will be changed. To reflect this other pressure the water body will be labelled as 'Poor Ecological Potential'. This is also true where data are available for physico-chemical quality elements.

18B.2.11 Some areas require special protection under European legislation. WFD therefore brings together the planning processes of a range of other European Directives such as the revised Bathing Waters Directive (2006/44/EC) and the Habitats Directive. These Directives establish protected areas to manage water, nutrients, chemicals, economically significant species and wildlife – and have been brought in line with the planning timescales of WFD.

b) Procedure and Process

18B.2.12 There is no designated methodology for the assessment of plans or projects in relation to undertaking WFD assessments. There are, however, several sets of guidance that have developed in relation to undertaking such assessments, predominantly written by the Environment Agency. Considered to be the most relevant to the Hinkley Point C Project proposals is the document "Clearing the Waters" (Ref. 18B.9), which has been produced by the Environment Agency in order to assist in the assessment of the potential impact of dredging and disposal on the requirements of the WFD. This document recommends a four stage process. In order to provide a general methodology for undertaking this assessment, the descriptions have been altered to provide context for the activities associated with the Hinkley Point C Project, as follows:

- **The Screening Stage (Stage 1)**: This stage only applies to pre-existing activities. In this context this means activities which started or were ongoing during the period 2006-2008. New projects, that is, ones commencing after the 1st January 2009 should go straight to the scoping stage (i.e. Stage 2). However, initial screening information is necessary as part of the scoping stage and, therefore, this stage is still often completed in practice in order to inform Stage 2.
- **The Scoping Process (Stage 2)**: The scoping stage enables regulators and operators to determine the scope of the assessment required to establish whether an activity will have a non-temporary effect on water status at water body level. Scoping therefore assists in defining which WFD parameters could be affected and in agreeing an appropriate level of assessment to meet WFD requirements.
- **Assessment (Stage 3)**: This stage of the assessment aims to assess whether the activity will have a significant non-temporary effect on the status of one or more WFD parameters at water body level. The test is therefore to determine whether the activity is likely to affect a parameter sufficiently to lower its existing class status. For priority substances, the process requires the assessment to consider whether the activity is likely to cause the parameter to achieve good chemical status.
- **Identification and Evaluation of Measures (Stage 4)**: If it is established that an activity is likely to affect water status at water body level (that is, by causing deterioration or by preventing achievement of the WFD objective), or that an opportunity may exist to contribute to improving status at a water body level, potential measures to achieve either of these must be investigated. This stage considers these measures and, where necessary, evaluates the measures in terms of cost and whether it is disproportionate.

c) Consultation on the WFD Assessment

18B.2.13 Significant consultation with the regulators on both the Environmental Impact Assessment (EIA) (and in particular the Marine Water and Sediment Quality Chapter, **Volume 2 Chapter 18**) and the HRA has highlighted areas of concern relevant to this assessment and has been used to inform it. This consultation is detailed in **Chapters 17**, **18** and **19**, in **Volume 2** of the ES, and **Chapter 2** of the HRA Report.

18B.3 The WFD assessment: Stage 1

a) Stage 1: Background

18B.3.1 Although Stage 1 is not strictly required in this case because the proposed development is a new project, basic information is required in order to progress the assessment forward. This information falls into two groups. The first group contains information in relation to the proposed activities. The second contains information in relation to the water bodies that the activities could affect.

18B.3.2 In order to scope the assessment for the activities set out below, tables provided in the Clearing the Waters guidance (Ref.18B.9) have been modified in order to assist in informing the scoping assessment and to provide a summary of the screening assessment.

18B.3.3 To determine which activities are of relevance to the WFD assessment, all potential impacts on marine water quality and marine ecology need to be considered. The following bullet points summarise the potential impacts identified during each of the relevant project phases: construction, commissioning and operation. Decommissioning impacts are not considered as the outcome in the ES for all parameters determines that decommissioning impacts are likely to be less or similar to those identified in the construction and operational phases.

18B.3.4 The elements of the development during the Hinkley Point C construction phase that could lead to marine water quality or marine ecology being affected are:

- surface drainage and groundwater discharges to the foreshore;
- construction of the construction outfall;
- construction, operation and dismantling of the temporary jetty;
- refurbishment of Combwich Wharf;
- treated sewage effluent from the temporary sewage works;
- drilling of the cooling water tunnel and the Fish Recovery and Return (FRR) system, and the installation of cooling system head structures;
- construction of the sea wall; and
- accidental spillages.

18B.3.5 The elements of the development during the commissioning phase that could lead to marine water quality and marine ecology being affected are the:

- surface drainage and groundwater discharges to the foreshore (until the cooling water system becomes available, which would then become the route of discharge);
- treated sewage effluent the from temporary sewage works (until the permanent treatment works are in place and the cooling water system is made available, which would then become the route of discharge); and
- discharge of commissioning test waters (to the foreshore for ‘cold’ tests, and to the subtidal via the cooling water outfall, once available, for ‘hot’ tests).

18B.3.6 The elements of the development during the operational phase that could lead to marine water quality and marine ecology being affected are the:

- groundwater discharge to the foreshore via the percolated sea wall drainage system;
- surface drainage and groundwater discharges via the cooling water tunnel;
- treated sewage effluent, from an on-site sewage treatment works, via the cooling water tunnel; and

- intake and discharge of the operational cooling water (including operational chemical contributions) to the Bristol Channel.

18B.3.7 For the purposes of this assessment, it is assumed that the bulk of the sediments that will be removed from any dredging works will be either deposited locally or re-suspended within the Severn Estuary (if the relevant Marine Licence criteria are met). There is, however, the possibility that any materials not deemed suitable for disposal in this way will be taken to an existing licensed disposal site, probably the Cardiff Grounds. Since the DCO application does not include for activities that will be undertaken under a Marine Licence (such as the dredging and disposal), a separate WFD assessment will be undertaken at such time as the Marine Licence applications are submitted. However, any resulting impacts from increased suspended sediment mobilisation during to the dredging are considered for each relevant activity herein.

b) Stage 1: Screening

18B.3.8 As described in Section 1.5 above, a full EIA has been completed for the proposals and submitted with the DCO application for the Hinkley Point C Project. The information in the following section draws on the impact assessment and conclusions provided within the ES, particularly **Volumes 2** to **11**. **Table 18B.1** lists all potential impacts on marine waters and summaries where potential impacts in relation to WFD chemical, ecological and hydromorphological status could occur.

c) Water Body Status

18B.3.9 The waters around the mouth of the River Parrett to the east of Hinkley Point are defined as a HMWB and are characterised as having moderate ecological potential. The water between the west of Hinkley Point and Porlock Bay is the Bridgwater Bay water body and is characterised as having moderate ecological status (Ref. 18B.10). **Table 18B.2** summarises the information available for each of these water bodies.

Table 18B.1: Details of Scheme Activities and Summary of Potential to Impact on General WFD Parameters

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Construction							
Construction, operation and removal of temporary jetty (not dredging)	Bridgwater Bay	Due to the way in which the jetty will be constructed (piled with open structure) only short term localised impacts on marine water quality from suspended sediments are predicted during construction. In terms of surface water, control measures will be put in place to ensure minimal spillage during loading and unloading. Run-off will therefore be limited to surface water and potentially any hydrocarbon residue. The small surface area of the jetty would limit the amount of run-off and effects are unlikely to be significant.	Due to the open pile nature of the jetty and the application of soft start piling techniques, no long term effects on fish are predicted. Impacts on benthic invertebrates and other supporting habitats are not deemed to be potentially significant effects within the ES. The exception is *Corallina*; however here only small areas of habitat in the vicinity are likely to be impacted and therefore minor impacts are predicted. As a result are not deemed significant on a water body scale (see Section 19.6, **Volume 2** of the ES).	Effects during construction are likely to be localised and transient and, thus, small scale in magnitude. It is considered that Hinkley Point C construction would cause very limited change to hydrodynamic and sedimentary properties.	No	N/A	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Dredging for temporary jetty berth (both capital and maintenance)	Bridgwater Bay and Parrett Estuary	Potential for contaminated sediments to impact on water quality and therefore cause EQS exceedence, i.e. Cefas Action Level 1 is predicted to be exceeded for some parameters (see Section 18.6, **Volume 2** of the ES). This is a trigger for assessment as detailed in Ref. 18B.9	Potential for EQS exceedence to impact on marine ecological status via toxicological effects. Impacts in relation to smothering are not deemed to be significant as it is expected that the receptor would experience little or no degradation because sediment deposition is likely to be within the range currently experienced in the study area (see Section 19.6, **Volume 2** of the ES).	Given the hyper-tidal nature of the water bodies and the associated extreme turbidity regime present, the sediment plume would become subject to the tidally driven transport, deposition and resuspension processes, and thus be continuously reworked (see Section 18.6, **Volume 2** of the ES). Given the relatively small volume involved, it is not considered likely that the local or wider deposition of sediment from the plume would have any significant effect on existing bathymetry, transport processes or depositional bedforms (see Section 17.6, **Volume 2** of the ES).	Maintenance dredging ongoing and, therefore, periodic effect over timescale of the jetty (7-9 years).	No	Yes

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Construction of structures and discharge of surface drainage and sewage effluent discharges to the foreshore	Bridgwater Bay	There is the potential for impact on marine water quality. However control measures and treatment would be installed to ensure environmental impacts are kept to a minimum. Additionally, any impact would only occur during construction, as during the operational phase all discharges wouldl be made via the cooling water outfall (see Section 18.6, **Volume 2** of the ES). Impacts are assessed as being minor.	As impacts on water quality are deemed to be unlikely, it is not anticipated that significant marine ecological impacts are likely. Additionally, outfalls have been located in order to avoid sensitive intertidal habitats such as *Corallina* (see Section 19.6, **Volume 2** of the ES).	Structures will be constructed above high tide and therefore hydromorphological impacts are deemed unlikely.	No	N/A	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Construction of seawall	Bridgwater Bay	As the majority of the works for the seawall would be undertaken above high water, the potential for impact on water quality is low. Discharge would relate to surface water run-off with limited potential for contaminants, and would be monitored and treated if required (see Section 16.6 and **18.6**, **Volume 2** of the ES)	The main biotope present within the working area is barren littoral shingle. All other biotopes are found on the lower shore are typical of relatively sheltered estuarine littoral environments and are widespread in the immediate vicinity of Hinkley Point, and limited localised effects are predicted as a result of disturbance or discharges (see Section 19.6, **Volume 2** of the ES).	As the majority of the works for the seawall would be undertaken above high water, the potential for impact on hydromorphology is limited (see Section 17.6, **Volume 2** of the ES).	No	N/A	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Drilling of cooling water and FRR tunnels, and installation of cooling water intake and outfall structures	Bridgwater Bay	There is the potential for impact on marine water quality but this is likely to be minimal and would only be for a short period during which the construction is occurring. Treatment of tunnel drilling wastewater would be provided should mud-assisted drilling be necessary to allow the discharge to be made to the foreshore (see Section 18.6, **Volume 2** of the ES).	The benthos of this area is typical of the extensive muddy plain that makes up most of the local seabed. Habitats of interest such as *Sabellaria* are not present within the proposed sites. Thus, no significant impacts are therefore predicted (see Section 19.6, **Volume 2** of the ES).	Effects are likely to be localised and transient, and thus be of small magnitude. It is considered that Hinkley Point C construction would cause very limited change to hydrodynamic and sedimentary properties.	No	N/A	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Refurbishment and extension of Combwich Wharf (not dredging)	Parrett Estuary	Due to way in which the wharf would be refurbished (piled and then in-filled around the existing structure) only short term, localised impacts on marine water quality from resuspended sediment are predicted during construction. In terms of surface water, control measures would be put in place to ensure minimal spillages occur during loading and unloading of vessels and goods. Run-off would be limited to surface water and potentially any hydrocarbon residue. The small surface area of the wharf would limit the amount of run-off and, therefore, effects are unlikely to be significant (see Section 18.6, **Volume 7** of the ES).	Due to the estuarine location of the piling and the application of soft start piling techniques during periods when areas are inundated by the tide, no medium or long-term effects on fish are predicted. Impacts on benthic invertebrates and other supporting habitats are not deemed to be potentially significant within the ES due to the limited estuarine area affected (see Section 18.6, **Volume 7** of the ES).	The wharf refurbishment would largely replace an existing structure and, therefore, the footprint would be similar to that already existing (see Section 18.6, **Volume 7** of the ES).	No	No – see hydromorphologic al assessment	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Dredging of Combwich Wharf Berth (both capital and maintenance)	Parrett Estuary	There is the potential for contaminated sediments to impact on water quality and therefore cause EQS exceedence, i.e. Cefas Action Level 1 is exceeded for some parameters (see Section 18.6, **Volume 7** of the ES). This is a trigger for further assessment (see Ref. 18B.9).	If EQS are exceeded there is the potential for impacts on marine ecological status via toxicological effects. Impacts in relation to smothering are not deemed to be significant as it is expected that the receptor would experience little or no degradation because sediment deposition is likely to be within the range currently experienced in the study area (see Section 18.6, **Volume 7** of the ES).	Given the tidal nature of the estuary water body and the associated extreme turbidity regime present, the sediment plume would become subject to the tidally driven transport, deposition and resuspension processes, and thus be continuously reworked. Given the relatively small volume involved, it is not considered likely that the local or wider deposition of sediment from the plume would have any significant effect on existing bathymetry, transport processes or depositional bedforms (see Section 18.6, **Volume 7** of the ES).	Maintenance dredging would be ongoing and, therefore, have a periodic effect over timescale of the Wharf operation (c. 60 years).	No	Yes

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Commissioning							
Discharge of hot and cold commissioning test water	Bridgwater Bay	Work in the EIA indicates that where required, all parameters likely to be present in the cold and hot test water would be subject to on-site treatment, in order to meet EQS. As a result, significant impacts are deemed unlikely (see Section 18.6, **Volume 2** of the ES).	As discharges will be treated to meet EQS and therefore significant impacts are not predicted	During the commissioning process the volumes of water are insignificant in relation to the water body (less than 0.1% of total volume at low water), and the volumes of water abstracted would be discharged with only a temporary interval. These limited effects which would be mostly confined to offshore locations would not result in localised or general changes to hydromorphology. The exception are the cold water tests which will discharge to the foreshore, however, the short term nature of the tests and the flows are unlikely to result in any changes to hydromorphology.	No	No	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Operation							
Intake and discharge of cooling water	Bridgwater Bay and Parrett Estuary	There is the potential for EQS exceedences associated with chemicals discharged within cooling water (see Section 18.6, **Volume 2** of the ES). Potential for thermal effects (see Section 18.6 **Volume 2** of the ES)	Potential for EQS exceedence to impact on marine ecological status via toxicological effects. Potential entrainment and impingement of fish and plankton via intake structure. Impacts in relation to thermal barriers effects on fish migration have been modelled and conclude that barriers would not be present (see Section 19.6, **Volume 2** of the ES).	Whilst the power station is operating, precisely the same volume would be discharged as abstracted. No suspended solids would be removed. There would thus be no impact upon the tidal prism of the Inner Bristol Channel and no loss of sediment from the system as a result of this process (see Section 17.6, **Volume 2** of the ES).	Intake and discharge would occur for 60 years, therefore, there is the potential for a non-temporary effect.	No	Yes
Presence of marine infrastructure (cooling water intake, outfall, FRR and seawall)	Bridgwater Bay	Insignificant impacts are predicted in relation to marine water quality due to the presence or maintenance of the structures (i.e dredging) (see Section 18.6, **Volume 2** of the ES).	The footprint of the structures could impact on marine invertebrates through loss of habitat. However, only very small areas of the seabed would be impacted by the development, therefore no significant impact is predicted on the marine ecological status (see Section 19.6, **Volume 2** of the ES).	Minimal impacts on hydromorphology predicted as the sub-tidal structures would only result in localised scour which occurs throughout the sub-tidal environment, with no morphological changes noticeable at the water body scale (see Section 17.6, **Volume 2** of the ES).	No	No	No

Hinkley Point C activity	Water body potentially impacted	Potential impact on chemical status	Potential impact on marine ecological status	Potential impact on hydromorphological elements	Non-temporary effect?	Will any of the water body mitigation measures be adversely impacted?	Assessment to Stage 2?
Presence of seawall	Bridgwater Bay	Insignificant impacts are predicted in relation to marine water quality due to the presence of the seawall.	The footprint of the seawall could impact on marine invertebrates through loss of habitat. However, only very small areas of the upper shore would be affected which comprises barren littoral shingle and, therefore, no effect on marine ecological function or status is predicted (see Section 19.6, Volume 2 of the ES).	As both the current cliff and the proposed sea wall stand on the upper shore well above mean high tides, only in extreme conditions will be any hydrodynamic interaction. The seawall therefore replaces the existing upper shore boundary with a similar plan form and steepness; therefore there would be no effect on hydromorphological parameters (see Section 17.6, **Volume 2** of the ES).	No	No	No
Other discharges (such as sewage effluent, groundwater and surface water) via the cooling water outfall	Bridgwater Bay and Parrett Estuary	Taken into account in assessments provided for cooling water outfall calculations.	Taken into account in assessments provided for cooling water outfall calculations.	Taken into account in assessments provided for cooling water outfall calculations.	N/A	N/A	N/A

Table 18B.2: Details of Water Bodies in the Vicinity of the Proposed Development at Hinkley Point C

Water Body name and reference	Water body size	Coastal or Transitional water body	Is the water body designated as heavily modified or artificial? Record reasons for designation	Current Status	If not at good status record 2015 objective	If not at good status record all WFD parameters at moderate status or below	HMWB mitigation measures in place?
Bridgwater Bay	9183.47ha	Coastal	No	Moderate ecological status (uncertain)	Good status by 2027	Invertebrates Macroalgae Phytoplankton Dissolved inorganic Nitrogen	N/A
Parrett Estuary	7069.01ha	Transitional	HMWB – Flood protection	Moderate ecological potential Good chemical status	Good ecological potential by 2027 High chemical Status by 2015	Dissolved inorganic Nitrogen	Yes: Structures or other mechanisms in place and managed to enable fish access to waters

18B.3.10 Protected areas within each of the water bodies are summarised in **Table 18B.3**.

Table 18B.3: Details of Protected Areas within the WFD Water Bodies

Water Body name and reference	Protected areas
Bridgwater Bay	Freshwater Fish Directive, Habitats and Species Directive, Nitrates Directive, Conservation of wild birds directive
Parrett Estuary	Bathing Waters Directive, Freshwater Fish Directive, Nitrates Directive, Conservation of Wild Birds Directive, Urban Wastewater Treatment Directive

18B.3.11 It should be noted that impacts in relation to Protected Areas, such designated habitats, are considered separately within the ES (Section 18.6, **Volume 2** of the ES) and the in HRA Report. Full assessment is not, therefore, provided here. Impacts on designated Bathing Waters were screened out on the basis that the plume does not extend to these designations and, therefore, impacts are not predicted. In terms of the nitrates and urban wastewater directive, consideration of the potential for discharge of nitrogen has been considered and is summarised in Section 18B.5.

18B.3.12 For each activity identified as potentially having a non-temporary effect on marine waters or marine ecology, tables similar to those presented in the Environment Agency's document Clearing the Waters in relation to screening (Ref. 18B.9) have been completed (see **Table 18B.4** to **Table 18B.5**).

Table 18B.4: Scheme activity – Dredging of Temporary Jetty Berth – Summary of screening assessment

WFD Parameter		1	2		3	4
		Issues identified	**Current status & 2015 objective of water body**		**Likelihood of effect (non temporary)**	**Data availability**
		Cross elements where potential casual link exists	Water body & Current status	2015 objective		
Biological element	Phytoplankton					
	Other aquatic flora					
	Benthic invertebrate	x	Bridgwater Bay: Moderate Status	Objective is for good ecological status for 2027	Low but needs to be assessed. Data are available for sediment quality and EIA information available in relation to general impact assessment on marine water quality and marine ecology.	
	Fish	x				
Hydromorphological elements supporting biological elements	Depth variation					
	Bed					
	Intertidal zone structure					
	Dominant currents					
	Freshwater flow					
	Wave exposure					
Chemical and physico-chemical elements supporting biological elements	Transparency	x			Low but needs to be assessed. Data are available for sediment quality and EIA information available in relation to general impact assessment on marine water quality and marine ecology.	
	Oxygenation conditions	x				
	Salinity					
	Nutrient conditions					
	Specific pollutants	x				
Protected Areas	Bathing Waters					
	European Marine Site	x				HRA Report available

Table 18B.5: Scheme activity – Dredging of Combwich Wharf – Summary of screening assessment

WFD Parameter		1	2		3	4
		Issues identified	**Current status & 2015 objective of water body**		**Likelihood of effect (non temporary)**	**Data availability**
		Cross elements where potential casual link exists	Water body & Current status	2015 objective		
Biological element	Phytoplankton					
	Other aquatic flora					
	Benthic invertebrate					
	Fish					
Hydromorphological elements supporting biological elements	Depth variation					
	Bed					
	Intertidal zone structure					
	Dominant currents					
	Freshwater flow					
	Wave exposure					
Chemical and physico-chemical elements supporting biological elements	Transparency					
	Oxygenation conditions					
	Salinity					
	Nutrient conditions					
	Specific pollutants	x			Low but needs to be assessed	Data are available for sediment quality and EIA information available in relation to general impact assessment on marine water quality and marine ecology.
Protected Areas	Bathing Waters					
	European Marine Site	x				HRA Report available

Table 18B.6: Scheme activity – Intake and discharge of cooling water – Summary of screening assessment

		1	2		3	4
		Issues identified	**Current status & 2015 objective of water body**		**Likelihood of effect (non temporary)**	**Data availability**
WFD Parameter		Cross elements where potential casual link exists	Water body & Current status	2015 objective		
Biological element	Phytoplankton	X	Bridgwater Bay: moderate status/Parrett Estuary: moderate ecological potential	Objective is for good ecological status for 2027 and good ecological potential for 2027	Potential Impact Likely. Data are from EIA information available in relation to all potential parameters.	
	Other aquatic flora	X				
	Benthic invertebrate	X				
	Fish	X				
Hydromorphological elements supporting biological elements	Depth variation					
	Bed					
	Intertidal zone structure					
	Dominant currents					
	Freshwater flow					
	Wave exposure					
Chemical and physico-	Transparency					

		1	2		3	4
		Issues identified	**Current status & 2015 objective of water body**		**Likelihood of effect (non temporary)**	**Data availability**
WFD Parameter		Cross elements where potential casual link exists	Water body & Current status	2015 objective		
	Thermal properties	x			Potential impact likely	Data are from EIA information available in relation to general impact assessment on marine water quality and marine ecology.
	Oxygenation conditions	x			Potential impact likely	Data are from EIA information available in relation to general impact assessment on marine water quality and marine ecology.
	Salinity					
	Nutrient conditions	x			Potential impact likely	Data are from EIA information available in relation to general impact assessment on marine water quality and marine ecology.
	Specific pollutants	x			Potential impact likely	Data are from EIA information available in relation to general impact assessment on marine water quality and marine ecology.
Protected Areas	Bathing Waters					
	European Marine Site	x				HRA Report available.

18B.4 Stage 2: The Scoping Stage

a) Introduction

18B.4.1 The scoping stage requires the identification of all WFD parameters that potentially could be affected at water body level by the proposed activity. The guidance **Plate 18B.1**.

Plate 18B.1: The eight stage process required in order to scope WFD assessments

Step 1	**Identify issues**
Step 2	Record current status and 2015 objective of the water body(s)
Step 3	Indicate likelihood of non-temporary effect on status at water body level
Step 4	Indicate data availability
Step 5	Decide on the level of the assessment
Step 6	For water bodies not at “good status” identify all failing WFD parameters
Step 7	Consider the delivery options for the assessment
Step 8	Confirm and agree the scope/delivery mechanism with the regulator/decision maker and/or us
Proceed if necessary to assessment stage	

b) Steps 1, 2 and 3

18B.4.2 Step 1 of the scoping stage involves considering each WFD parameter on the list in the WFD assessment tables to identify all those parameters where a possible casual link exists for all activities screened in during Stage 1. Step 2 records the current status and the 2015 objective of the quality element. A level of confidence in the assessment must also be identified at this stage where this is possible.

18B.4.3 Step 3 of the scoping phase then requires a preliminary judgement to be made on how likely it is that the activity could have a non-temporary effect on status at water body level. Such an effect could involve a deterioration in status. Alternatively, it could also mean that the activity could prevent the water body(s) from meeting WFD objectives (i.e. good status or good ecological potential). This element of the assessment has been completed in Section 3 (above) and, therefore, reference is made to **Table 18B.4** to **Table 18B.6**.

c) Steps 4, 5 and 6

18B.4.4 Steps 4, 5 and 6 consider the availability of data for each activity identified in Steps 1 to 3, and Steps 5 and 6 provide for considering the level of assessment required and the identification of all failing WFD parameters.

d) Steps 7 and 8

18B.4.5 Step 7 requires the consideration of the delivery of the assessment and Step 8 requires the confirmation and agreement of the scope of the assessment with the regulator.

18B.4.6 In this case it is considered that all of these steps have been completed within the screening exercise and therefore the three activities identified at the screening stage are carried through into Stage 3: Assessment.

18B.5 Stage 3: Assessment

a) Introduction

18B.5.1 An assessment of effects under the WFD must focus on the potential for impacts on the status of the various WFD parameters and should only consider whether the activity will have a significant non-temporary effect on the status of one or more WFD parameters at water body level (Ref.18B.9). The WFD 'test' is, therefore, about determining whether the activity is likely to affect a parameter sufficiently to lower its existing class status. The assessment again is undertaken in a staged process similar to that required in undertaking EIA:

- Step 1: consultation and further elaboration of scope with regulators and key stakeholders;
- Step 2: data collection/collation;
- Step 3: baseline environment description (for the parameters scoped into the assessment);
- Step 4: identification of how the proposed activity may affect the baseline environment (what type of changes may occur);
- Step 5: qualitative/quantitative description of the predicted changes including the area affected and the duration of the change;
- Step 6: impact assessment (the significance of the predicted change against the relevant standards and thresholds); and
- Step 7: discussion (including levels of confidence and certainty).

18B.5.2 Section 1.5 provides information on the consultation undertaken to date. For the purposes of this stage of the assessment, steps 2 and 3 have been combined to provide the baseline descriptions in Section 5.3.

b) Data Collation/Collection

18B.5.3 See Section 1.5

c) Baseline

18B.5.4 Full baseline conditions are provided in **Chapters 18** and **19**, **Volume 2** of the ES for marine water quality and marine ecology respectively and therefore further information is not presented here.

d) WFD Impact Assessment

i Impacts on WFD Water Bodies Associated with Dredging at the Temporary Jetty

18B.5.5 Due to the relatively small areas to be dredged (in relation to the scale of the Bristol Channel and water bodies), and the high concentrations of naturally occurring suspended solids in the area, modelling of potential impacts from suspended sediment plumes was not considered to be necessary. Additionally, any sediment suspended within the water column would be quickly dispersed into existing sediment transport processes. Impacts on transparency and oxygen levels were therefore deemed unlikely (Section 18.6, **Volume 2** of the ES).

18B.5.6 Dredging activities have the potential to increase water contaminant concentrations through sea bed disturbance. Comparison of the survey data collected in 2009 with Cefas Action Levels (Ref. 18B.1112) found elevated metal concentrations to be widespread but very few of the metal concentrations recorded are considered to be highly contaminated. Metal concentrations were routinely found that were above Cefas Action Level 1 and hence further assessment in relation to WFD compliance is required.

18B.5.7 In order to identify whether dredging in this area could potentially impact on chemical status, a site-specific assessment in order to determine whether sediment-bound contaminants could be mobilised and impact marine water quality status undertaken as part of the EIA is relevant here. Further details are provided within **Chapter 18**, **Volume 2** of the ES.

18B.5.8 In summary the method:

- estimated the maximum increase in suspended solids concentration as a result of dredging activities;
- multiplied the maximum contaminant concentration recorded in sediment cores with the estimated concentration increase to give a concentration of pollutant released into the water column;
- used partition coefficients to estimate the concentration of pollutant that is likely to enter the dissolved phase; and
- compared estimated maximum values of dissolved contaminant with WFD marine water EQSs.

18B.5.9 **Table 18B.7** presents the calculated maximum concentrations of metals entering the water column from disturbed sediment, and compares the resulting dissolved contaminant concentrations with marine water WFD EQS.

Table 18B.7: Estimated maximum concentrations of metals entering the water column and the dissolved phase from disturbance as a result of marine sediment dredging

Determinand	Max overall conc. ($mg.kg^{-1}$)[1]	Total conc. in suspen. ($mg.l^{-1}$)[2]	Total conc. in susp. ($\mu g.l^{-1}$)	Partition Coeff. [3]	Conc. entering diss. phase ($\mu g.l^{-1}$)	Backgnd mean conc ($\mu g.l^{-1}$)[4]	Total diss conc ($\mu g.l^{-1}$)[5]	WFD Marine EQS
Arsenic	30	0.015	15	10000	1.50E-03	2.3	2.3015	25 [AD]
Cadmium	1.5	0.00075	0.75	130000	5.77E-06	<0.01	<0.01	0.2[AD]
Chromium	67	0.0335	33.5	191000	1.75E-04	0.02	0.0202	0.6 [AD*]
Copper	51	0.0255	25.5	61000	4.18E-04	3.95	3.9504	5 [AD]
Lead	141	0.0705	70.5	882000	7.99E-05	0.02	0.02	N/A
Mercury	0.67	0.000335	0.335	100000	3.35E-06	0.02	0.02	0.07 [AD]
Nickel	59	0.0295	29.5	80000	3.69E-04	0.19	0.1904	20 [AD]
Zinc	307	0.1535	153.5	4860	3.16E-02	39.27	39.302	40 [AD]

Notes:
A = Average; D = Dissolved; * = chromium VI;

18B.5.10 After the application of partition coefficients, the predicted concentrations of metal contaminants entering the dissolved phase are several orders of magnitude below the EQS set by the WFD and Dangerous Substances Directive. A deterioration in chemical water quality status is not, therefore, predicted.

18B.5.11 In terms of biological parameters, potential impacts identified include those on fish and marine invertebrates. The invertebrate biotopes within the marine sediments potentially affected by the berthing pocket during the EIA were deemed to be typical of the extensive muddy plain that makes up most of the local seabed (Section 19.5, **Volume 2** of the ES). Additionally, the small area over which the dredging is likely to occur (approx 8000 m^2) is relatively small in relation to the size of the water body. Re-colonisation is also likely to occur once is dredging complete and any additional disturbance ceases. Impacts in relation to marine invertebrates are therefore deemed unlikely to effect ecological status.

18B.5.12 In terms of fish, it is considered that migratory fish are most at risk as they could be present in the study area during certain times of year and / or intermittently; consequently they could be affected by physical disturbance associated with the dredging. However, migratory fish would be able to avoid areas of physical disturbance and only a very small percentage of the subtidal habitat of the water body would be affected at any one time. Impacts on fish are therefore unlikely to effect ecological status.

ii Impacts Associated with Dredging at Combwich Wharf

18B.5.13 The refurbishment of Combwich Wharf will involve a range of construction and operational activities that could lead to disturbance of estuarine silts and sediments within the tidal River Parrett over and above those already experienced during the day to day operation of Combwich Wharf. Such activities include further dredging; removal of existing wharf infrastructure; and a range of piling activities. It is estimated that refurbishment of Combwich Wharf will require the dredging of approximately 5,000 m^3 of bank materials and sediment. Maintenance dredging may also be required during the operation of the Wharf. It should be noted, however, that removal of sediment during the construction will predominantly undertaken using land-based plant operating at low water and transported away by land. Impacts in relation to dredging therefore relate, in the main, to any maintenance dredging required.

18B.5.14 Sampling of the sediments in the location of works indicated generally low levels of contamination throughout the depths of the cores. There are occasional exceedances of Cefas Action Level 1 for individual contaminants but no exceedances of Cefas Action Level 2 were recorded (Ref. 18B.1).

18B.5.15 Sediment disturbance during the construction works is therefore unlikely to lead to the release of contaminants into the water column at concentrations that would result in an adverse effect on water quality (Ref. 18B.13). It is the case that sediment released during the works and during operation would be rapidly entrained into the transport system and either re-deposited within the River Parrett or flushed out into the wider Bridgwater Bay. As such, significant dilution would occur, resulting in the redistribution of any contaminants at concentrations that would not exceed background levels elsewhere in the system. The water quality of the water body is therefore unlikely to be affected.

iii Impacts Associated with the Discharge of Cooling Water (Thermal Impacts)

18B.5.16 Full details of the characteristics of the cooling water discharge are included in Section 18.6, **Volume 2** of the ES and it is determined that under normal operating conditions, the HPC EPRs' water would be discharged up to 12.5°C above ambient temperature. To ensure that all transitional and coastal waters are at least at good status by 2015, UKTAG 2008 (Ref. 18B.14) has produced draft thermal standards for rivers which, in the absence of any other standards, are being used for TraC waters until such time as standards specific to TraC waters are determined.

18B.5.17 UKTAG 2008 (Ref. 18B.14) states that in order to achieve WFD good status, maximum temperatures at the edge of the mixing zone (as thermal impacts are largely related to point discharges) must not exceed 23°C, based on an annual 98 percentile, and that outside the mixing zone temperatures should not rise by more that 3°C.

18B.5.18 On the basis of these standards, it is considered that a 2.6°C mean temperature increase above an assumed 98 percentile of 20.4°C (baseline data as determined in Section 18.5, **Volume 2** of the ES) would exceed the 23°C temperature boundary for good/moderate status in terms of temperature and, therefore, cause a water body deterioration to moderate status.

18B.5.19 In order to assess the potential for deterioration, plume modelling was undertaken. For full details of this modelling, please refer to Section 18.4, **Volume 2** of the ES and Technical Report 186 by BEEMS (Ref. 18B.4). Using the model runs as described in Section 18.4, **Volume 2** of the ES, the three relevant scenarios for the consideration of potential impacts are runs C, D and E. These correspond to Hinkley Point C operating in isolation at 100% output (run C), Hinkley Point C operating at 100% output simultaneously with Hinkley Point B operating at 70% (run D) and Hinkley Point C operating at 100% simultaneously with Hinkley Point B at 100% (run E), respectively:

- Run C calculates the thermal plume conditions in relation to the operation of Hinkley Point C only (i.e. the effects of Hinkley Point B are removed). This reflects conditions that would occur in the future when Hinkley Point B ceases generation.
- Run D reflects a time whereby Hinkley Point C is operating at full capacity and Hinkley Point B is operating, but potentially below consented maxima (as described above). Run D thus provides the opportunity to assess impacts on the potential lower range of Hinkley Point B operation.
- Run E is considered to represent the upper limit of potential combined operation, i.e. both Hinkley Point C and Hinkley Point B are operating at maximum consented levels.

18B.5.20 For the purposes of this assessment, run E represents the worst-case scenario, i.e. with both power stations operating in combination at maximum consented levels.

18B.5.21 **Figures 18B.4**, **18B.5 and 18B.6** show the modelled mixing zone in relation to standards for Runs C, D and E at the surface and seabed for both standards.

Table 18B.8 summaries the mixing zones in terms of area of the surface and seabed affected by the discharge of cooling water for each of the runs.

Table 18B.8: Prediction of thermal plume areas exceeding WFD thermal standards

Run		Area of plume >23°C (hectares)		Area of plume >3°C (hectares)	
		Parrett Estuary	Bridgwater Bay	Parrett Estuary	Bridgwater Bay
C	Surface	0	38 (0.4%)	0	9 (0.1%)
	Sea bed	0	2 (0.02%)	0	0.4 (<0.01%)
D	Surface	812 (11%)	246 (3%)	385 (5%)	41
	Sea bed	879 (12%)	57 (0.6%)	384 (5%)	6 (0.1%)
E	Surface	1023 (14%)	401 (4%)	692 (10%)	147 (1.6%)
	Sea bed	1062 (15%)	163 (2%)	764 (11%)	42 (0.5%)

18B.5.22 On the basis of this information, it can be concluded that only the Bridgwater Bay water body would be impacted by the discharge of Hinkley Point C alone and this is equivalent to an impact of less than 0.5% of the water body area. A deterioration in class status is therefore unlikely to occur for the operation of Hinkley Point C alone in either water body.

18B.5.23 When considering the potential operation of Hinkley Point C and Hinkley Point B together at 100%, the zone of impact largely relates to the Parrett Estuary water body where up to 15% of the seabed could be impacted by a change in temperature of over 23°C. There could, therefore, be a potential deterioration in status within the Parrett Estuary water body. It is therefore is considered appropriate to consider the potential impact of these thermal changes on the biological parameters as set out in **Table 18B.3**.

18B.5.24 The identified elements in the ES (Section 19.6, **Volume 2**) that potentially could be impacted by thermal changes are marine invertebrates and fish. It is important to note that whilst the combined modelling work demonstrates that compared to the discharge of Hinkley Point C alone, larger areas of the Parrett Estuary water body would be affected by raised water temperatures with Hinkley Point C and Hinkley Point B operating simultaneously, in reality the ecological effects of the combined discharges would be relatively limited. This is because any temperature effects of the discharge from Hinkley Point B are already present in the system as Hinkley Point B is currently operating and, therefore, represents reference or baseline conditions to some extent.

18B.5.25 The potential impact on the benthic invertebrates is, therefore, considered to be whether the additional increase in water temperature associated with Hinkley Point C would combine with the existing discharge from Hinkley Point B to increase water temperatures in the area already affected by Hinkley Point B such that any further effects on the ecology might be expected. In respect of this, the only identified benthic invertebrate receptor likely to be sensitive to an increase in temperature is *M. balthica*. All other epibenthic and infaunal species are deemed unlikely to be negatively impacted by the combined temperature effect of the discharge plumes (Section 19.6, **Volume 2** of the ES).

18B.5.26 However, further analysis of information and data available from the location of Hinkley Point B (Section 19.6, **Volume 2** of the ES) indicates that there appears to be no correspondence in *Macoma* communities with the thermal contours of the Hinkley Point B plume. It is concluded therefore that there is no discernible adverse effect on the *Macoma* population within the footprint of the thermal plume from Hinkley Point B. Thus it therefore follows that there is unlikely to be any significant impact on the *Macoma* as a result of Hinkley Point C discharging as the thermal plumes do not appear to significantly overlap. Hence impacts on marine invertebrates are unlikely to be significant and a change in biological status is not predicted.

18B.5.27 In terms of fish, the thermal plume covers a very small proportion of the area of interest for the fish assemblage (for the purposes of this assessment, deemed to be the Bristol Channel / Severn Estuary and beyond rather than at the water body level Ref. 18B.3). The plume however, covers a larger area available to intertidal fish.

18B.5.28 Adult fish are mobile and therefore are likely to respond to a thermal stimulus by moving away or towards it. Hence they are deemed to have a high level of resilience to any potential effect of the predicted localised increase in water temperature.

18B.5.29 For migratory fish, the temperature differential at the edge of the plume could act as a physical barrier to migratory passage thus disrupting life cycles and potentially the ability to reproduce. Calculations for the assessment of potential barriers to fish migration undertaken to assess potential impacts on water quality show that the potential for thermal occlusion of the estuary which could impede migratory fish is unlikely (Ref. 18B.3).

18B.5.30 Juvenile life stages are considered to be less able to resist exposure to the thermal plume but several species recorded in the Bridgwater Bay area appear to have biogeographic ranges that include warmer locations so can be presumed to be relatively tolerant of warmer waters (Ref. 18B.3).

18B.5.31 Given the above and the very small area relative to the wider estuary likely to be impacted by the thermal plume, the cross-sectional calculations that predict that barriers are unlikely to be an issue to fish migration and their relatively high resilience (Ref. 18B.3), impacts on fish assemblages and migratory fish due to the thermal plume are unlikely and therefore a change in biological status is deemed unlikely.

iv Impacts Associated with the Discharge of Cooling Water (Physical Parameters – Dissolved Oxygen)

18B.5.32 Other issues associated with the cooling water discharge include the impacts of increased temperature on dissolved oxygen (DO) and un-ionised ammonia concentrations.

18B.5.33 DO is relevant because an increase in temperature directly affects the amount of oxygen dissolved in water as the solubility of gases reduces. Currently the Bridgwater Bay water body is considered to be at high status for this parameter but a status is not recorded for the Parrett Estuary water body.

18B.5.34 The approach used to investigate the extent of oxygen consumption (or demand) from saturation was to use data for August when DO levels are likely to be close to their lowest levels and salinities would be high. Details of the methodology used can be found in TR186 (Ref. 18B.4). The assessment is therefore extremely precautionary as these conditions only exist for a very limited time of the year.

18B.5.35 WFD includes threshold values for TraC waters and the standard for 'Good' status is 4.0 $mg.l^{-1}$ to 5.7 $mg.l^{-1}$ for marine waters. In summary, the results for the DO concentration in the area influenced by the plume is reduced to around 6.5 $mg.l^{-1}$ and when the biological oxygen demand is taken into account, a wider area of lower DO concentrations is noted. For Hinkley Point C alone, this equates to a mixing zone (in relation to high status) of 2% and 3% of the sea bed and surface of the Bridgwater Bay water body respectively. For both Hinkley Point B and Hinkley Point C discharging at 100% the mixing zones increase to 6% and 8% of the sea bed and surface respectively. Since this mixing zone is relatively small and more importantly will only occur for very short periods of the year, impacts on high status for the DO parameter are not predicted for the Bridgwater Bay water body.

18B.5.36 For the Parrett Estuary water body, the oxygen concentration remains consistently above 4.4 $mg.l^{-1}$ for all combinations of Hinkley Point C and Hinkley Point B which is within the boundary conditions for good status. The objective for good ecological potential will therefore not be compromised.

18B.5.37 In terms of ammonia, the un-ionised form of ammonia is more toxic to aquatic biota than the ionised form and the proportion of un-ionised ammonia increases with increasing temperature and pH, but decreases with increasing salinity. There is therefore the potential for the increased temperature of the cooling water discharge to alter the natural equilibrium of ammonia:un-ionised ammonia, whereby concentrations of the more toxic un-ionised form would increase. Again modelling was undertaken (for full details please refer to TR186 Ref. 18B. 4).

18B.5.38 In summary, the maximum resulting un-ionised ammonia concentration contour was 11.2 $\mu g.l^{-1}$ for Hinkley Point C operating at 100% alone (Run C). For Hinkley Point B operating at 100% in addition to Hinkley Point C at 100%, the maximum resulting un-ionised ammonia concentration contour was 16 $\mu g.l^{-1}$. For all model runs, the maximum value is less than the EQS of 21 $\mu g.l^{-1}$ annual average for un-ionised ammonia. A deterioration in overall water body status for either the Parrett Estuary water body or the Bridgwater Bay water body is, therefore, not anticipated.

v Water Quality Impacts Associated with the Discharge of Cooling Water (Chemical Parameters)

18B.5.39 During the operational phase the cooling water is predicted to contain the following main contaminants:

- metals (aluminium, copper, chromium, iron, manganese, nickel, lead and zinc);
- boric acid;
- boron;
- lithium hydroxide;
- hydrazine;
- morpholine and associated breakdown products: ethanolamine, acetates, formiates, glycolates, oxalates;
- total nitrogen as N, un-ionised ammonia;

- phosphates;
- detergents;
- chemicals used for maintenance of demineralised plant reverse osmosis membranes, e.g. ATMP, HEDP, Phosphoric acid and Sodium Polyacrylate; and
- suspended solids.

18B.5.40 Modelling of all process chemicals to be discharged to the marine environment via the cooling water discharge has been undertaken according to an Environment Agency H1-type assessment methodology (Ref. 18B.15). The first tier of assessment screens out discharges considered to be of no environmental significance. Chemical parameters found to be at significant concentrations (i.e. above EQS) are then subject to more detailed analysis for a range of scenarios. It was concluded that the resultant depth average environmental concentrations at 100 m and 500 m from the discharge point are below concentrations of environmental significance for all chemicals considered, with the exception of hydrazine and total residual oxidants (TRO).

18B.5.41 It should be noted that the discharge of inorganic nitrogen was considered as part of the H1 assessment. In summary it was concluded that the concentrations of nitrogen within the proposed discharge would not change the current nutrient quality status of the receiving water. The assessment also indicated that the current status of the Bridgwater Bay water body, based on background survey information collected for the EIA, could be at good status for this parameter and will remain at good status with the presence of the discharge.

18B.5.42 In order to further assess the potential impact of hydrazine on marine water quality, an extension of the modelling described for the thermal plume was undertaken. Further detail is provided in BEEMS TR 186 (Ref. 18B.4) and Section 18.6, **Volume 2** of the ES.

18B.5.43 Hydrazine breaks down rapidly into nitrogen and water, and so by storing it prior to discharge concentrations can be significantly reduced. Breakdown may also be enhanced by thermal degradation, which produces ammonia as a breakdown product. Treatment is already part of the existing EPR design for Hinkley Point C and therefore is accounted for in the following assessment results.

18B.5.44 Since an EQS is not available for hydrazine, calculations of potential impacts use the chronic Predicated No Effect Concentration (PNEC) concentration of 0.0004 µg/l. Further information in relation to this standard is provided in TR186 (Ref. 18B.4). **Figure 18B.7** and **Table 18B.9** show the results for Hinkley Point C only as Hinkley Point B is not consented to discharge hydrazine.

Table 18B.9: Prediction of Plume Area Exceeding the Hydrazine PNEC

Surface/seabed	Area of plume >0.004ug/l	
	Parrett Estuary	Bridgwater Bay
Surface	7 (0.1%)	184 (2%)
Seabed	3 (0.04%)	74 (0.8%)

18B.5.45 Only the subtidal soft sediments located adjacent to the outfall would be exposed to hydrazine concentrations that exceed the chronic PNEC. Limited toxicological data are available against which to assess potential sensitivity of infaunal invertebrates to hydrazine and this is detailed in TR 184 (Ref. 18B.3).

18B.5.46 It is therefore possible that some toxic effects could arise through the use of hydrazine, but only in the localised vicinity of the discharge outfall where the PNEC could be exceeded. Given the very small area affected and the suggested tolerance of organisms to the predicted concentrations, it is considered that any toxic effects associated with this substance would not be significant and, therefore, a deterioration in chemical status unlikely.

18B.5.47 In relation to chlorination, within the General Design Assessment (GDA), under normal conditions for EPR units, worst case chlorination would involve dosing to $0.5mg.l^{-1}$ of active chlorine applied sequentially once every 30 minutes per cooling channel.

18B.5.48 However, the review of operational information and the risk assessments undertaken for biofouling at Hinkley Point B identify that, unlike other sites operated in the UK by EDF Energy, chlorination of the intake heads, shafts, tunnels and forebays is not required to control biological fouling. This local understanding is exceptional, and the standard operating procedure that applies to EDF Energy's coastal power stations requires that a means of dosing nonetheless is maintained in case of need.

18B.5.49 Detailed analysis regarding the modelling approach used to determine the potential impacts associated with discharges of chlorine to the subtidal area is provided in BEEMS TR186 (Ref. 18B.4). The model outputs for the chlorination assessment were used to calculate areas of the plume at the surface and bed that exceed the chlorine EQS of 0.01 $mg.l^{-1}$ expressed as total residual oxidants. These are presented in **Table 18B.10** and **Figures 18B.8** and **18B.9**.

Table 18B.10: Prediction of Plume Area Exceeding the TRO Standards

Run	Surface/seabed	Area of plume >$0.01mg.l^{-1}$ (hectares)	
		Parrett Estuary	Bridgwater Bay
C (HPC $0.2mg.l^{-1}$)	Surface	0	159 (2%)
	Seabed	0	63 (1%)
E (HPC 0.2 $mg.l^{-1}$ & HPB 0.3 $mg.l^{-1}$)	Surface	46 (1%)	205 (2%)
	Seabed	67 (1%)	65 (1%)

18B.5.50 The Bridgwater Bay water body is most affected by the TRO plume at the surface with areas that exceed the EQS for TRO calculated at 205 hectares. This equates to 2% of the Bridgwater Bay water body. For the Parrett water body, the TRO EQS is not exceeded at the surface or at the seabed and, therefore, impacts on the water body and its chemical status are not predicted.

18B.5.51 **Figures 18B.8** and **18B.9** show that the area of EQS exceedance within the Bridgwater Bay water body is relatively small and is generally restricted to the local area of the discharge. As a consequence the majority of habitats are unlikely to be impacted by the plume.

18B.5.52 The only habitat potentially at risk from the TRO plume is therefore the subtidal soft sediments in the immediate vicinity of the outfall. Toxicity testing with two abundant species in the intertidal mudflat (found in the subtidal soft sediments) has been summarised in BEEMS Technical Report TR163 (Ref. 18B.5) and further described in the HRA Report (Ref. 18B.2). It is concluded that there may therefore be some mortality within the area exceeding the EQS however this area is likely to be minimal. Impacts on subtidal mudflat habitats associated with chlorination are therefore predicted to be minimal.

18B.5.53 In terms of chemical contaminants in the plume impacting on the fish assemblages and migratory species, again only a very small area relative to the area of interest would be impacted by exceedances of standards (see summary of water quality effects above).

18B.5.54 These concentrations are not predicted to occur outside of the area immediately adjacent to the discharge. Again as for the thermal plume, adult fish are mobile animals and are expected to respond to a chemical plume by avoiding it. Similarly for migratory fish, a chemical plume could act as a physical barrier to the migratory passage, disrupting the species' life cycles and, potentially, ability to reproduce (Ref. 18B.2). Such an effect appears unlikely in Bridgwater Bay given the relatively small area of chemical impact relative to the available habitat.

18B.5.55 Planktonic life stages are less able to resist negative effects of TROs (Ref. 18B.16), so species reproducing in the area exposed to the plume may suffer some degree of impact. However, the survey data does not suggest that there is any spawning activity or aggregation of planktonic stages in the area of the discharge point (Ref. 18B.3).

18B.5.56 Given the very small area of impact compared and the potential for fish to avoid the plume, it is deemed that effects on fish are unlikely.

18B.5.57 Overall, therefore, impacts on biological and chemical parameters are not deemed to be significant and deterioration in both biological and chemical status is not anticipated.

vi Impacts Associated with the Intake of Cooling Water

18B.5.58 The abstraction of cooling water from the Bristol Channel for the Hinkley Point C nuclear power station will carry with it the risk of fish impingement and entrainment potentially resulting in the loss of fish from estuarine populations.

18B.5.59 Data on impingement are available from the Hinkley Point B monitoring dataset and the Comprehensive Impingement Monitoring Programme (CIMP) carried out over a 12 month period. Full details of this work are provided in Section 19.5, **Volume** 2 of the ES.

18B.5.60 Using these data, a prediction of the potential impingement of fish has been undertaken by the Centre for Ecology of Fisheries and Aquaculture Science (Cefas) (Ref. 18B.17). Cefas concluded that, without mitigation, impingement at Hinkley Point C would increase about fourfold over that of Hinkley Point B simply as a result of the increased abstraction of cooling water.

18B.5.61 Given the potentially large increase in impingement for Hinkley Point C, assessment work has taken into account the potential reductions in impingement that could possibly be achieved by implementing appropriate mitigation measures. These measures are also viewed as Best Available Technology (BAT) and implementation of such measures has been viewed as an important aspect of the overall design of the water cooling system.

18B.5.62 To summarise the findings of the ES, the cooling water system for the power station has been designed with low velocity intake structures in order to reduce potential impingement losses. In addition, the installation of an acoustic deterrent system would further reduce impingement and a FRR system will also be installed. Further details of these measures are provided in TR148 (Ref. 18B.7) and BEEMS TR197 (Ref. 18B.6). If these proposed mitigation measures function as designed, the impingement losses at Hinkley Point C are calculated to be less than or similar to those of the existing Hinkley Point B station. Impacts on biological status in relation to fish are not therefore predicted.

18B.5.63 A significant number of organisms (juvenile fish and crustaceans, and plankton) would, however, inevitably enter with the cooling water. Plankton plays an important role in the ecological function of the estuary and is a specific biological element detailed under WFD. Holoplankton (dominated by copepods) provide an important food resource for a large range of organisms that reside within or pass through the estuary, notably juvenile fish and crustaceans. The larval stages of many of the invertebrate species that comprise the intertidal and subtidal communities of benthic substrates in the estuary make up the meroplankton.

18B.5.64 Consequently, significant losses of plankton through entrainment could have implications for the overall population dynamics of a range of organisms either directly through the loss of larval stages or indirectly as a reduction in prey availability. Similarly, a significant reduction in phytoplankton could lead to a reduction in productivity and affect nutrient flow through the estuarine foodwebs.

18B.5.65 The smaller organisms (plankton, eggs and larvae of fish and crustaceans) that pass through the drum screens would be entrained in the cooling flow and continue on through the power station cooling system to be returned via the thermal discharge back to the Bristol Channel. Significant proportions of these entrained organisms are expected to survive the entrainment process to re-enter the estuarine ecosystem, however, they are at risk of a number of mechanical, hydraulic, pressure, temperature and chemical related stressors during this passage. The survival of entrained individuals is dependent upon the species, their developmental stage and size, physiological condition and the design of the cooling water system.

18B.5.66 Each group has been considered in detail in both the ES (**Chapter 19**, **Volume 2**) and the HRA Report (Ref. 18B.2) and in summary both assessments do not predict significant impacts on any plankton component. Although the assessment is undertaken at the estuarine scale (i.e. the Bristol Channel), it is considered that it is appropriate for the impacts to be scaled down to a water body level and similar conclusions reached. This is because it is assumed that the plankton distribution is relatively even across the study area.

e) Cumulative Impact Assessment (Water Quality)

i Elements Assessed

18B.5.67 Two elements of the proposed development that could give rise to cumulative effects on marine water quality were considered in the ES (Section 5.9, **Volume 11** of the ES). These are summarised below.

ii Increases in Suspended Solids

18B.5.68 Each of the elements of the project that could give rise to increases in suspended solids are located some distance away from one another but within the Bridgwater Bay water body. For example, the jetty is located approximately 800 m away from the foreshore discharge. Many of the sediment generating activities would also be separated temporally, e.g. the sea wall and construction outfall would be carried out at different times to other sediment generating activities. Control measures would be in place to reduce the suspended solid concentrations within discharges from the land. Predicted impacts associated with the jetty dredging and cooling system drilling and dredging operations, although difficult to control, are expected to be insignificant, predominantly due to the already naturally high concentrations of suspended solids and strong tidal currents. Any temporary increases in suspended solid concentrations within the vicinity of Hinkley Point are, therefore, likely to be dispersed to background concentrations rapidly.

18B.5.69 Given the temporary nature of each of the predicted impacts, cumulative impacts within each water body are not predicted and, therefore, neither are changes to WFD status.

18B.5.70 For the Parrett Estuary water body, impacts in relation to Combwich Wharf are deemed to be the same as those assessed for Combwich Wharf alone as this activity is remotely located and is predicted to be of low significance in terms of impact. No cumulative impacts on the Parrett Estuary water body are therefore predicted.

iii Increases in Contaminants

18B.5.71 All of the assessments that have considered the potential for contamination within the existing Hinkley Point C site soils have concluded that contamination is either comparable to baseline conditions or the risk of finding significant contamination is low. The risk of releasing contaminated sediment into surface water during the site works is therefore low. Additionally, control within the drainage systems would be put in place in order to reduce the potential risk of discharging contamination to the surface water drainage system.

18B.5.72 Any water quality contamination associated with sediment mobilisation resulting from dredging, offshore drilling and scour associated with offshore infrastructure is predicted to be minor and would occur geographically remotely from one another. Cumulative impacts in relation to impacts on either of the water bodies are not therefore, predicted.

18B.5.73 As above, for the Parrett Estuary water body, impacts in relation to Combwich Wharf are deemed to be the same as those assessed for Combwich Wharf alone as this activity is remotely located and is predicted to be of low or minor significance. No cumulative impacts on the Parrett Estuary water body are therefore predicted.

f) Cumulative Impact Assessment (Marine Ecology)

i Habitat Damage Due to Cross-Shore Works

18B.5.74 Works across the shore include: jetty construction, operation and removal; drilling of the horizontal tunnels for the cooling water structures; and sea wall construction. The impacts of these activities would be additive in terms of the areas impacted, except where access corridors coincide.

18B.5.75 Overall it is concluded in Section 19.6, **Volume 2** of the ES that while the foreshore at Hinkley Point may be subject to a number of construction related disturbance events, the totality of these events would be one of prolonging the overall period of effect across distinct parts of the foreshore, rather than intensifying impacts, such that a longer term loss or change in habitat function would occur. Impacts on individual habitats are therefore unlikely to lead to a significant cumulative effect. Impacts on the biological parameters of the water bodies are not, therefore, deemed to be significant and a change in status is not predicted.

ii Habitat Damage Due to Subtidal Works

18B.5.76 The offshore works which could result in cumulative impacts include the installation of jetty piles, dredging associated with the berthing pocket of the jetty, and the installation of the vertical shafts for the cooling water system.

18B.5.77 The jetty will be in its operational phase during the installation of the vertical shafts and, hence, no cumulative impacts on marine life through increased suspended sediments or disturbance would arise. The capital dredging for the berthing pocket will also have been complete, but there is the potential for maintenance dredging of the berthing pocket to overlap with the installation of the vertical shafts.

18B.5.78 However, the areas over which these activities will occur are relatively small and impact on subtidal communities typical of the study area. Cumulative impacts are therefore not predicted on the water bodies and, consequently, a change in status is similarly not predicted.

18B.6 Stage 4: Identification and Evaluation of Measures

a) Introduction

18B.6.1 Although impacts at a water body level have not been identified, this section summarises details of the proposed monitoring for the assessed activities in order to provide further information on the assessments made and to ensure that the mitigation measures included within the design are effective. For further information, please refer to Sections 18.10 and 19.10, **Volume 2** in the ES.

b) Coastal Geomorphology and Hydrodynamics

18B.6.2 For operational reasons, there will be a need to establish and maintain monitoring of vertical profiles of mud density within the temporary aggregate jetty berthing pocket. Maintenance dredging is anticipated when densities increase to a magnitude that will permit this activity to be both needful and effective.

18B.6.3 A 'Waverider' directional wave and temperature recording buoy has been established in 10m of water off Hinkley Point since December 2008. This buoy is maintained as a part of the BEEMS project although it has also been adopted as a component of the national WaveNet wave monitoring network, managed by Cefas. This deployment will be maintained throughout the construction period of Hinkley Point C both to continue to secure a baseline of local wave conditions and provide management information for operations associated with the temporary aggregate jetty. The need for longer term maintenance of this deployment will be dependent on operational safety case considerations at Hinkley Point C.

c) Water Quality during Operation

i Thermal Plume

18B.6.4 Field investigations will be undertaken in order to assess the behaviour of the thermal plumes under known tidal and meteorological conditions, allowing comparison of the results with previous modelled estimates. Additional model runs may prove necessary in order to replicate the field conditions found at the time.

18B.6.5 There will be a need to gather a sufficient body of empirical data on these operations before it becomes possible to validate these models. Upon commissioning therefore, a transect section will be established and sampled initially at frequent intervals (100 m) close to the discharge and 0.5-1 km at more remote sites, monthly, over a period of 12 months. The spatial distribution of samples will be reviewed on the basis of initial results. Parameters to be measured include:

- temperature at surface, -2 m and near bed;
- dissolved oxygen;
- (unionised) ammonia;
- hydrazine (if included in discharge consent);
- dissolved nutrients;
- dissolved metals; and
- selected organics used by HPC e.g. ethanolamine.

18B.6.6 Over the operational life of the plant, continuous monitoring of the cooling water discharge temperature will be maintained.

ii Monitoring of Bio-fouling

18B.6.7 Monitoring will be maintained of heat exchanger efficiency, the incidence of fouling within the plant, and for the presence of typical fouling species on local shores. The use of chlorination will be justified solely on the basis of empirical evidence from these sources.

18B.6.8 Such surveillance is currently maintained by Hinkley Point B and elements of this, adapted as appropriate given the difference in plant design (primarily the offshore position and low flow nature of the HPC intake design), will be adopted by the HPC operator.

18B.6.9 Should chlorination be applied on any occasion, daily sampling of the final effluent stream and TRO analysis by colorimetric means will be maintained throughout. The following chlorination by-products (CBPs) will also be monitored via initial characterisation and subsequent weekly sampling:

- Bromoform;
- Bromodichloromethane;
- Chlorodibromomethane;
- Monobromoacetic acid;
- Dibromoacetic acid; and
- 2, 4, 6, tribromophenol.

18B.6.10 Following initial characterisation, subsequent routine monitoring for bromoform alone is likely to be sufficient.

d) Ecological Monitoring during Operation

i Invertebrate Populations on Stert Flats

18B.6.11 The existing baseline of seasonal studies of *Macoma* and other key invertebrate species on Stert Flats will be extended in order to elaborate on the existing understanding of within-year and between-years variance. After an initial 3 year period a reduced sampling strategy will be implemented in order to track longer term trends in these populations.

ii Efficacy of Fish Protection Measures

18B.6.12 Precautionary estimates have been used is assessing the mitigation benefit of the AFD (acoustic fish deterrent) and FRR systems that will be installed. There will therefore be a need to prove that the minimum performance standard, based upon these estimates, has been met early in the operational life of the station. Thus, trials will be carried out at that time and any adjustments made to these systems should this prove necessary. A fish impingement/entrainment programme will also be developed and implemented.

18B.7 Conclusions

18B.7.1 The two WFD water bodies within the study area for the proposed developed are the Parrett Estuary and Bridgwater Bay. A screening and scoping assessment has considered all activities that potentially could impact on these marine water bodies and has subsequently concluded that, based on trigger levels within *Clearing the Waters* guidance (Ref. 18B.9) and impact assessments from the ES, there are three potential activities that could either cause a deterioration in water body status or potentially threaten the ability of the water bodies to meet their objectives.

18B.7.2 A stage 3 assessment was, therefore, carried out on the three activities and, using information already available, determined that the proposal will not cause deterioration in water body status or cause potential problems with respect to the ability of the water body to meet its objectives in the future. In order to ensure that these conclusions are correct, a programme of monitoring is proposed.

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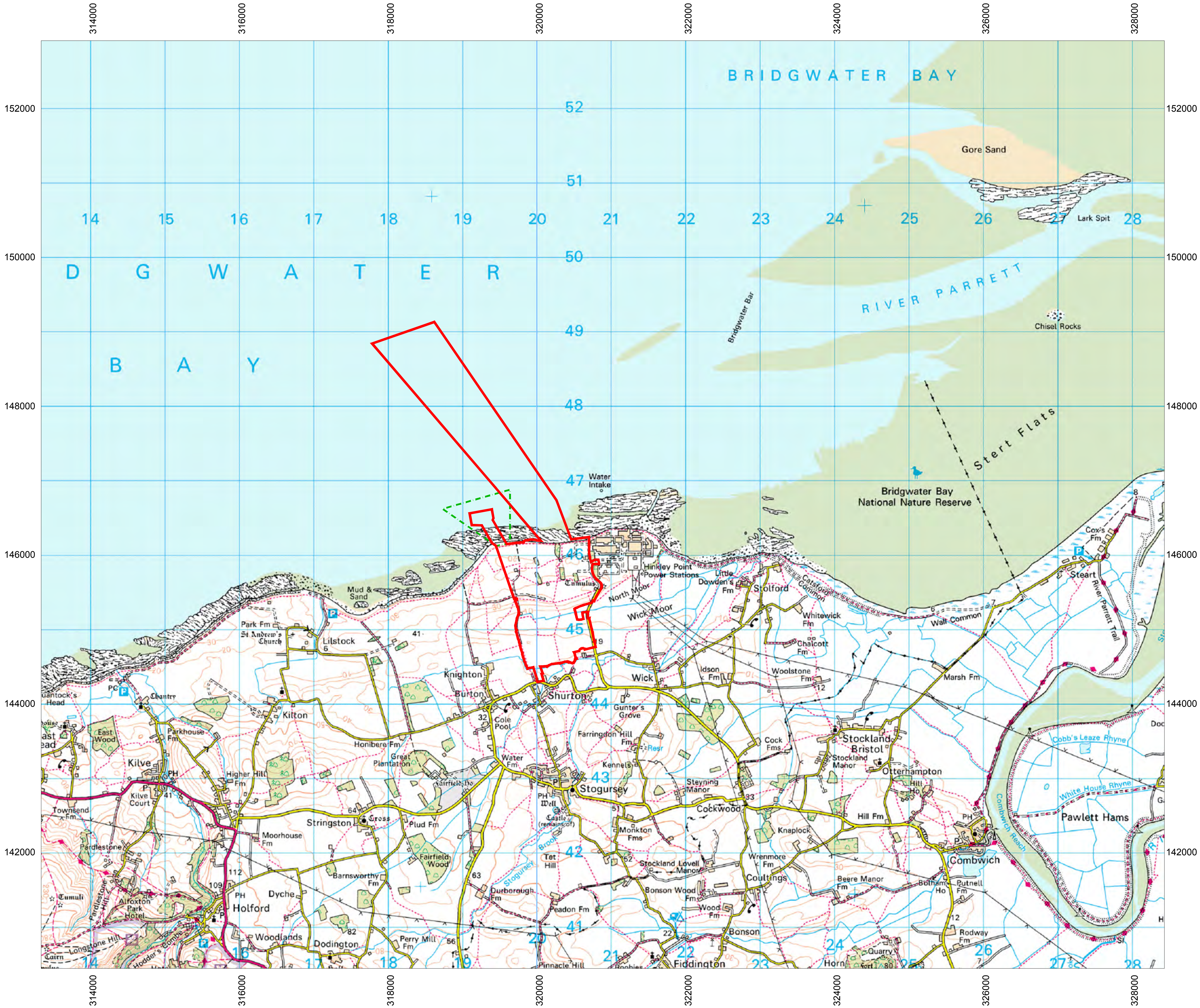

KEY

HINKLEY POINT C DEVELOPMENT SITE BOUNDARY

TEMPORARY JETTY SEAWARD HARBOUR LIMITS

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DOCUMENT:

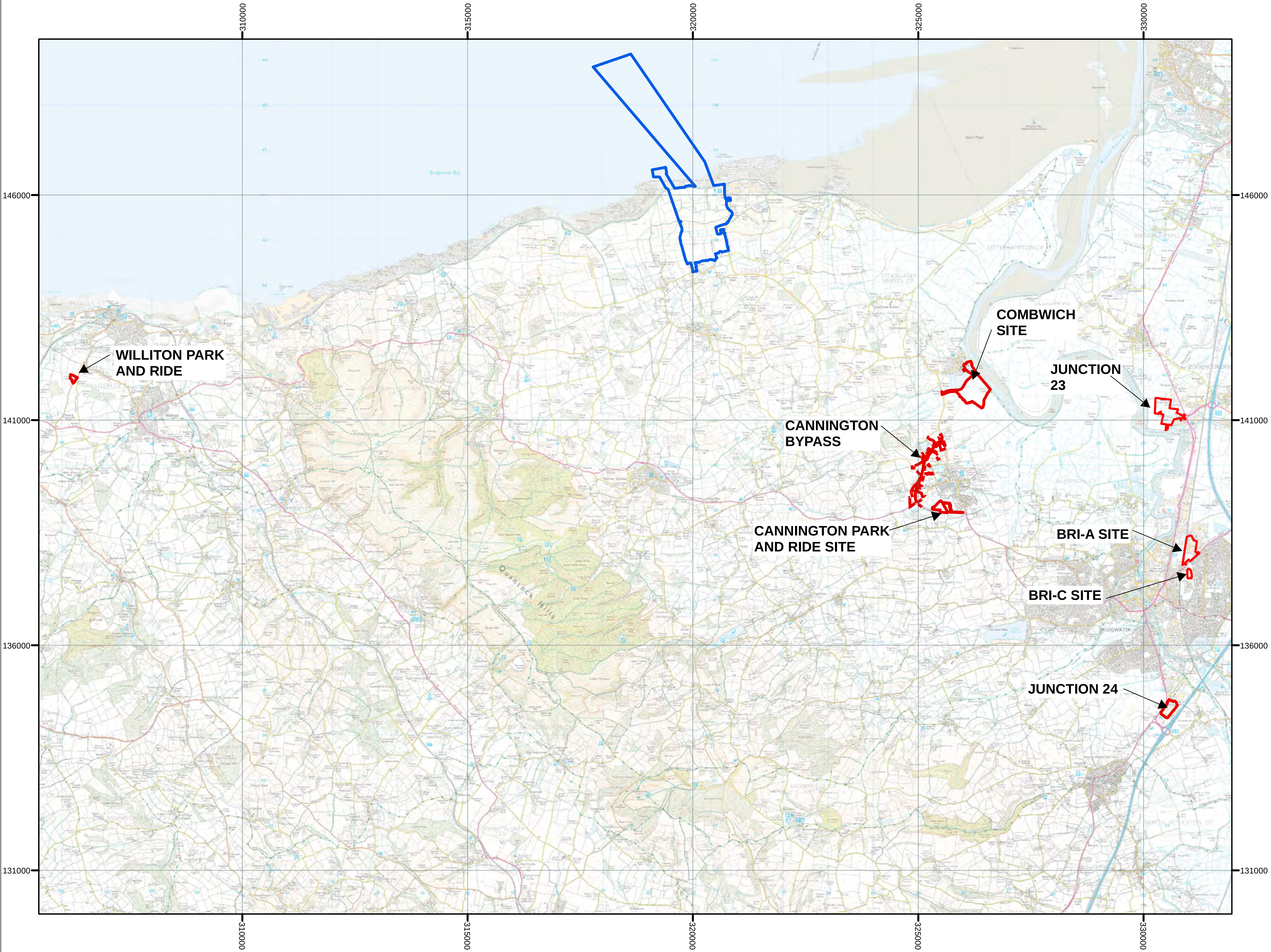
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 APPENDIX 18B

FIGURE TITLE:

HINKLEY POINT C DEVELOPMENT SITE

FIGURE NO:		REVISION:
FIGURE 18B.1		01
DATE:	DRAWN:	SCALE:
SEPT 2011	J.S	1:50,000@A3

SCALE BAR
0 500 1000 1500 2000 2500
metres



KEY

ASSOCIATED DEVELOPMENT SITES

HPC DEVELOPMENT SITE

REGION	TITLE
BRI-A	BRIDGWATER A (BRI-A) ACCOMMODATION CAMPUS AND ASSOCIATED LEISURE FACILITIES;
BRI-C	BRIDGWATER C (BRI-C) ACCOMMODATION CAMPUS;
COMBWICH SITE	COMBWICH FREIGHT LAYDOWN FACILITY, AND REFURBISHMENT AND EXTENSION OF COMBWICH WHARF;
JUNCTION 23	JUNCTION 23 PARK AND RIDE FACILITY, FREIGHT MANAGEMENT FACILITY, CONSOLIDATION FACILITY FOR POSTAL/COURIER DELIVERIES AND INDUCTION CENTRE;
JUNCTION 24	JUNCTION 24 (SOMERFIELD SITE) PARK AND RIDE FACILITY, FREIGHT MANAGEMENT FACILITY, TEMPORARY CONSOLIDATION FACILITY FOR POSTAL/COURIER DELIVERIES AND TEMPORARY INDUCTION CENTRE

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DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:

PROXIMITY OF OFF-SITE ASSOCIATED DEVELOPMENTS TO HINKLEY POINT C

FIGURE NO:		REVISION:
FIGURE 18B.2		01
DATE:	DRAWN:	SCALE:
SEPT 2011	M.P	1:87,000@ A3

SCALE BAR

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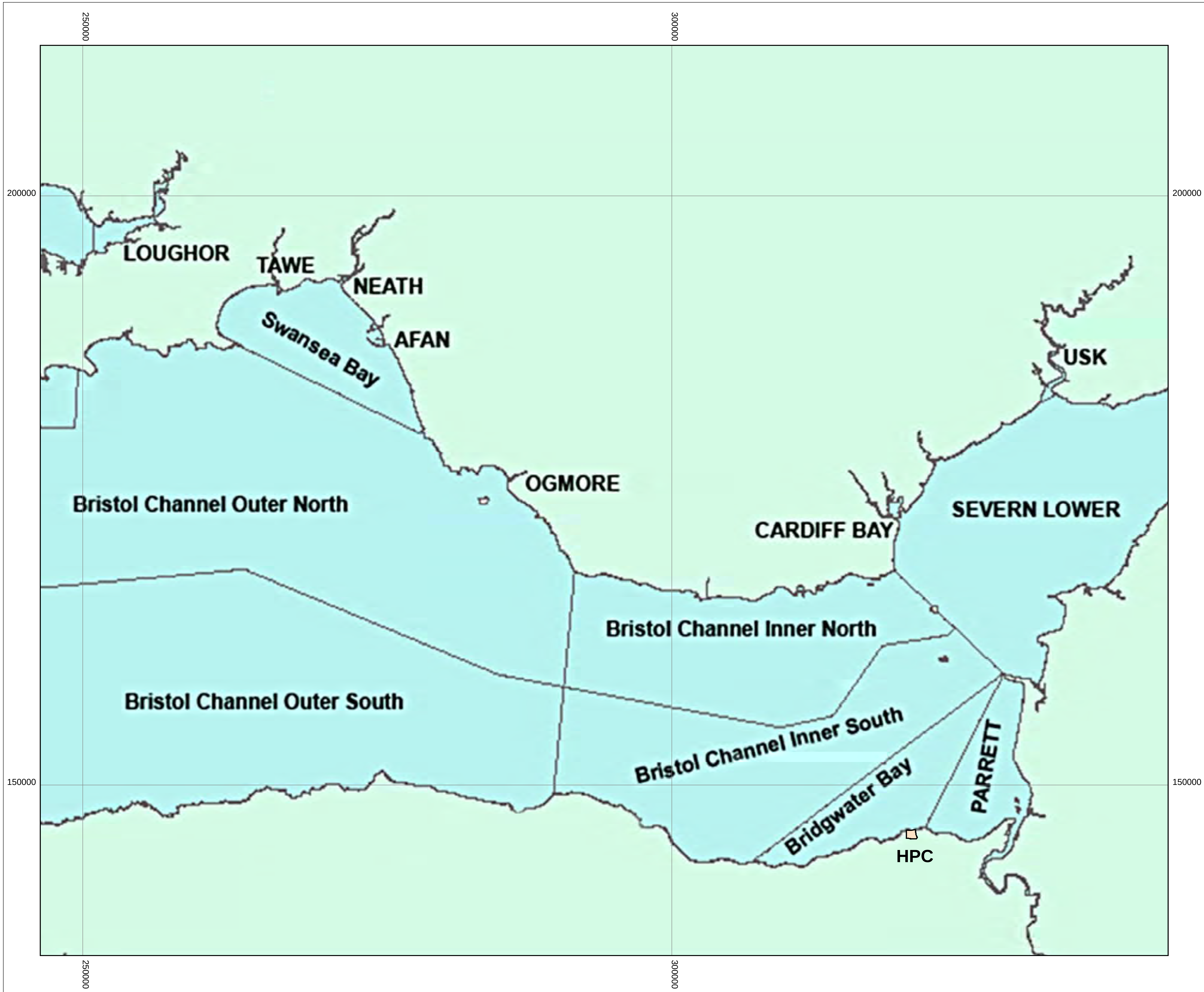
Metres



KEY

PROPOSED HINKLEY POINT C POWER STATION

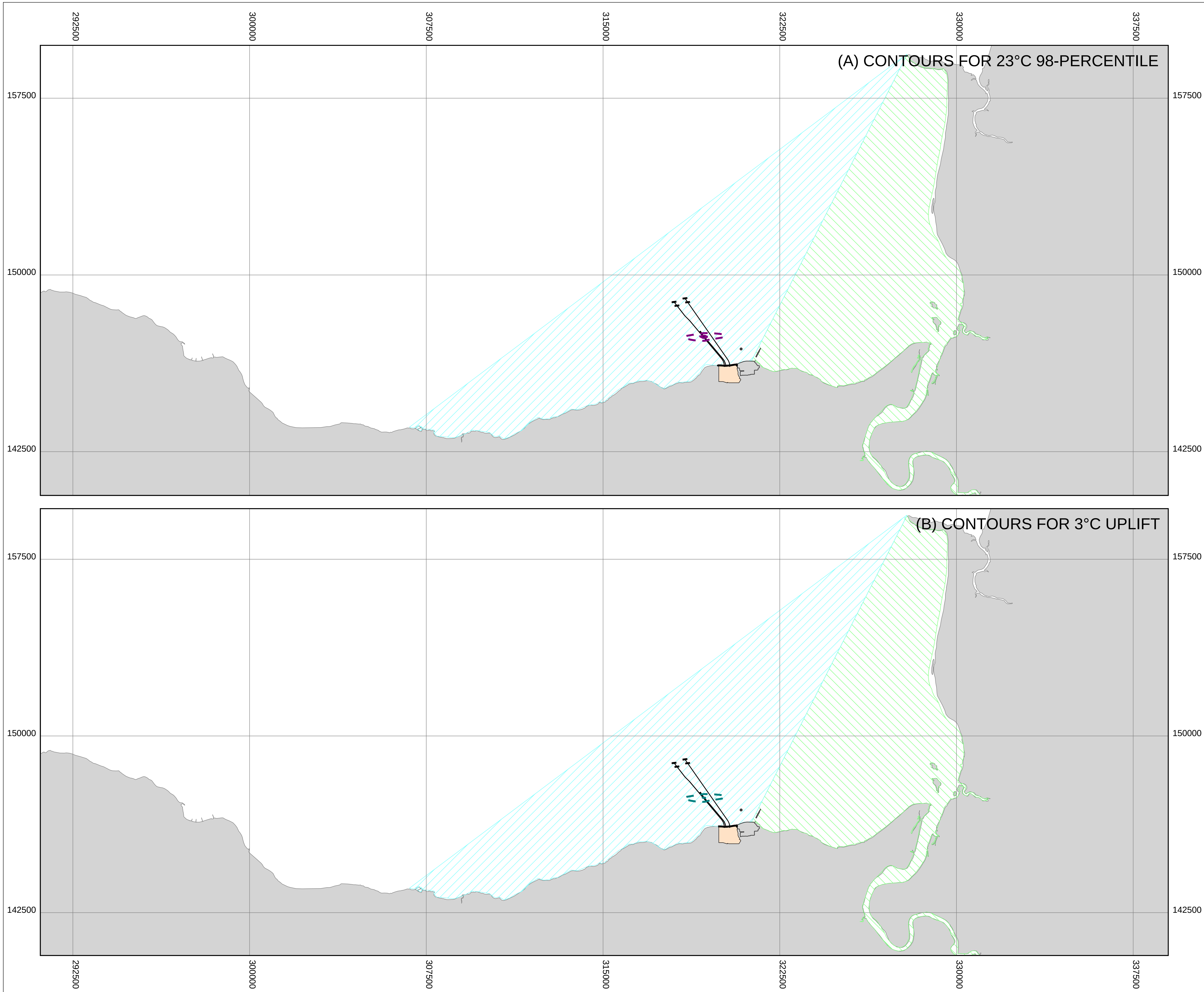
EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:
MAP OF THE SEVERN ESTUARY / BRISTOL CHANNEL SHOWING THE VARIOUS WFD WATER BODIES

FIGURE NO:		REVISION:
FIGURE 18B.3		01
DATE:	DRAWN:	SCALE:
SEPT 2011	B.B.	1:300000 @ A3

SCALE BAR
0 3 15 km



KEY

- PROPOSED HINKLEY POINT C POWER STATION
- HINKLEY POINT A AND B SIGNIFICANT STRUCTURES
- WFD COASTAL WATERBODY (BRIDGWATER BAY)
- WFD TIDAL WATERBODY (PARRETT ESTUARY)

THERMAL CONTOURS

- 23°C DEGREES AT SURFACE
- 23°C DEGREES AT BED
- 3°C DEGREES UPLIFT AT SURFACE
- 3°C DEGREES UPLIFT AT BED

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EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:

MIXING ZONES FOR THERMAL IMPACT FROM HPC OPERATING AT 100% IN ISOLATION (RUN C)

FIGURE NO:	REVISION:
FIGURE 18B.4	01

DATE:	DRAWN:	SCALE:
SEPT 2011	B.B.	1:150000 @ A3

SCALE BAR
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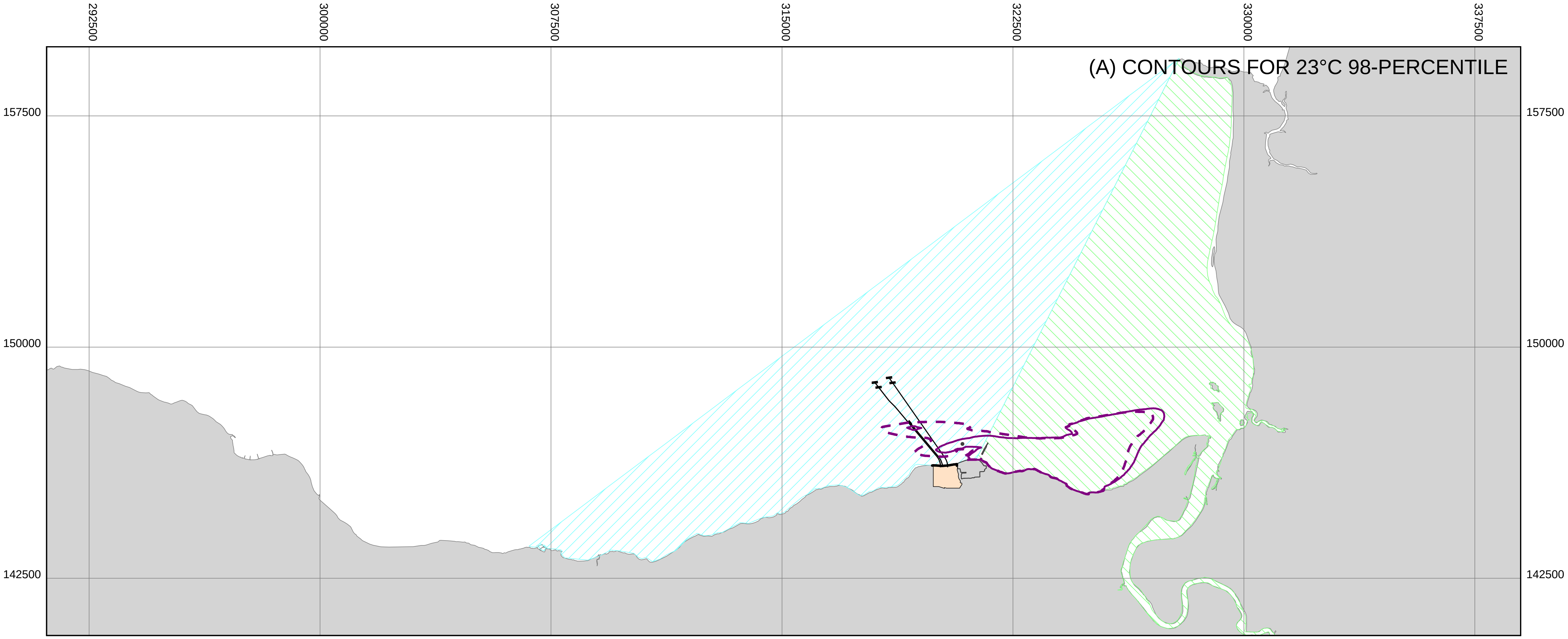

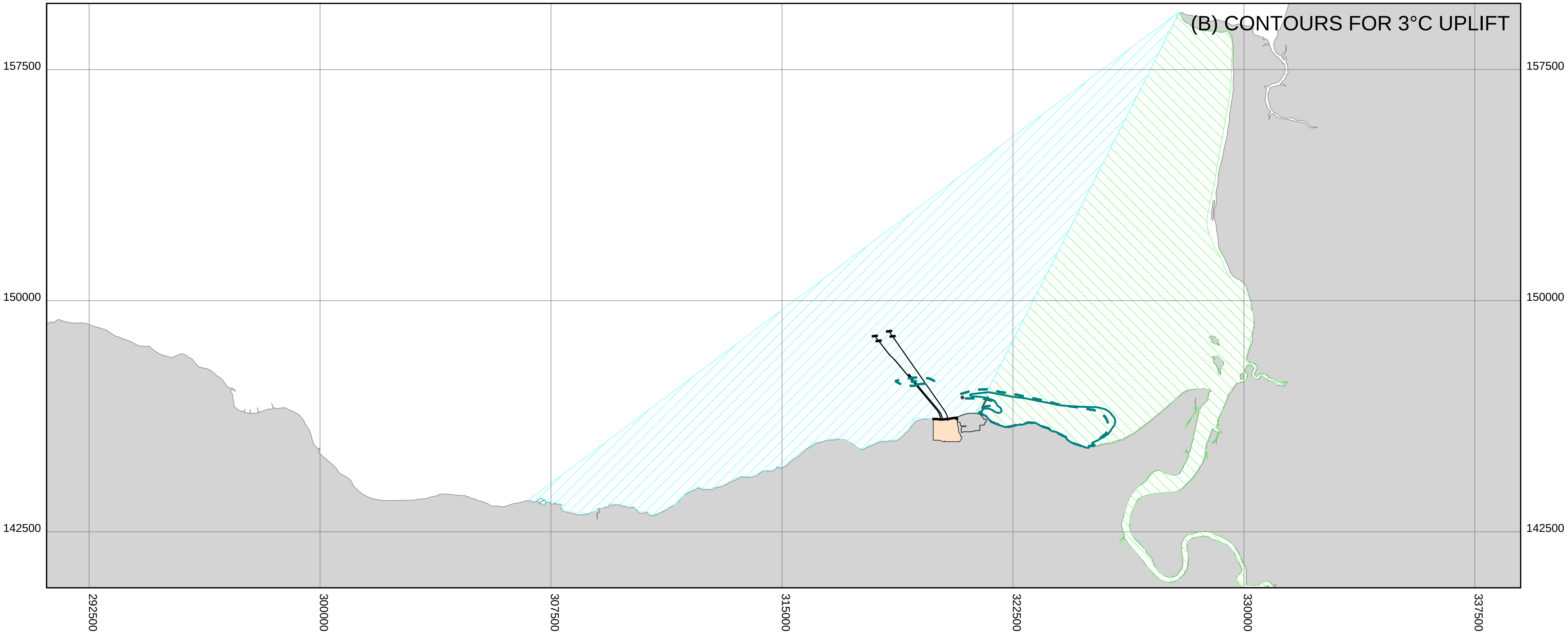

KEY

PROPOSED HINKLEY POINT C POWER STATION

HINKLEY POINT A AND B SIGNIFICANT STRUCTURES

WFD COASTAL WATERBODY (BRIDGWATER BAY)

WFD TIDAL WATERBODY (PARRETT ESTUARY)

THERMAL CONTOURS

23°C DEGREES AT SURFACE

23°C DEGREES AT BED

3°C DEGREES UPLIFT AT SURFACE

3°C DEGREES UPLIFT AT BED

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
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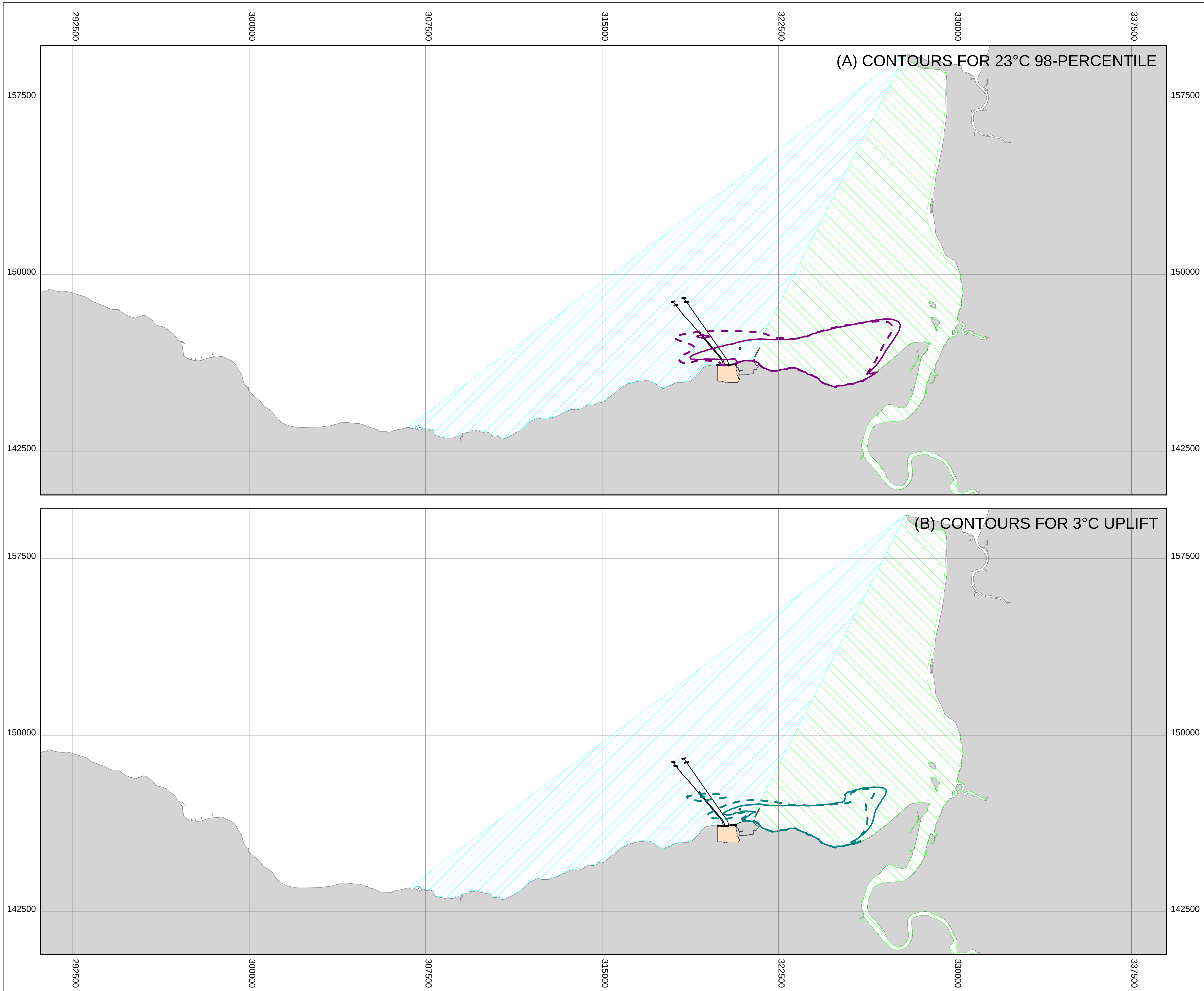
FIGURE TITLE:

MIXING ZONES FOR THERMAL IMPACT FROM HPC OPERATING AT 100% IN COMBINATION WITH HPB OPERATING AT 70% (RUN D)

FIGURE NO:	REVISION:	
FIGURE 18B.5	01	
DATE: SEPT 2011	DRAWN: B.B.	SCALE: 1:150000 @ A3

SCALE BAR

0 1.5 7.5 km



KEY

PROPOSED HINKLEY POINT C POWER STATION

HINKLEY POINT A AND B SIGNIFICANT STRUCTURES

WFD COASTAL WATERBODY (BRIDGWATER BAY)

WFD TIDAL WATERBODY (PARRETT ESTUARY)

THERMAL CONTOURS

23°C DEGREES AT SURFACE

23°C DEGREES AT BED

3°C DEGREES UPLIFT AT SURFACE

3°C DEGREES UPLIFT AT BED

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EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:

MIXING ZONES FOR THERMAL IMPACT FROM HPC OPERATING AT 100% IN COMBINATION WITH HPB OPERATING AT 100% (RUN E)

FIGURE NO:	REVISION:
FIGURE 18B.6	01

DATE:	DRAWN:	SCALE:
SEPT 2011	B.B.	1:150000 @ A3

SCALE BAR
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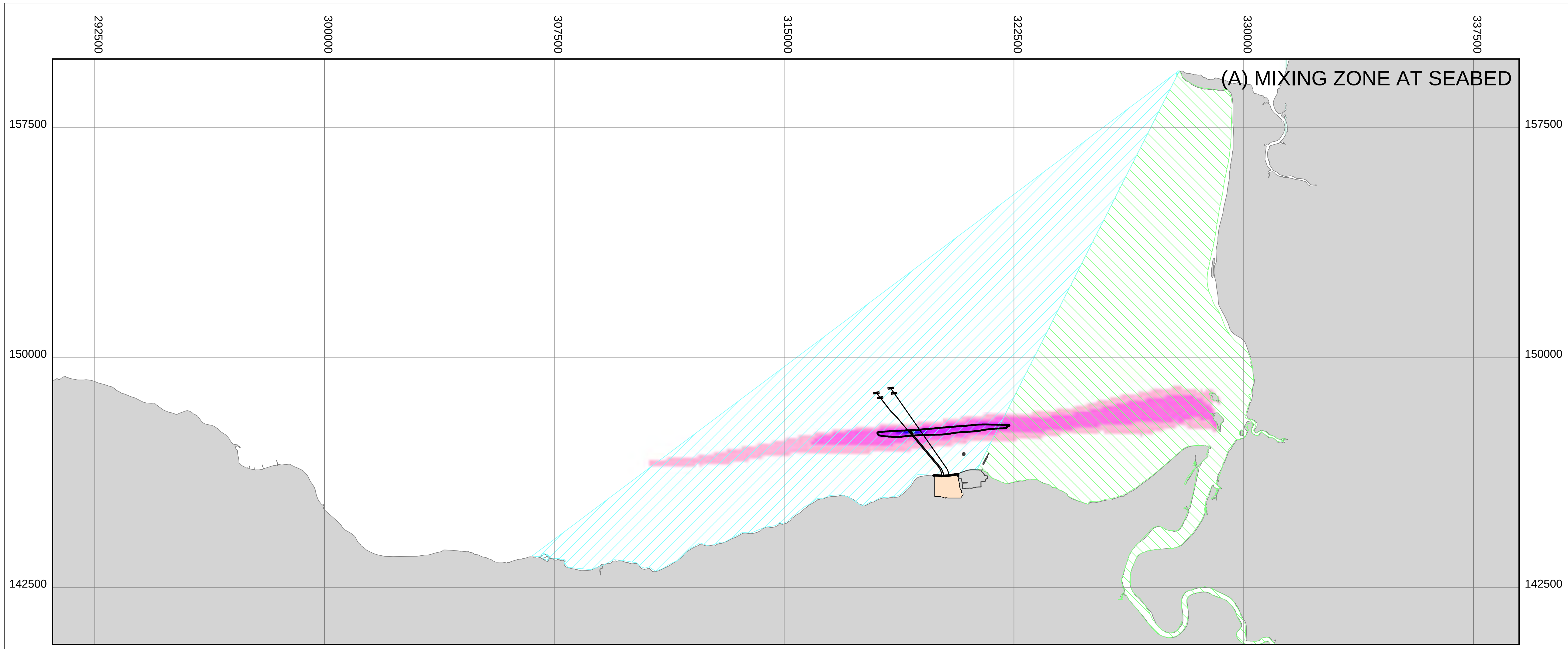

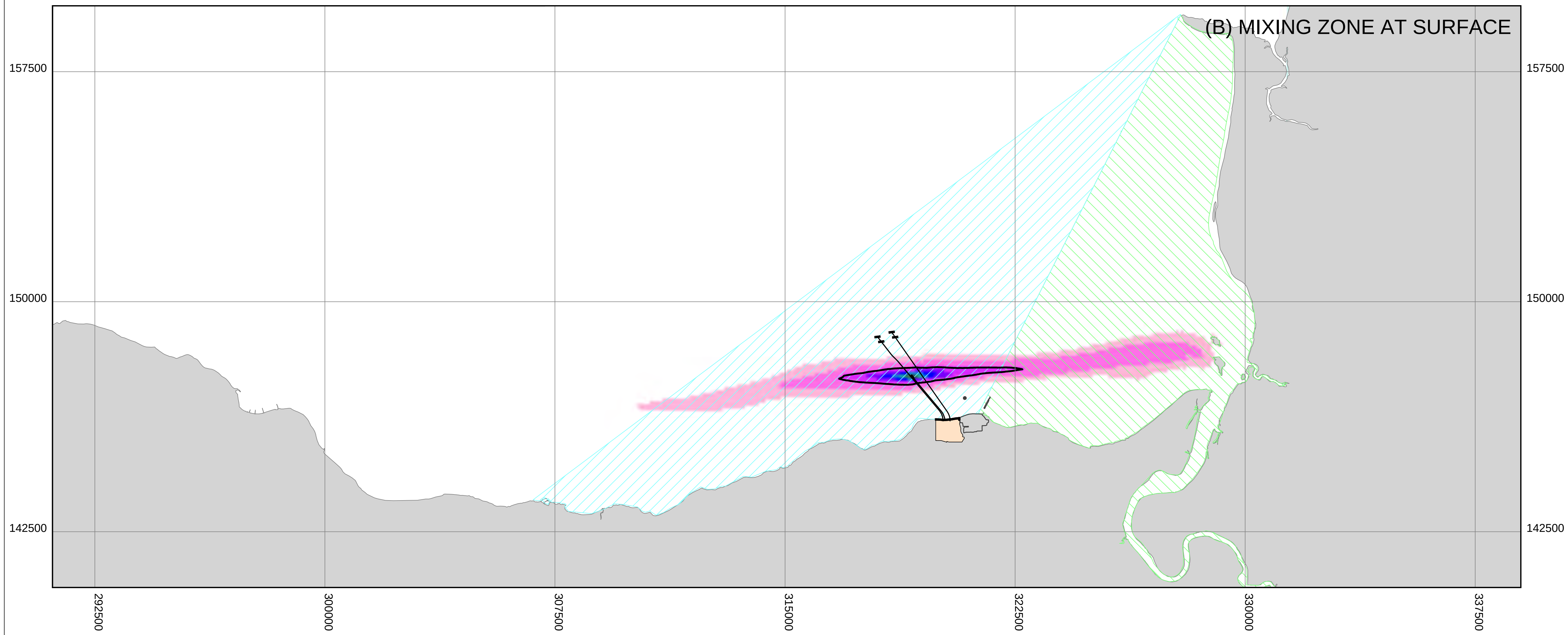

KEY

- PROPOSED HINKLEY POINT C POWER STATION
- HINKLEY POINT A AND B SIGNIFICANT STRUCTURES
- WFD COASTAL WATERBODY (BRIDGWATER BAY)
- WFD TIDAL WATERBODY (PARRETT ESTUARY)

HYDRAZINE [µg/l]

- >0.0001 - 0.0002
- >0.0002 - 0.0004
- >0.0004 - 0.0006
- >0.0006 - 0.0008
- >0.0008 - 0.001
- >0.001 - 0.0012
- >0.0012 - 0.0014
- >0.0014 - 0.0016
- >0.0016 - 0.0018
- >0.0018 - 0.002
- >0.0020 - 0.0022
- >0.0022

- CHRONIC PREDICTED NO EFFECT CONCENTRATION (PNEC)

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EDF ENERGY

DOCUMENT:

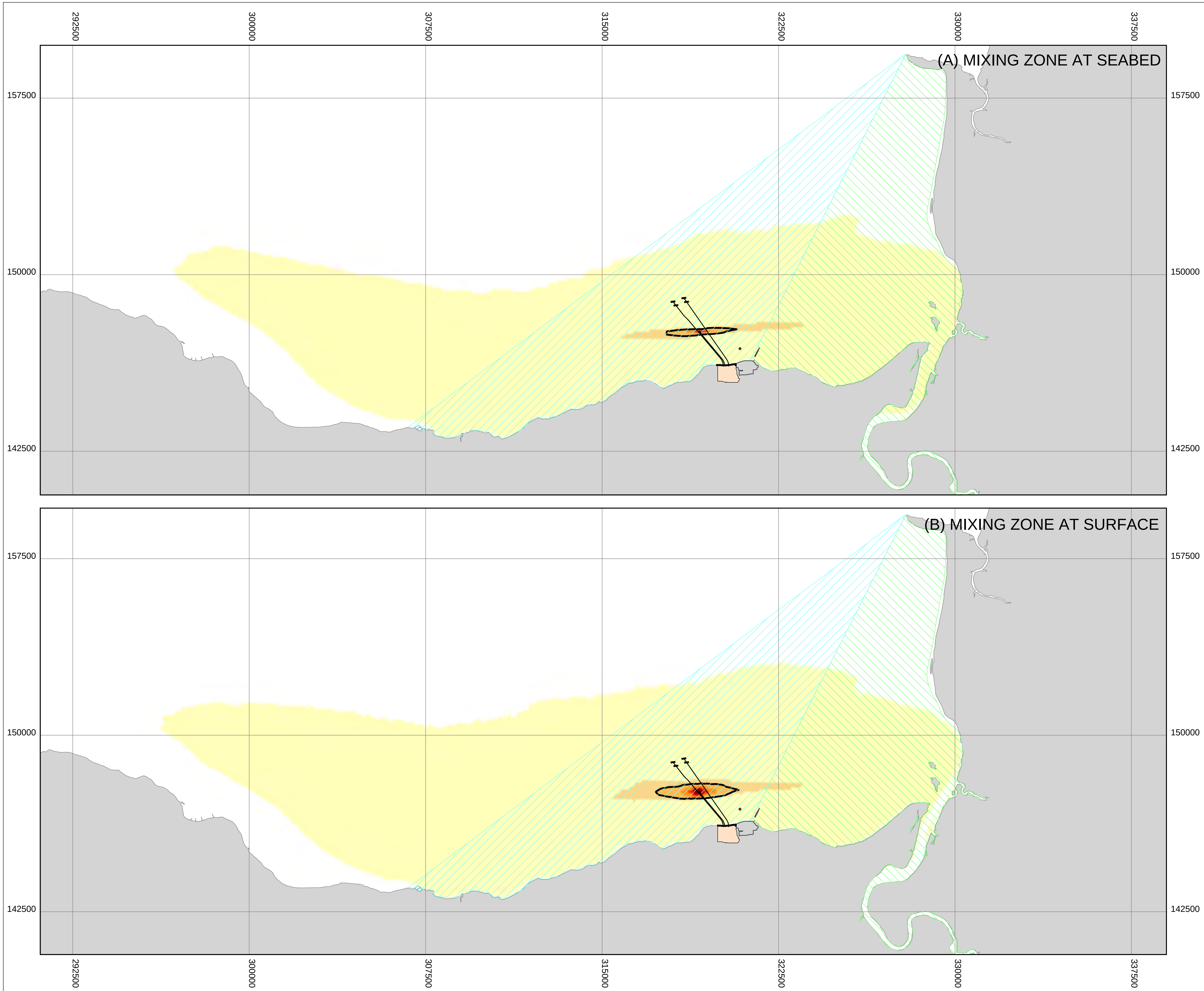
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:

MIXING ZONES FOLLOWING HYDRAZINE TREATMENT FOR HPC AT 100% IN ISOLATION (RUN C)

FIGURE NO:		REVISION:
FIGURE 18B.7		01
DATE: SEPT 2011	DRAWN: B.B.	SCALE: 1:150000 @ A3

SCALE BAR
0 1.5 7.5 km



KEY

PROPOSED HINKLEY POINT C POWER STATION

HINKLEY POINT A AND B SIGNIFICANT STRUCTURES

WFD COASTAL WATERBODY (BRIDGWATER BAY)

WFD TIDAL WATERBODY (PARRETT ESTUARY)

TRO [mg/l]

>0.0001 - 0.005

>0.005 - 0.01

>0.01 - 0.02

>0.02 - 0.03

>0.03 - 0.04

>0.04 - 0.05

>0.05

ENVIRONMENTAL QUALITY STANDARD (EQS)

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EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:

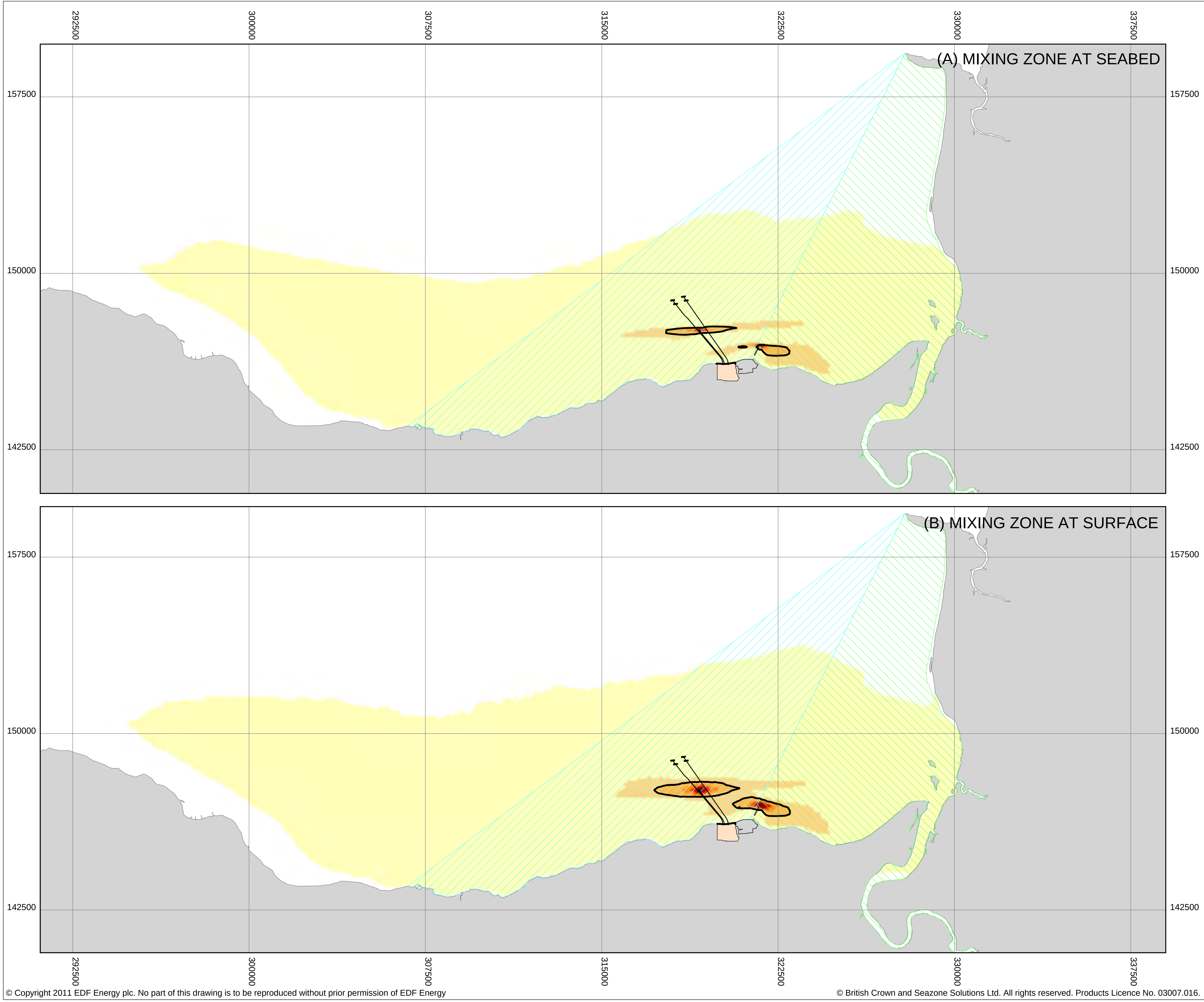
MIXING ZONES FOLLOWING CHLORINATION AT 0.2MG/L AT HPC OPERATING AT 100% (RUN C).
DOSING TO ACHIEVE THE SPECIFIED CONCENTRATION AT THE CONDENSERS.

FIGURE NO:	REVISION:
FIGURE 18B.8	01

DATE:	DRAWN:	SCALE:
SEPT 2011	B.B.	1:150000 @ A3

SCALE BAR

0 1.5 7.5 km



EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2, APPENDIX 18B

FIGURE TITLE:

MIXING ZONES FOLLOWING CHLORINATION AT 0.2MG/L AT HPC AT 100% IN COMBINATION WITH 0.3MG/L AT HPB AT 100% (RUN E). DOSING TO ACHIEVE THE SPECIFIED CONCENTRATION AT THE CONDENSERS.

FIGURE NO:	REVISION:	
FIGURE 18B.9	01	
DATE: SEPT 2011	DRAWN: B.B.	SCALE: 1:150000 @ A3

SCALE BAR
0 1.5 7.5 km

APPENDIX 19A: CROSS-SHORE HYDRAULIC MODELLING AND SELECTION OF POINT OF DISCHARGE

CONTENTS

FIGURES

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APPENDIX 19A: CROSS-SHORE HYDRAULIC MODELLING

19A.1 Context

19A.1.1 On the northern half of the Hinkley Point C (HPC) site, within Built Development Areas East and West, surface drainage run-off will initially be discharged into the HPC drainage ditch and thence discharged to the foreshore. At an early stage of construction, Water Management Zones (WMZs) will be created along the ditch to attenuate flow (which will be restricted to greenfield run-off rates) and suspended solids concentration (which will be restricted to 250mg.l^{-1}). Once the spine drains (the central drainage channels) have been installed, this ditch will be removed, and a new discharge point to the foreshore in its stead.

19A.1.2 The purpose of this **Appendix 19A** to **Chapter 19** of the ES is to review the assessment that has led to the selection of that new discharge point.

19A.1.3 The spine drains will receive: all surface drainage from the northern area of the site (Built Development Areas East and West); groundwater pumped from the deep well system serving deep excavations; treated sanitary effluent from package treatment plants; and any waste water from tunnel excavation works for the cooling water and fish return systems. Each of the three spine drains will be served by its own WMZ to attenuate flows and ensure that the conditions of the Environmental Permit are met, in terms of discharge flow and water quality.

19A.1.4 As the development progresses and until the main cooling water discharge route becomes available, it will also be necessary to discharge early ('cold-flush') commissioning discharges.

19A.1.5 All such effluent streams will receive the appropriate level of treatment, so as to satisfy all applicable Environmental Quality Standards at the point of discharge.

19A.2 Options considered

19A.2.1 Three options have been considered for discharge across the intertidal area, as follows (see **Figure 19A.1**; Ref. 19A.1).

19A.2.2 **Option 1: Three discharge outfalls**. This option would involve the three main spine drains discharging directly to the upper intertidal area through their own outfall structures at the cliff face at 9m AOD.

19A.2.3 **Option 2: One single outfall at Location A**. This option would involve spine drains in the same positions as Option 1, but cut short of discharging to the intertidal area by a collector drain running parallel to the shore (on the landward side of the cliff, within the application site). This collector drain would then discharge to the upper intertidal area at 7.5m AOD, landward of the location of the historical construction dry dock (buried beach feature), used in the construction of Hinkley Points A and B.

19A.2.4 **Option 3: One single outfall at Location B**. This option would be similar to the single outfall at Location A, being serviced by a collector drain and discharging to the upper intertidal area at 7.5m AOD, except that the outfall discharge pipe would be at a similar location to the existing HPC Ditch, which runs through Built Development Areas West and East, as described above.

19A.3 Receptors

19A.3.5 There are a number of potentially sensitive receptors within the local intertidal area. **Figures 19.08-19.10**, within **Volume 2, Chapter 19**, show the distribution of the various biotopes involved.

19A.3.6 The two most significant biotopes involved in considering potential outfall locations are those associated with the reef-building polychaete worm, *Sabellaria* spp., and the turf-forming red alga, *Corallina* spp. The *Sabellaria* interest is described in 19A.5b)i and 19A.5c)ii, below, and the *Corallina* interest in 19A.5b)ii and 19A.5c)iii.

19A.4 Assessment Methodology

19A.4.1 The behaviour of the cross-shore effluents associated with each of these outfall scenarios has been compared and the effect on intertidal habitats assessed, using numerical modelling of the lateral spread of the discharges across the intertidal area and relating the findings to habitat and biotope mapping.

19A.4.2 A digital terrain model (DTM) of the intertidal area, utilising light detection and ranging (LiDAR) data (Environment Agency), was established. These data had a grid resolution of 1m and a vertical accuracy of ±0.15m.

19A.4.3 To determine likely quantities and lateral extent of freshwater discharges to the shore during the site preparation and construction works, a number of hydrological modelling scenarios were considered, as agreed with Natural England and the Environment Agency (technical consultation, held 24th May, 2010). These provide an estimation of the potential, lateral spread of freshwater discharges to the intertidal area for each of the three options. Baseline, i.e. pre-development, drainage discharge was modelled for 43% (**Figure 19A.2**) and 3.33% (**Figure 19A.3**) annual exceedance probability (AEP) events. AEP is the probability, given as a percentage, associated with the return period of an event. Thus an event-of-return period of 100 years has an AEP of 1% (also known as, e.g. the 100-year flood, or 1:100 year flood); 50 years, 5%; 30 years, 3.33%.

19A.4.4 Two-dimensional (2D) modelling was then undertaken to simulate the flood extents, using the TUFLOW numerical hydraulic modelling code (Ref. 19A.1).

19A.4.5 For the purposes of enveloping worst case estimates associated with the expected site construction discharges, further modelling was undertaken in order to simulate the additional volumes involved.

19A.5 Assessment

a) Introduction

19A.5.1 The location of the outfall options in relation to the intertidal area and distribution of *Sabellaria* and *Corallina* related biotopes is given in **Figure 19A.2**. A service road would be constructed to give vehicular and construction worker access to the foreshore and outfall structure during the preparation and construction phases. This service road would be located at the point where the existing HPC drainage ditch exits onto the intertidal area and it would be less than 100m in length. Any disturbance would be restricted to this short stretch of the upper intertidal area, above Highest Astronomical Tide (HAT). The biotope of this area is described under the EUNIS classification as 'barren, littoral shingle' (see **Volume 2, Chapter 19, Figures 19.08, 19.09** and **19.10**).

19A.5.2 Although the upper intertidal areas lie within the Severn Estuary SAC, SPA and Ramsar site, none of the features within the upper shore area is a qualifying feature and these biotopes are widespread along the intertidal zone, throughout the study area, which extended as far as Watchet approximately 15 km to the west of Hinkley Point.

19A.5.3 The upper intertidal habitat is not regularly used by large numbers of roosting or foraging birds. Accordingly, the receptor value is assessed as low. The area of the works would be subject to disturbance, in addition to natural events, but such impacts are not expected to be of any greater magnitude than high-tide storm events. Furthermore, following a natural storm event, it is unlikely that any evidence of foreshore access would remain. The impact magnitude is therefore assessed as very low and the significance of the potential impact as negligible.

19A.5.4 The volumes and lateral extent of freshwater discharged to the foreshore would impact upon the intertidal ecology during low-tide periods by causing an influx of water of a different quality and salinity into retained saline pools. The intertidal ecology is specifically adapted to tidal cycles of emersion and immersion as well as seasonally variable extremes of rainfall and drying and is thus tolerant of wide salinity range. This is demonstrated by the character of many of the biotopes involved (**Volume 2, Chapter 19, Figures 19.8** to **19.10**), described under EUNIS as being of 'variable salinity'. Inundation by increased levels of freshwater, nevertheless, has some potential to cause an adverse impact upon local communities, either through scour and displacement or through osmotic stress.

b) Effects of Freshwater Discharge

i. *Sabellaria*

19A.5.5 Section 5 of the advice given under Regulation 33(2)(a) of the Conservation (Natural Habitats, &c.) Regulations (Ref. 19.114 in Chap. 19) states that *Sabellaria* reef is of moderate vulnerability to changes in salinity and suspended solids. For the purposes of this assessment, due to its moderate vulnerability, *Sabellaria* reef thus considered to be of **medium** value.

19A.5.6 The main areas of *Sabellaria* reef local to Hinkley Point C lie in the lower intertidal area, approximately 300m offshore at the eastern end of the application site. There is also a small area approximately 200m directly downshore from both Option 2, Location A and Option 3, Location B, as well as the existing HPC drainage ditch discharge location (**Figure 19A.2**). While the main areas would be unaffected by any of the proposed outfall options, this smaller area could be affected; this feature has been described as being of low to moderate 'reefiness' (see **Volume 2, Chapter 19**).

19A.5.7 The modelled routes of the discharge of freshwater during a 3.33% AEP event show that the flow falls short of areas of *Sabellaria* reef for both Outfall Option 1 (**Figure 19A.4**) and Outfall Option 2 (**Figure 19A.5**) whereas there is potential for intertidal *Sabellaria* reef to be inundated with freshwater from Outfall Option 3 at Location B (**Figure 19A.6**). As the *Sabellaria* reef is on the lower intertidal area, exposure at low tide would be infrequent and brief. Impacts are thus predicted to be direct and temporary.

Options 1 and 2 (*Sabellaria*)

19A.5.8 *Sabellaria* reef is considered to be of **medium** value, as it is an Annex I habitat of international importance, designated under the Habitats Directive, although not one considered to be sensitive to either moderate variations in salinity, flow, or high turbidity. The magnitude of the effect of Options 1 and 2 is considered to be **very low**, given that *Sabellaria* currently exist in the line of the present discharge (**Figures 19A.2 and 19A.3**) and appear to be unaffected by it and also given that the modelled discharges fall short of reaching the *Sabellaria* (**Figures 19A.4** and **19A.5**). The proposed outfall developments in Options 1 and 2 are therefore assessed as having a **minor** impact on *Sabellaria* reef.

Option 3 (*Sabellaria*)

19A.5.9 As previously mentioned, *Sabellaria* is seemingly unaffected by the current discharge. However, the greater volumes modelled in Option 3, discharged from Location B may have some impact. The magnitude of this impact on the **high**-value/sensitivity *Sabellaria* is predicted to be **low**. Consequently, an overall impact of **minor,** adverse significance is predicted.

ii. *Corallina*

19A.5.10 The geological configuration of the foreshore at Hinkley Point, with a wide platform of rock pavement gently dipping seawards in the lower intertidal zone, provides a niche for the development of *Corallina* turf habitat. This is especially so where long-shore drainage overtops scarps in the pavement during low-tide periods to form wide spillways. These wide areas of turf occupying the wetted areas of these spillways are termed '*Corallina* run-offs' and are the most distinctive feature of the HPC intertidal shore. This turf habitat is considered to be a notable sub-feature of the SAC. For the purposes of this assessment, given the relatively low vulnerability of this species to variable salinity and high turbidity, the sensitivity/value it taken to be **medium**.

19A.5.11 While it is generally considered that *Corallina* is relatively tolerant of infrequent and short-term changes in salinity, it is important to draw a difference between acute and chronic freshwater inundation.

19A.5.12 Periodic storm-event discharges of freshwater from land and direct precipitation to the intertidal shore (both of which involve large but infrequent volumes of water – the acute condition) are unlikely to cause adverse effects on *Corallina*, since diurnal tidal immersion will regularly refill the long-shore intertidal drainage features with seawater. Ponded seawater in these features will protect *Corallina* turf from desiccation at low water and maintain some salinity when freshwater is discharged. However, should freshwater regularly flush these pools, due to constant discharges from site preparation and construction activities (the chronic condition), there is potential for the *Corallina* to be adversely affected by chronically low salinity, although this will again be limited by tidal immersion. In addition, there is potential for the *Corallina* turf to be smothered by sediment deposition (addressed in 19A.5c)iii, below).

19A.5.13 The locations of the three outfall options in relation to recorded areas of *Corallina* are shown in **Figure 19A.2**. *Corallina* habitat is present approximately 100m downshore of each of the three discharge points of Option 1. *Corallina* habitat is also present in the intertidal zone approximately 150m downshore from the proposed discharge location of Option 2, Location A, on the eastern edges of the historical berthing dock. For Option 3, Location B (beside the current location of the HPC drainage ditch), *Corallina* is present in the intertidal zone 100m downshore and slightly to the west of the proposed discharge point.

19A.5.14 Hydraulic modelling of discharged flows during the low tide period has been undertaken to assess the likely extent of freshwater inundation of the foreshore, based on a 3.33% AEP event (see Figures **19A.4, 19A.5** and **19A.6**). It should be noted that 99.5% of high tides (based on records from Hinkley Point tide gauge) inundate the areas of *Corallina*. Thus, for the most part, even the *Corallina* furthest inshore is not exposed for longer than around 12.5h (given two tidal cycles per diem). Between tidal cycles, the *Corallina* would, however, be immersed in freshwater flowing from the outfall discharge and collecting in the gullies.

19A.5.15 Taking the above into account, the potential impact of each of the three discharge options on *Corallina* is identified below.

Option 1 (*Corallina*)

19A.5.16 Option 1, involving three outfalls, would potentially result in adverse impacts on *Corallina* and the habitat that it maintains, due to the proximity of the outfalls to extensive, recorded areas of this habitat. The modelled lateral extent of the discharge of freshwater during a 3.33% AEP event shows that approximately 40% of the total area of *Corallina* would be inundated (**Figure 19A.4**). The impact would be likely, adverse, indirect and widespread across the foreshore. The value of the *Corallina* has been assessed as **medium.** The overall magnitude of the impact is predicted to be **medium**, as the receptor may experience some degradation and possible reductions in biomass beyond the range of natural variability, but limited to areas within and adjacent to the development. Consequently, it is assessed that the impact would be of **moderate**, adverse significance due to the location of the outfalls in proximity of the *Corallina*.

Option 2 (*Corallina*)

19A.5.17 Option 2, a single outfall at Location A, runs just to the west of the most easterly patch of Coralline turf (**Figure 19A.5**). It is therefore predicted to be an impact of only **very low** magnitude to the **medium**-value *Corallina*. Overall, a **minor** impact is anticipated.

Option 3 (*Corallina*)

19A.5.18 Option 3, a single outfall at Location B (HPC drainage ditch), would result in adverse impacts on a small area of *Corallina* and the habitat that it maintains, due to the modelled, lateral extent of the discharge (**Figure 19A.6**). The impact is likely and would be adverse, direct and localised. However its overall magnitude is predicted to be **low**, with some limited degradation of the habitat. Hence it is anticipated that the impact of freshwater discharge from Option 3 would be of **minor,** adverse significance due to the proximity of the outfall to (**medium**-value) *Corallina*.

iii. Assessment Outcome

19A.5.19 For *Sabellaria*, each of the options would bring only minor effects from freshwater discharge. For *Corallina*, Options 2 and 3 would bring minor effects, whereas impacts from Option 1 would be moderate. Therefore, either the single outfall at Location A or the single outfall at Location B would be the best choice of discharge location, to mitigate impacts of freshwater discharge.

c) Effects of Sediment Deposition

i. Introduction

19A.5.20 Sediment-laden water would be generated from a range of site preparation activities in the northern areas of the site (Built Development Areas East and West). The main source of these sediments would be surface drainage, arising from areas of bare earth and any requirement to dewater excavations. Consideration has been given to the extremely high concentrations of suspended sediments that are naturally present within the Inner Bristol Channel when assessing potential impacts. However, there is potential for discharges with concentrations of suspended solids (given a mean baseline equivalent concentration of 250mg/l) to cause temporary smothering of intertidal fauna and flora, particularly *Corallina* turf habitats, during low-tide periods.

ii. *Sabellaria*

19A.5.21 As described in 19A.5.5, *Sabellaria* is moderately vulnerable to changes in suspended solids. The *Sabellaria* reefs are a qualifying feature of the Severn Estuary SAC.

19A.5.22 The more open structure of the tubes constructed by the *Sabellaria* worms provides opportunities for a range of invertebrate species associated with hard-bottom habitats to co-exist there (Ref. 19A.2).

19A.5.23 Given the shifting nature of sediments in the Severn Estuary, *Sabellaria* is subjected to frequent burial. Whilst they may tolerate days or weeks of being buried, if this is prolonged, their survival is reduced. Hence, populations of *Sabellaria* are often ephemeral.

19A.5.24 *Sabellaria* recruitment is very variable; larvae are thought to take between six weeks and six months to settle and larvae often re-colonise old, dead reefs. The species may therefore be considered highly opportunistic.

19A.5.25 Whilst *Sabellaria* is subjected to, and often is able to colonise due to, natural changes in sediment, reefs are known to have been lost from rising sand levels, as a consequence of the construction of sea walls. However, recovery has also been reported in these instances.

19A.5.26 With the above taken into account, the potential impacts of each of the outfall options are considered below.

Options 1 and 2 (*Sabellaria*)

19A.5.27 The modelled discharges in Option 1, the three outfalls, and Option 2, the single outflow at Location A, each fall short of the *Sabellaria* patches (**Figures 19A.4** and **19A.5**, respectively). These options are therefore considered to be of **low**, predicted magnitude on *Sabellaria*. The value and sensitivity of *Sabellaria* is **medium**, leading overall to a **minor**, adverse impact from each option.

Option 3 (*Sabellaria*)

19A.5.28 Option 3, a single outfall at Location B (HPC drainage ditch), could potentially result in adverse impacts on *Sabellaria* and the magnitude is considered to be **medium**. The value of *Sabellaria* reef is **medium** as it is listed as an Annex I habitat of international importance, designated under the Habitats Directive, yet not deemed highly sensitive to disturbance. Overall, the impact is predicted to be of a **moderate**, adverse impact on *Sabellaria*.

iii. *Corallina*

19A.5.29 As described in 19A.5.12, due to the proximity of *Corallina* to the discharge points and the potential for increased sediment loadings of discharged water to the foreshore from run-off and soil erosion during site preparation works, there is potential for the *Corallina* turf to be smothered by sediment deposition.

19A.5.30 Taking the above assessment into account, the potential effects of sediment deposition on *Corallina* due to each of the three discharge options are identified below.

Option 1 (*Corallina*)

19A.5.31 Option 1: The three outfalls would have the potential to disturb *Corallina* and the habitat that it maintains due to the proximity of the outfalls to extensive, recorded areas of this habitat. As described above, the modelled lateral extent of the discharge of freshwater during a 3.33% AEP event shows that approximately 40% of the total area of *Corallina* would be inundated (**Figure 19A.4**). The impact would be likely, adverse, direct and widespread across the foreshore. However, the areas of foreshore would be subject to normal tidal events that would re-suspend any deposited material, and the estuary already maintains high levels of suspended sediments. Acknowledging that the value of the *Corallina* has been assessed as **medium**, the overall magnitude of the impact is predicted to be **very low**, as the receptor would experience little to no degradation, with any disturbance in the range of natural variability. Consequently, the impact of Option 1 is assessed as **minor**, adverse for this receptor.

Option 2 (*Corallina*)

19A.5.32 The discharge of Option 2, the single outfall at Location A, runs just to the west of the most easterly patch of algal turf (**Figure 19A.5**). It is therefore predicted to be an impact of only **very low** magnitude to the **medium**-value *Corallina*. Overall, a **minor** impact is anticipated.

Option 3 (*Corallina*)

19A.5.33 Option 3, the single outfall at Location B (HPC drainage ditch), would potentially result in adverse impacts on a small area of *Corallina* and the habitat that it maintains, due to the modelled lateral extent of the discharge (**Figure 19A.6**). The impact would be likely, adverse, direct and localised. However, as for Option 1, the areas of foreshore would be subject to normal tidal events that would re-suspend any deposited material and the estuary already maintains high levels of suspended sediments. The overall magnitude of the impact is predicted to be **low**, as the receptor would experience little or no degradation with any disturbance in the range of natural variability. Consequently, the impact of Option 3 is assessed to be **minor,** adverse for this **medium**-value receptor.

iv. Assessment Outcome

19A.5.34 For *Sabellaria*, Options 1 and 2 would bring only minor effects from sediment deposits, yet moderate effects would result from Option 3. For *Corallina*, Option 1 would bring moderate effects from sediment deposits, whereas Options 2 and 3 would have only minor effects. Therefore, the single outfall at Location A (Option 2) would be the best compromise to mitigate impacts of sediment deposits.

d) Effects of Scour

19A.5.35 A further consideration is the potential impact of larger volumes of discharge in terms of the potential physical scour imposed by the flow itself and consequent disturbance of the habitats involved. Peak volume rates expected under a 3.33% AEP event are not so different from those currently estimated for the HPC drainage ditch (20,470m^3, at 13.5m^3.s^{-1}). Given that Option 2 is predicted to have the least impact on the intertidal receptors in terms of sediment deposits and a lesser effect than Option 1 for freshwater discharge, only Option 2 has been considered in this section.

19A.5.36 Additional modelling of Option 2 (the preferred discharge option) was carried out to explore a worst-case scenario. In addition to the 3.33% AEP event, the following volumes were incorporated into the model: pumped groundwater, sewage effluent, tunnel excavation emergency discharge, plus commissioning phase 'cold-flush' treatment (Ref. 19A.1). This resulted in a 3.33% AEP event plus effluent stream flow rate of 13.674m^3.s^{-1}. **Figure 19A.7** illustrates that this worst-case plume for Option 2 and demonstrates no radical difference from the earlier model for Option 2.

19A.5.37 Detailed habitat and biotope mapping is illustrated in **Volume 2, Chapter 19**, **Figures 19.08** to **19.10**. **Figure 19A.8** appended to this appendix illustrates the simulation for Option 2 for the local intertidal area and, for comparison, the estimated discharge pattern associated with the existing HPC drainage ditch. The total intertidal area affected by the Option 2 discharge flow would be approximately 8,170m^2 at the estimated 1 in 30 year freshwater runoff rate. The areas of EUNIS biotopes that would be affected by these same flows would be:

- A1.32: LR.LLR.FVS: Fucoids with variable salinity*:* **1189m^2**;
- A1.322: LR.LLR.FVS.FspiVS: [*Fucus spiralis*] on sheltered variable salinity upper eulittoral rock: **123m^2**;
- A1.323/A1.326: LR.LLR.FVS.FvesVS/FserVS; [*Fucus vesiculosus*] on mid eulittoral variable salinity boulders and stable mixed substrata and/or [*Fucus serratus*] and large [*Mytilus edulis*] on variable salinity lower eulittoral rock: **63m^2**;
- A1.324: LR.LLR.FVS.AscVS [*Ascophyllum nodosum*] and [*Fucus vesiculosus*] on variable salinity mid eulittoral rock: **22m^2**;
- A1.326: LR.LLR.FVS.FserVS: [*Fucus serratus*] and large [*Mytilus edulis*] on variable salinity lower eulittoral rock: **56m^2**;
- A1.46 (MudBed): Variable depth mud and/or sandy mud on flat bedrock, coded as hydrolittoral soft rock: **3658m^{-2}**;
- A2.111: LS.LCS.Sh.BarSh: Barren littoral shingle: **441m^2**;
- A2.431: LR.FLR.Eph.BLitX: Barnacles and [*Littorina* spp.] on unstable eulittoral mixed substrata: **2575m^2**; and
- A2.711: LS.LBR.Sab.Salv: *Sabellaria alveolata* reefs on sand-abraded eulittoral rock: **44m^2**.

19A.5.38 Thus, this discharge route mainly crosses rock substrata which is largely, if not altogether, impervious to scour. The area of mixed substrata is in the mid-intertidal zone and thus is subjected to spring/neap tidal processes of suspension/deposition/ re-suspension and wave influence. In addition, the biotopes described are widespread within the area and typical epifauna and epiflora of rocky shores. The value of the aggregate receptor is therefore considered to be **low** and the magnitude of the impact also **low**. A **minor,** adverse impact is thus anticipated.

19A.6 Overall Conclusion

19A.6.39 Whilst the various outfall options have the potential to cause different adverse effects, depending on biota sensitivity and location, in summary, most effects will be minor. However, Option 1 and Option 3 would have more significant effects than Option 2 on the intertidal habitat.

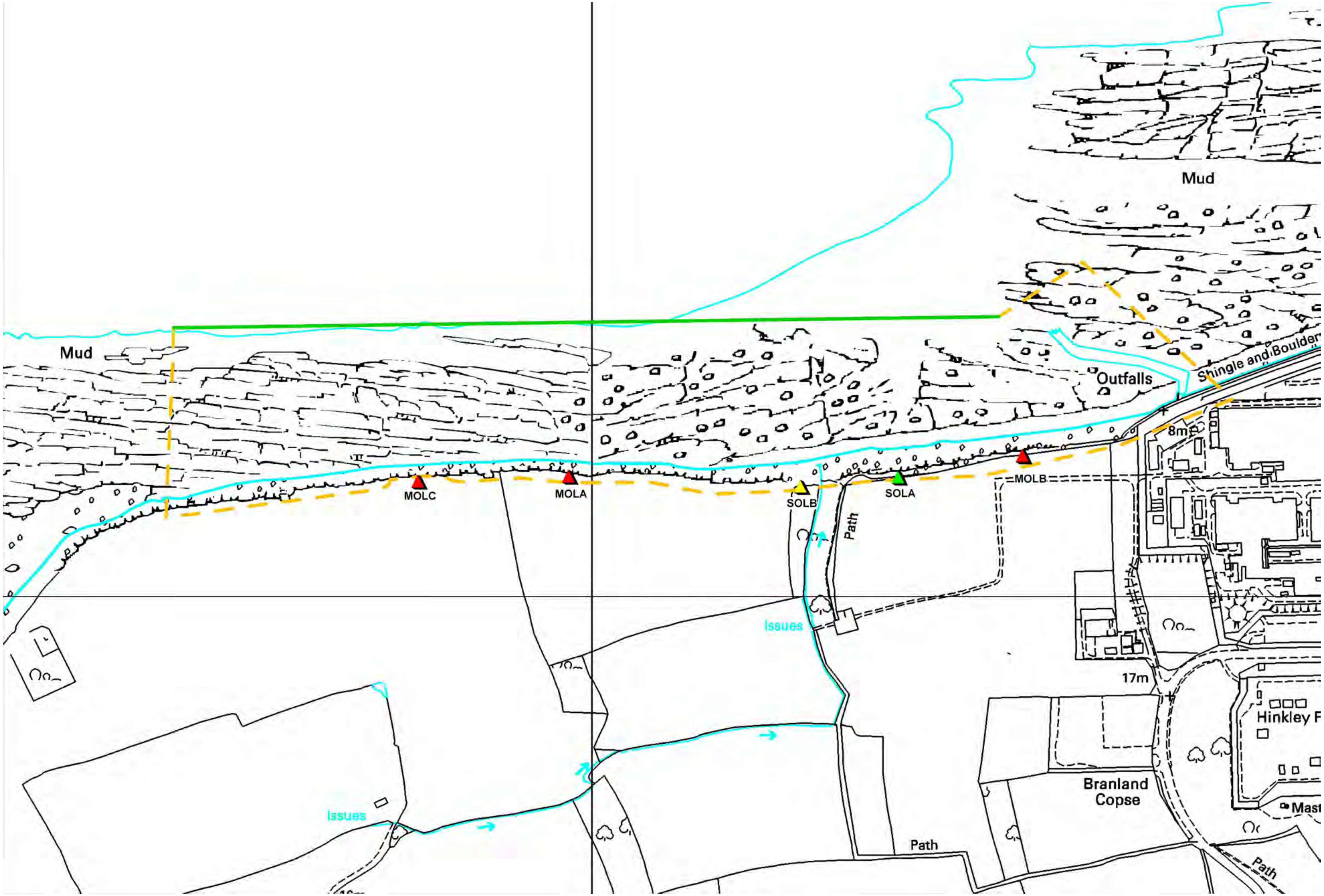
19A.6.40 Given these results, the outfall site at Location A (Option 2) is proposed as the most favourable site to ensure that impacts on intertidal biota are minimal.

19A.6.41 Other issues, such as the release of ammonia-containing, sanitary, waste effluent and the related biochemical oxygen demand have not been explored in this report. However, the Environment Agency has indicated that the permit will likely be set at the Water Framework Directive environmental quality standard of 21µg.l^{-1} at the point of discharge.

References

19A.1 AMEC, September 2011. TR180 – Hinkley Point Foreshore Construction Drainage Discharge Modelling. AMEC report to EDF.

19A.2 Warwick, R. M., 2008, Final Note – Bristol Deep Sea Container Terminal. Subtidal *Sabellaria alveolata* reefs in the Severn Estuary – response to issues raised by consultees following submission of the Harbour Revision Order and Environmental Statement.



KEY

- STAGE DISCHARGE BOUNDARY
- MODELLED EXTENT
- OPTION 1: MULTIPLE OUTFALL LOCATIONS
- OPTION 2: SINGLE OUTFALL LOCATION A
- OPTION 3: SINGLE OUTFALL LOCATION B

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

FIGURE TITLE:
PROPOSED OUTFALL LOCATIONS AND MODELLED EXTENT

FIGURE NO:		REVISION:
FIGURE 19A.1		01
DATE: SEPT 2011	DRAWN: R.C	SCALE: 1:5,000@A3

SCALE BAR
0 100 250m

KEY

SABELLARIA

CORALLINA

OPTION 1: MULTIPLE OUTFALL LOCATIONS

OPTION 2: SINGLE OUTFALL LOCATION A

OPTION 3: SINGLE OUTFALL LOCATION B

DEPTH OF FLOW (M)

0.57

0.00

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

FIGURE TITLE:

BASELINE MAXIMUM FLOOD EXTENT FOR HINKLEY POINT C DRAINAGE DITCH DURING 43% AEP EVENT (QBAR)

FIGURE NO:		REVISION:
FIGURE 19A.2		01
DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:5,000@A3

SCALE BAR

0 100 250m

KEY

SABELLARIA

CORALLINA

OPTION 1: MULTIPLE OUTFALL LOCATIONS

OPTION 2: SINGLE OUTFALL LOCATION A

OPTION 3: SINGLE OUTFALL LOCATION B

DEPTH OF FLOW (M)

0.57

0.00

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

FIGURE TITLE:

BASELINE MAXIMUM FLOOD EXTENT FOR HINKLEY POINT C DRAINAGE DITCH DURING 3.33% AEP EVENT

FIGURE NO:	REVISION:
FIGURE 19A.3	01

DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:5,000@A3

SCALE BAR

0 100 250m

KEY

SABELLARIA

CORALLINA

OPTION 1: MULTIPLE OUTFALL LOCATIONS

OPTION 2: SINGLE OUTFALL LOCATION A

OPTION 3: SINGLE OUTFALL LOCATION B

DEPTH OF FLOW (M)

0.57

0.00

N
W E
S

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
EVIRONMENTAL STATEMENT
VOLIME 2 CHAPTER 19
APPENDIX 19A

FIGURE TITLE:

MAXIMUM FLOOD EXTENT FOR OPTION 1 MULTIPLE OUTFALL DURING 3.33% AEP EVENT

FIGURE NO:		REVISION:
FIGURE 19A.4		01
DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:5,000@A3

SCALE BAR

0 100 250m

KEY

SABELLARIA

CORALLINA

OPTION 1: MULTIPLE OUTFALL LOCATIONS

OPTION 2: SINGLE OUTFALL LOCATION A

OPTION 3: SINGLE OUTFALL LOCATION B

DEPTH OF FLOW (M)

0.57

0.00

N S E W

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENT STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

FIGURE TITLE:

MAXIMUM FLOOD EXTENT FOR OPTION 2: SINGLE OUTFALL LOCATION A DURING 3.33% AEP EVENT

FIGURE NO:	REVISION:
FIGURE 19A.5	01

DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:5,000@A3

SCALE BAR
0 100 250m

KEY

SABELLARIA

CORALLINA

OPTION 1: MULTIPLE OUTFALL LOCATIONS

OPTION 2: SINGLE OUTFALL LOCATION A

OPTION 3: SINGLE OUTFALL LOCATION B

DEPTH OF FLOW (M)

0.57

0.00

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENT STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

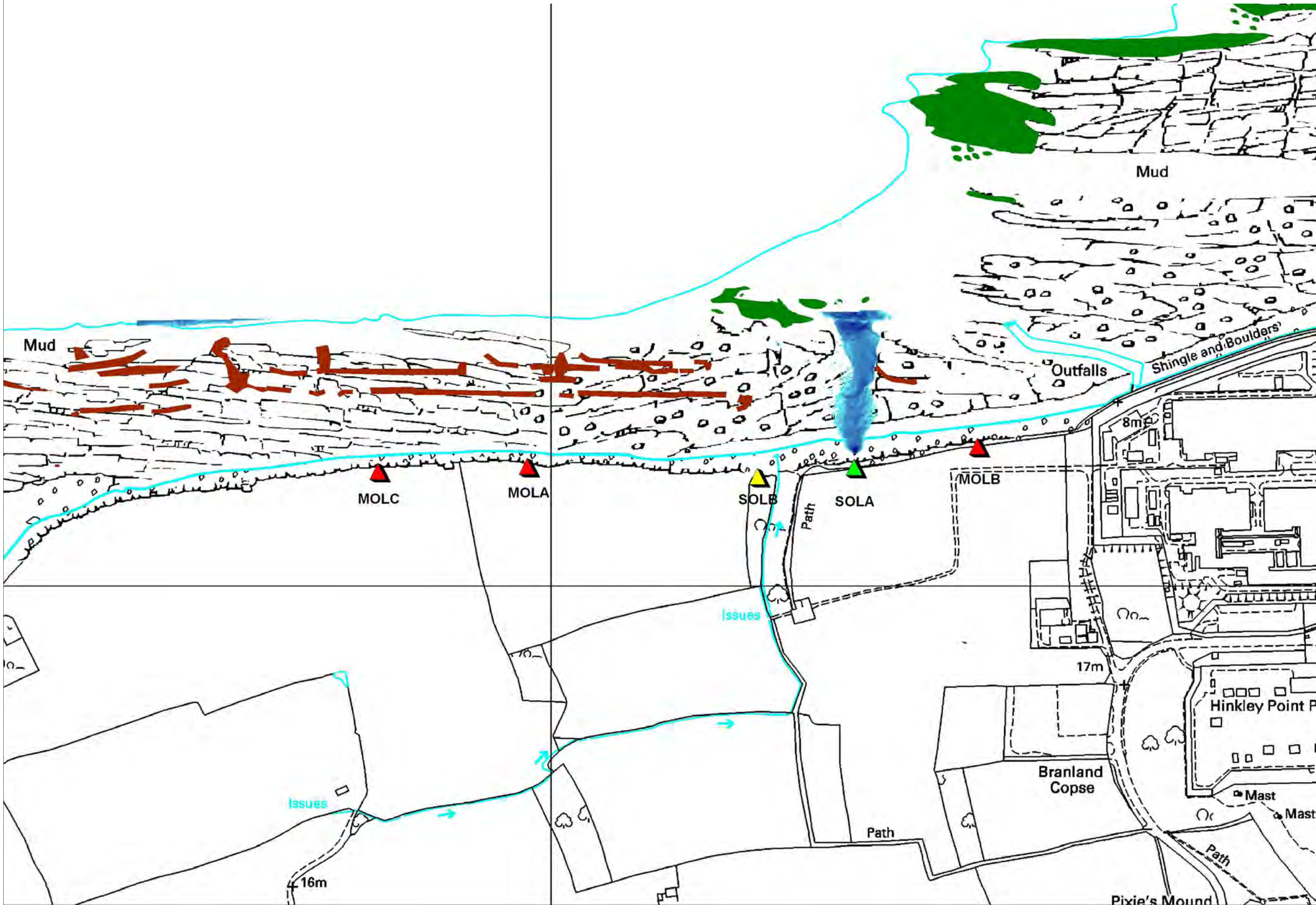
FIGURE TITLE:

MAXIMUM FLOOD EXTENT FOR OPTION 3: SINGLE OUTFALL LOCATION B DURING 3.33% AEP EVENT

FIGURE NO:		REVISION:
FIGURE 19A.6		01
DATE: SEPT 2011	DRAWN: R.C	SCALE: 1:5,000@A3

SCALE BAR

0 100 250m



KEY

SABELLARIA

CORALLINA

OPTION 1: MULTIPLE OUTFALL LOCATIONS

OPTION 2: SINGLE OUTFALL LOCATION A

OPTION 3: SINGLE OUTFALL LOCATION B

DEPTH OF FLOW (M)

0.57

0.00

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENT STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

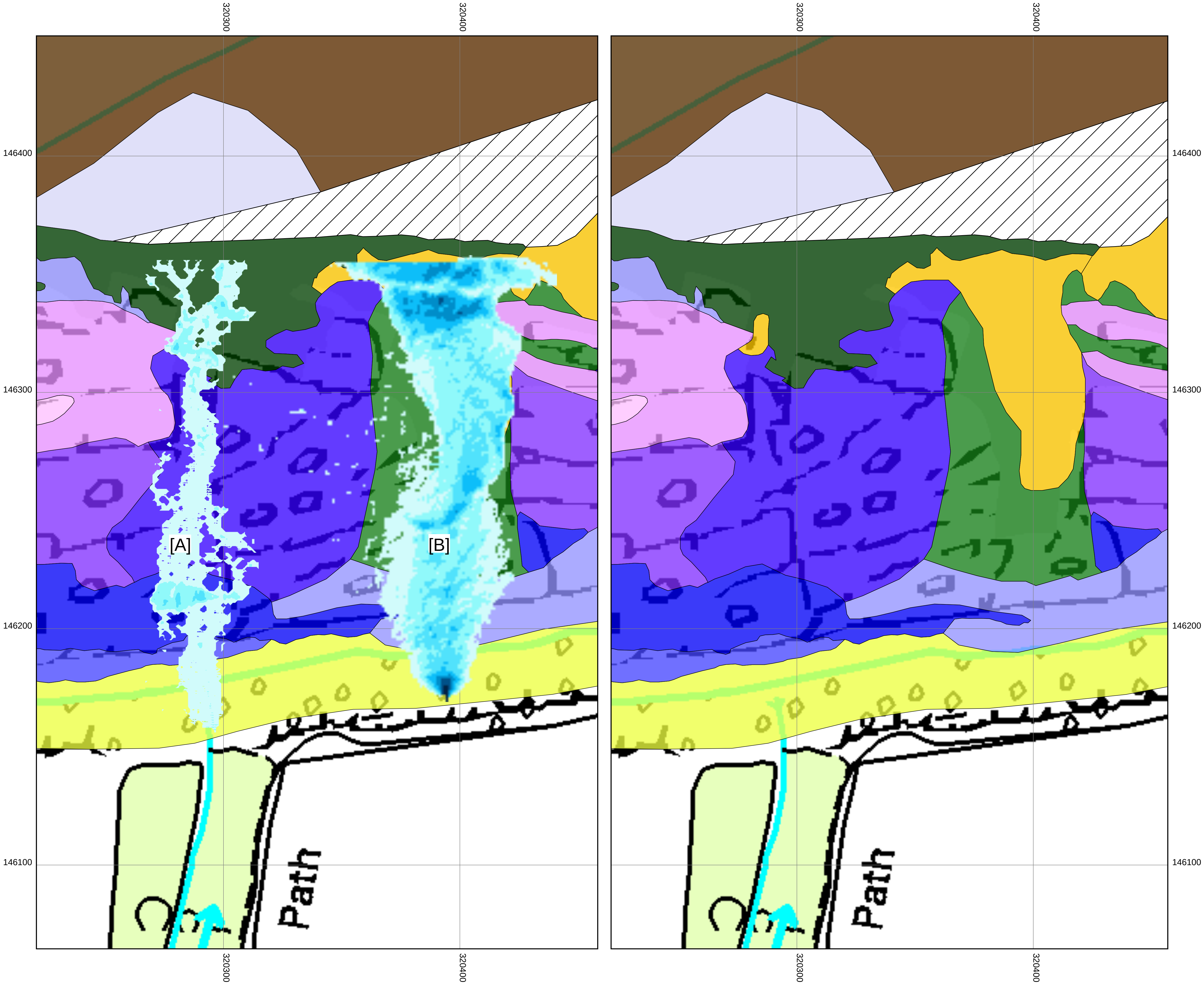
FIGURE TITLE:

MAXIMUM FLOOD EXTENT FOR OPTION 2iv: SINGLE OUTFALL LOCATION A WORST CASE SCENARIO

FIGURE NO:	REVISION:
FIGURE 19A.7	01

DATE:	DRAWN:	SCALE:
SEPT 2011	R.C	1:5,000@A3

SCALE BAR
0 100 250m



KEY

EUNIS Classification

- MODERATE ENERGY LITTORAL ROCK
- FUCOIDS IN VARIABLE SALINITY
- [PELVETIA CANALICULATA] ON SHELTERED VARIABLE SALINITY LITTORAL FRINGE ROCK
- [FUCUS SPIRALIS] ON SHELTERED VARIABLE SALINITY UPPER EULITTORAL ROCK
- [FUCUS VESICULOSUS] ON VARIABLE SALINITY MID EULITTORAL BOULDERS AND STABLE MIXED SUBSTRATA/[FUCUS SERRATUS] AND LARGE [MYTILUS EDULIS] ON VARIABLE SALINITY LOWER EULITTORAL ROCK
- [ASCOPHYLLUM NODOSUM] AND [FUCUS VESICULOSUS] ON VARIABLE SALINITY MID EULITTORAL ROCK
- [FUCUS SERRATUS] AND LARGE [MYTILUS EDULIS] ON VARIABLE SALINITY LOWER EULITTORAL ROCK
- CORALLINE CRUSTS AND [CORALLINA OFFICINALIS] IN SHALLOW EULITTORAL ROCKPOOLS
- HYDROLITTORAL SOFT ROCK
- BARREN LITTORAL SHINGLE
- LITTORAL SAND AND MUDDY SAND/ LITTORAL MIXED SEDIMENTS
- BARNACLES AND [LITTORINA] SPP. ON UNSTABLE EULITTORAL MIXED SUBSTRATA
- [SABELLARIA ALVEOLATA] REEFS ON SAND-ABRADED EULITTORAL ROCK
- NOT MAPPED

DISCHARGE

0.00 0.57 1.30

N S E W

EDF ENERGY

DOCUMENT:
HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 19
APPENDIX 19A

FIGURE TITLE:
[A] EXISITING HPC DRAINAGE DITCH DISCHARGE AND [B] HPC CONSTUCTION DISCHARGE IN RELATION TO INTERTIDAL BIOTOPE DISTRIBUTION

FIGURE NO:	REVISION:	
FIGURE 19A.8	01	
DATE: SEPT 2011	DRAWN: B.B.	SCALE: 1:1500 @ A3

SCALE BAR
0 15 75 m

APPENDIX 20A: HINKLEY HABITAT SURVEY REPORT

EDF Energy

Hinkley

Habitat Survey Report

August 2010

AMEC Environment & Infrastructure UK Limited

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Doc Reg No. 19801Cb304

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EDF Energy

Hinkley

Habitat Survey Report

August 2010

AMEC Environment & Infrastructure UK Limited

Document Revisions

19801Cb3 04	Report template changed for consistency reasons but no other changes have been made	Not relevant as content unchanged since original issue date

Contents

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as ‘Hinkley C’) on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now part of AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, excluding coastal/marine biodiversity other than birds. This report details the results of habitat surveys that were conducted in 2009, comprising a Phase 1 Habitat survey, hedgerow assessment and woodland condition survey. Relevant previous survey work, undertaken in 2007 and 2008, is also summarised. The results of the detailed vegetation surveys completed using the National Vegetation Classification (NVC) methodology are reported separately.

1.2 Background Information

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. At the time of the habitat surveys that were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1.1). The boundary of the SSA was therefore used to define the area for the 2009 habitat surveys; hence all references to the habitat survey area boundary in chapter 11 of the ES relate to the SSA. The SSA boundary includes all the land within the final ‘Construction Boundary’.

1.2.2 Site Description

The majority of the land within the SSA is agricultural, comprising 16 arable fields and 16 grassland fields with various levels of agricultural improvement. The fields are primarily bordered by mature hedgerows. Six small, rectangular broad-leaved woodlands are located within the northern part of the SSA and a square block of young broad-leaved plantation has been created in the central part of the area, with smaller areas of isolated scrub scattered along the northern boundary and in the eastern parts of the SSA. Two watercourses flow west to east through the SSA (further seasonal ditches also occur) and a further watercourse is present on the southern boundary of the SSA. Three ponds occur within the SSA.

The SSA is adjacent to the Bristol Channel. A low cliff, between 0.2m and 10m in height, forms an escarpment between the land and sea.

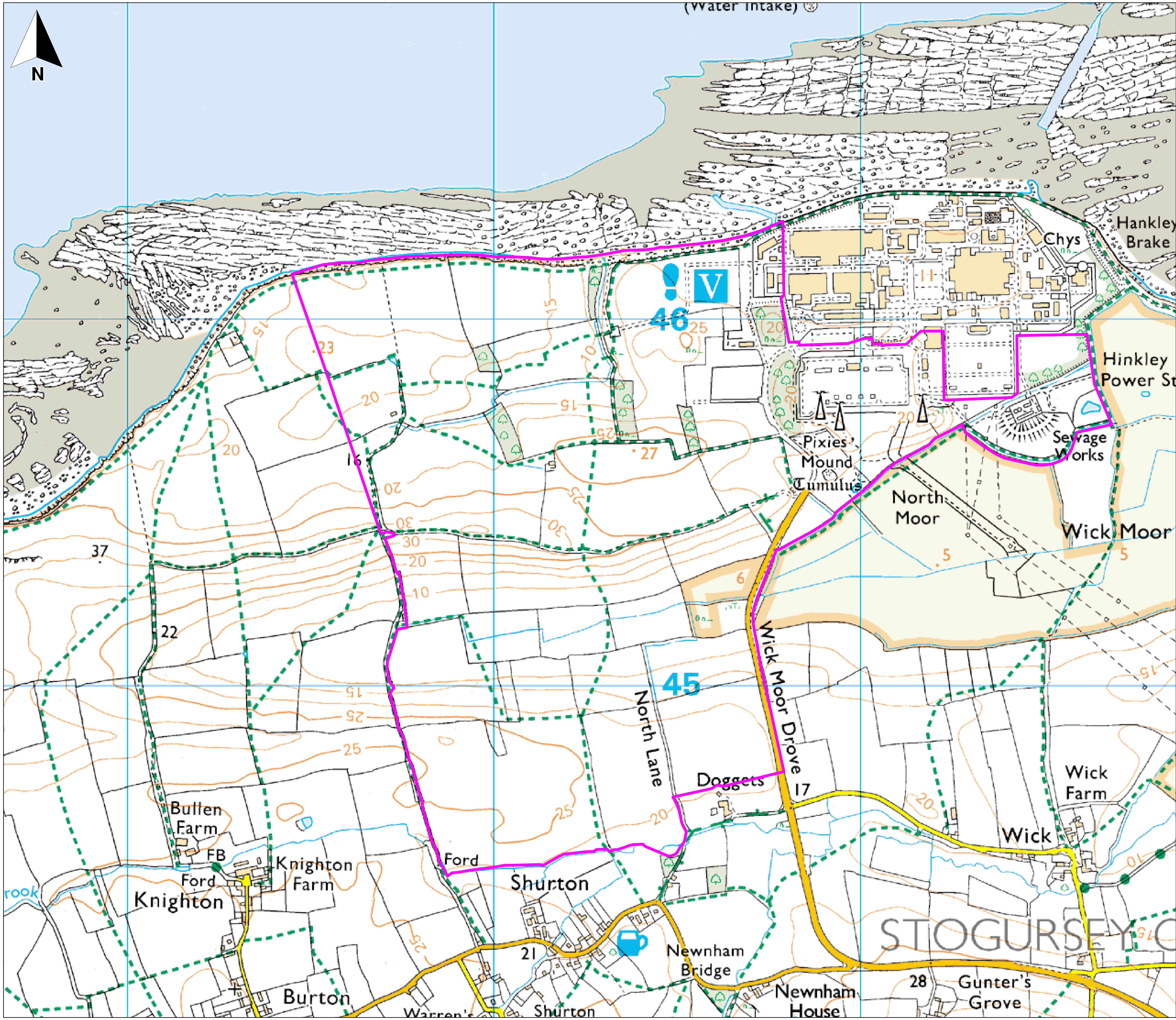
The land immediately adjacent to the west SSA is similar in character to that within the western part of the SSA, i.e. it comprises agricultural fields (both arable and improved pasture), which are separated by intact species-poor and species-rich hedgerows. A small number of ponds occur and the upper reaches of the Bum Brook flow through the area.

The land east of the SSA is different in character to that within the SSA. It forms part of Bridgwater Bay SSSI and comprises large open fields separated by drains, with very few hedgerows present. The fields immediately adjacent to the SSA have been agricultural improved and are relatively species-poor. However, those fields to the south and east are less intensively grazed and support a more varied sward and have a greater diversity of plant species.

The proposed development falls into the Vale of Taunton and Quantock Fringes Natural Area[1] (English Nature, 1998), which describes the lowland landscape around the major towns of Taunton, Wellington and Minehead between the Quantock Hills, Brendon Hills, Exmoor and the Blackdown Hills. The Natural Area is characterised by a wide variety of habitats and species, including hedgerow and hedgebanks, calcareous grassland, streams, woodland and scrub, nightingale, otter and bats, all of which occur or could occur within the site.

The Natural Area immediately to the east of the site is the Somerset Levels and Moors Natural Area (English Nature, 1997).

[1] The classification of areas of the country into distinct Natural Areas (NAs) was undertaken by English Nature (now Natural England) in order that areas of the countryside identified by unique combinations of physical attributes, wildlife, land use and culture could be grouped together. Overall, 143 NAs, including 24 Coastal NAs have been identified.



Key

SSA boundary

0 m
500 m
Scale 1:10,000 @ A3

Hinkley Habitat Survey Report

Figure 1.1
SSA Boundary

September 2010
19801-R380c.wor adamk

2. Methodology

2.1 Methods

2.1.1 Phase 1 Habitat Survey

Distinct habitats within the survey area were identified and mapped based on the Phase 1 habitat ecological survey methodology (JNCC, 2003). Additional information such as the typical plant species composition of the habitat types, whether stock are present or other management information was also recorded where appropriate. Any features considered to be of particular biodiversity interest were subject to a more detailed description in a target note; these have then been incorporated into the main text.

As the standard Phase 1 habitat survey methodology is, in the main, concerned only with vegetation communities, initial surveys (in 2007 and 2008) were extended[2] to allow for the provision of information on other ecological features, particularly to identify the presence/potential presence of legally protected species, such as bats, badgers and water voles. This was not a necessary component of the 2009 Phase 1 habitat survey (which covered the entire SSA and was undertaken on the 12, 13 and 21 May and 03 June 2009 by Gemma Lee MIEEM), given that the requirement for protected species surveys had already been identified.

2.1.2 River Corridor Survey

A river corridor survey was completed for each watercourse within the SSA following the guidance provided in the River Corridor Surveys - Conservation Technical Handbook (NRA, 1992). Each watercourse was surveyed on the 20 July 2009. During the survey, information on the physical and biological features of the channel were recorded within the aquatic, marginal, bank and adjacent land zones in order to characterise the watercourse. The river corridor survey allows a more detailed survey to record the plant species present within and adjacent to the channel and also highlights culverts, bridges and other channel features.

The output of the survey is a series of maps illustrating the course of the channel, the habitat types within and adjacent to the channel and the dominant plant species. The Key to the maps produced is included in Appendix A.

2.1.3 Hedgerow Assessment

All hedgerows considered to be at least 30 years old within the SSA were assessed against '*The Hedgerows Regulations 1997*'. Therefore, for each hedgerow a 30m section (per every 100m of hedgerow) was surveyed and the following information recorded on a standard Entec pro-forma:

- site information (including a grid reference);
- hedgerow dimensions (i.e. Height, width and length);

[2] Institute of Environmental Assessment (1995) *Guidelines for Ecological Assessment* Chapman and Hall

- number of woody species;
- hedgerow features (including ditches, banks and standard trees);
- number of connections to other hedgerows, woodlands or ponds; and
- ground flora plant species.

A photo was also taken of every hedgerow surveyed. For hedgerows over 100m long (where more than one 30m section was surveyed), an average of the number of woody species was taken.

The Regulations provide criteria against which the historical and ecological importance of hedges can be assessed. During this survey only the ecological importance was assessed, not the archaeological importance which also forms part of the Hedgerow Regulations. For a hedgerow to be classified as being ecologically important it must meet at least one of the following criteria:

- contains at least seven woody species in a 30m stretch; or
- at least six woody species in a 30m stretch and at least three features; or
- at least six woody species in a 30m stretch and the presence of native black poplar (*populus nigra*), small leaved lime (*tilia cordata*), large leaved lime (*tilia platyphyllos*) and wild service tree (*sorbus torminalis*); or
- at least five woody species in a 30m stretch and four features; or
- if adjacent to a bridleway or footpath at least four woody species in a 30 m stretch and three features.

Features referred to above include the following:

- a bank or wall along at least half the length of the hedge;
- an intact hedge;
- one standard tree per 50m of length;
- three valuable ground flora species (as defined in the regulations);
- a ditch along at least half the length of the hedgerow;
- good connections with other hedgerows; and
- a parallel hedge within 15m.

Using the information gathered, it has been determined which hedgerows should be considered as ecologically important under The Hedgerow Regulations.

2.1.4 Woodland Condition Survey

In order to characterise the woodlands within the SSA, in more detail than is possible under the Phase 1 habitat survey methodology, a woodland condition survey was completed. There is no standard methodology or guidance available for this type of survey. However, as the ultimate aim of the survey is to provide information to determine the biodiversity value of the woodlands, the assessment criteria within the Guidelines for the Selection of Biological SSSIs (Chapter 2 Woodlands, JNCC, 2006) have been used a framework for the data collection.

The broad assessment criteria from this document are as follows:

- diversity;
- naturalness;
- rarity;
- size;
- ecological position;
- potential value;
- representativeness; and
- fragility.

In order to investigate the value of the woodlands against the criteria listed above, information (based on the field measures of the Nature Conservation Review criteria for British Woodlands contained within the Guidelines for Selection of Biological SSSI) was collected for each woodland through a desk study and field survey.

Hence, the Ordnance Survey basemap was used to calculate the area of each woodland. Whether the woodlands are listed on the Ancient Woodland Inventory (and therefore have been in existence prior to 1600AD) was determined using the Multi-Agency Geographical Information for Countryside website (www.magic.gov.uk). Historical maps from the website http://www.old-maps.co.uk, were then used to investigate whether those woodlands not on the Ancient Woodland Inventory were, nevertheless, present between 1887 and 1904.

During the field surveys, a detailed list of the plant species present within the ground flora, understorey and canopy layers of the woodland was compiled, with notes on dominant species also taken. This information has been used to compare the woodland plant communities present within the SSA with those described in the woodland section of the National Vegetation Classification (NVC) (Rodwell, 1991) to determine how typical, diverse and natural the woods are. Information regarding the structure of the woodland, whether the wood supports any other habitat types and the classification of the adjacent land use was also recorded.

Any evidence of historical or recent woodland management was also recorded during the field surveys. For those woodlands managed by British Energy[3], this information was augmented with information from the yearly land management reports, which record the management that has been completed.

[3] British Energy became part of EDF Energy in 2009

3. Results

3.1 Phase 1 Habitat Survey

The location of the various habitats recorded during the 2009 survey is shown on the Phase 1 Habitat map in Figure 3.1. A description of the habitat types present within the SSA is provided below.

3.1.1 Arable

As described in section 1.2.2, half the agricultural fields within the SSA are currently being used for arable crop production. Most of these fields have been sown with grain crops (such as wheat and corn), but a few have been sown with grass seed and mown for silage. All of the fields are intensively managed with very small or no field margins. Plant species recorded around the edges of the fields typically include species that are tolerant of disturbance such as common fumitory (*Fumaria officinalis*), scented mayweed (*Matricaria recutita*), scarlet pimpernel (*Anagallis arvensis* subsp. *Arvensis*), common poppy (*Papaver rhoeas*), knotgrass (*Polygonum aviculare*) and common field-speedwell (*Veronica persica*).

3.1.2 Grassland

Improved and Poor Semi-Improved

Approximately half of the agricultural fields within the SSA comprise improved or poor semi-improved grassland.

The improved fields (around the Power Station external car park and adjacent to the central watercourse) are currently (or have previously) been grazed by cattle and are dominated by perennial rye grass (*Lolium perenne*) with white clover (*Trifolium repens*), cock's-foot (*Dactylis glomerata*), meadow foxtail (*Alopecurus pratensis*), shepherd's-purse (*Capsella bursa-pastoris*) and common chickweed (*Stellaria media*). In some of the fields the sward is more structurally diverse and supports a greater range of species such as creeping cinquefoil (*Potentilla reptans*), bulbous buttercup (*Ranunculus bulbosus*) and meadow vetchling (*Lathyrus pratensis*) (TN1).

There are three areas of poor semi-improved grassland within the SSA. In the northern part of the site three fields are within an environmental stewardship scheme and are being managed to encourage reversion to calcareous grassland (TN2). At present, however, these fields support few species indicative of calcareous grassland. Instead, they are dominated by grasses, particularly meadow foxtail, false-oat grass (*Arrhenatherum elatius*), tall fescue (*Festuca arundinacea*) and rough meadow grass (*Poa trivialis*) with common herbs such as hop trefoil (*Trifolium campestre*), red clover (*Trifolium medium)*, ground ivy (*Glechoma hederacea*) and common vetch (*Vicia sativa* subsp. *segetalis*). The presence of glaucous sedge (*Carex flacca*) suggests the early stages of reversion to a more species-rich, calcareous sward.

A further field (Pixies Mound Field - TN3) is also being managed to encourage a more diverse and calcareous influenced sward. However, as with the fields by the coast, a limited number of indicative calcareous species are present including yellow oat-grass (*Trisetum flavescens)* and common centaury (*Centaurium erythraea*). Much of the vegetation is instead dominated by teasel (*Dipsacus fullonum*) and, where rabbit grazing is high, ground ivy and selfheal (*Prunella vulgaris*). A more detailed description of this vegetation community is provided in the Hinkley National Vegetation Classification Report (Entec, 2007).

Two fields adjacent to the watercourse (TN4) located in the centre of the SSA are also considered to support poor semi-improved grassland. Due to the location of the fields in the valley, they support some wetland plant species rather than the calcareous species found in other areas of the site. The fields are again dominated by grasses, primarily meadow foxtail, Yorkshire fog (*Holcus lanatus*) and cock's-foot (*Dactylis glomerata)* with small amounts of marsh foxtail (*Alopecurus geniculatus*) and red fescue (*Festuca rubra*). Hard rush (*Juncus inflexus*), jointed rush (*Juncus articulatus*) and false fox-sedge (*Carex otrubae*) are also present with abundant meadow buttercup (*Ranunculus acris*) and cuckooflower (*Cardamine pratensis*).

Semi-Improved Calcareous

There are four main areas of calcareous grassland within the SSA. These are located along the coastal strip (TN5), within two small fields adjacent to the coast (TN6), to the east of Pixies Mound and Branland Copse (TN7) and around the Sewage Treatment Works (STW) (TN8). The first two areas are described in more detail in the Hinkley National Vegetation Classification Report (Entec, 2007), whilst the third and fourth areas are described in the Hinkley National Vegetation Classification Report 2009 (Entec, 2009).

The calcareous grassland along the coast (TN5) occurs in a linear strip between the cliffs and agricultural fields to the south. Much of the grassland supports a range of common species including cleavers (*Galium aparine*), teasel, selfheal and hairy bitter-cress (*Cardamine hirsuta*). Pyramidal orchid (*Anacamptis pyramidalis*), wild carrot (*Daucus carota*) and agrimony (*Agrimonia eupatoria*) are common in these areas with infrequent bee orchid (*Ophrys apifera*) and grass vetchling (*Lathyrus nissolia*). A small area (near an information/interpretation sign) supports a lower growing sward and species indicative of calcareous grassland including yellow-wort (*Blackstonia perfoliata*), carline thistle (*Carlina vulgaris*), salad burnet (*Sanguisorba minor*) and common birds-foot trefoil (*Lotus corniculatus*).

The grassland at TN6 is dominated by the grasses creeping bent (*Agrostis stolonifera*), cock's-foot, red fescue, common bent (*Agrostis capillaries*) and crested dog's-tail (*Cynosurus cristatus*), but also supports a wide range of herbs commonly found on calcareous substrates including agrimony, glaucous sedge, yellow-wort, burnet-saxifrage(*Pimpinella saxifrage*) grass vetchling and dyers greenweed (*Genista tinctoria*) also occur.

To the south of the existing Power Station (TN7), calcareous grassland occurs in small pockets of sloping ground between areas of scrub. The sward is short due to rabbit grazing and supports a wide of grass and herb species including early dog-violet (*Viola reichenbachiana*), creeping cinquefoil, perforate St. Johns-wort (*Hypericum perforatum*), yarrow (*Achillea millefolium*), agrimony and fern grass (*Catapodium rigidum*).

The composition of the calcareous grassland around the STW is similar in composition to the area indicated by TN7, although it is slightly less diverse, with a greater degree of dominance of grasses such as Yorkshire fog and common couch (*Elytrigia repens*). Herbs recorded include primrose (*Primula vulgaris*), yarrow, creeping cinquefoil, common knapweed (*Centaurea nigra*) and common bird's-foot trefoil.

3.1.3 Woodland and Scrub

Woodland

Seven areas of semi-natural broad-leaved woodland occur within the coastal part of the SSA. All support an open canopy of mature trees with a dense scrub understorey. These semi-natural woodlands are described in more detail in section 3.3.

Within the SSA areas of plantation woodland also occur and these are described in more detail below.

In the southern part of the SSA there are two areas of broad-leaved plantation woodland. The larger of these is known as Bishop's Wood (TN9) and was planted in winter 1998/1999. Hawthorn (*Crataegus monogyna*), sycamore (*Acer pseudoplatanus*), hazel (*Corylus avellana*), wild privet (*Ligustrum vulgare*), dogwood (*Cornus sanguinea*) and downy birch (*Betula pubescens*) have been planted and are around 2-3m tall. Underneath the open canopy the ground flora is relatively species-rich supporting cowslip (*Primula veris*), common vetch, imperforate St John's-wort (*Hypericum maculatum*), common bird's-foot trefoil and hedge woundwort (*Stachys sylvatica*). The smaller area of plantation woodland (TN10) has been planted with a similar range of native broad-leaved species. However, tall ruderal vegetation, such as nettle (*Urtica dioica*) and creeping thistle (*Cirsium arvense*), dominates the ground flora.

Two further areas of mature broad-leaved plantation woodland occur along the eastern edge of the Power Station security fence and along Bum Brook.

Scrub

Patches of scrub occur mainly in the eastern and northern areas of the SSA, often in mosaics with semi-improved calcareous grassland.

An extensive area of scattered and dense scrub, approximately 40m by 15m, is located to the south of the existing Power Station (TN7). The commonest scrub species within this area are bramble (*Rubus fruticosus agg.*), blackthorn (*Prunus spinosa*) and hawthorn, with dogwood, elder (*Sambucus nigra*) and hazel less frequent. Around the STW similar species have been planted.

A dense area of European gorse (*Ulex europaeus*) also occurs on a slope in one of the improved fields to the west of the Hinkley B Training buildings (TN11). This area has reduced in size since 2007 due to management to control its spread.

Along the coastal strip, scattered areas of dense scrub occur between the coast path and the cliff. These areas comprise a range of relatively low growing (due to the prevailing wind) species including dogwood, blackthorn and hawthorn.

3.1.4 Water Features

Watercourses

Two watercourses occur within the SSA (TN12 and TN13). The results of the River Corridor Survey for the watercourse at TN12 are presented in Appendix B and for the watercourse at TN13 in Appendix C.

Two further watercourses are present on the southern boundary of the SSA (TN14 and TN15).

Watercourse at TN12

The first watercourse within the site (TN12) issues at ST197456 within the SSA boundary, flowing east, then north through Whitewall Brake (broad-leaved woodland, ST202460) and into the sea at ST202461. It is approximately 1km in length and varies in width between 0.5m and 1m. The watercourse passes through three culverts.

The banks are steep (up to approximately 80cm tall) from the origin of the watercourse to Whitewall Brake, from where the channel appears to have been re-profiled and the banks are shallower (around a 45^o slope). The banks consist of earth throughout. Approximately 70% of the stream bed has a muddy substrate, whilst in Whitewall Brake gravel predominates. The north-eastern section is culverted under a farm track and footpath (for approximately 3m) into Whitewall Brake. This part of the watercourse has sparse bank-side and channel vegetation limited to fool's water-cress (*Apium nodiflorum*), hemlock water-dropwort (*Oenanthe crocata*) and bramble. The stream exits the wood and percolates through the unconsolidated rocky shore to the sea.

This watercourse tends to have a steady flow of water estimated at ~20-30cm deep during the wetter, winter months. However, sections of the watercourse dry out completely in the summer and autumn, particularly the section upstream from Whitewall Brake. The water level of the stream within Whitewall Brake was estimated at 10cm during May 2009. The banks support a range of ruderal and marginal species, which quickly shade the water in the summer. Species present include bramble, creeping thistle, great willowherb (*Epilobium hirsutum*), nettle, hemlock (*Conium maculatum*), hemp-agrimony (*Eupatorium cannabinum*), water figwort (*Scrophularia auriculata*) and fool's water-cress. The mature trees within Whitewall Brake, including crack willow (*Salix fragilis*) and hawthorn, also shade this section of the watercourse throughout the year.

Watercourse at TN13

This watercourse is approximately 1km in length and flows west to east across the centre of the SSA before joining with the drains on Wick Moor underneath the Power Station entrance road. The watercourse is between 0.5m and 1m wide and varies in depth between 0.1m and 1m. The watercourse passes through five culverts and under one stone bridge.

The far western section of the watercourse appears to be dry in most years as it currently supports fairly well established grassland and ruderal vegetation including nettle, false oat-grass (*Arrhenatherum elatius*) and broad-leaved dock (*Rumex obtusifolius*), and probably only holds water in very heavy and prolonged rain.

The central section of the watercourse is located within an improved grassland field grazed by cattle. Because of this, the banks are very poached and disturbed and support a limited range of species, with only small amounts of creeping thistle, hard rush, false fox-sedge, creeping buttercup (*Ranunculus repens*) and cocksfoot on the bank and fool's-watercress and brooklime (*Veronica beccabunga*) present in the channel. The base of the watercourse in this section is silt and mud, which combined with the cattle disturbance, results in limited water clarity. This section of the watercourse dried out significantly between May 2009 and July 2009, such that it no longer flowed and only pools of water were present. A small number of scattered hawthorn, dog-rose (*Rosa canina*) and bramble bushes line the shallow banks (~100cm in height) of the watercourse in this location.

The eastern section of the watercourse forms a boundary between the fields north and south of it. These are also grazed by cattle but at present the poaching is less severe (than the central section) and only on one side of the bank (hedgerows prevent cattle access to both sides). This section also appears to have been dredged in 2007 or 2008 with the arisings left on the adjacent banks (which are characterised by a ruderal community dominated by creeping thistle). The watercourse here is bounded by a dense hedgerow west of the road which becomes a line of scrub towards the central section. Vegetation beneath the hedgerow is sparse and the earth at the base is compacted. The bank underneath the hedge is approximately 20cm tall. The bank opposite the hedgerow is generally species-rich, supporting a range of ruderals and grasses including meadowsweet (*Filipendula ulmaria*), hard rush, reed sweet-grass (*Glyceria maxima*), false oat-grass and hemlock water-dropwort. Within the channel, common reed (*Phragmites australis*) is locally dominant (up to 20% cover) and duckweed (*Lemna minor*) covers up to 95% of the water surface. Common starwort (*Stellaria media*) occurs with duckweed and covers approximately 5% of the water surface. Water crowfoot (*Ranunculus aquatilis*) also occurs in dense sub-merged patches where the water is deeper. Water forget-me-not (*Myosotis scorpioides*), brooklime and creeping buttercup also occur within the channel.

Watercourse at TN14

This watercourse is ~1m wide and has steep earth banks up to 70cm in height. The bed of the watercourse is predominantly muddy, with vegetated mud platforms at the base of the banks.

This watercourse has a steady flow of water. An estimated 70cm of water was present during March 2007, but the western section dries up during the summer.

The east section, around the Sewage Treatment Works retains water throughout the year and is dominated by common reed and duckweed with few other species present. The banks are approximately 40-50cm tall on the north side and ~30cm tall on the south side with some sections being heavily poached by cattle from the adjacent fields.

The west section is bounded on the north side by scrub woodland and the substrate is predominantly decaying leaf litter. The northern bank is approximately 20cm tall and the southern bank is 40-50cm tall. The southern bank supports a wide range of ruderal and grass species including false oat grass, purple loosestrife (*Lythrum salicaria*), bramble, nettle, hemlock and fleabane (*Pulicaria dysenterica*). Duckweed covers approximately 85% of the water surface and water-plantain (*Alisma plantago-aquatica*) also occurs.

Watercourse at TN15

This watercourse comprises the Bum Brook and Bayley's Brook, which join adjacent to the SSA and then separate near to Stolford into the West Brook and East Brook. The watercourse varies in width and depth, but along most of the area adjacent to the SSA it is approximately 1m wide and 30-50cm deep.

The watercourse flows east from Pond 8 (Hinkley Great Crested Newt Report, Entec, 2009) located on Benhole Lane, and forms a field boundary between arable and pasture fields. The watercourse is very shaded in this section due to the extensive bank vegetation, which includes bramble, nettle, Himalayan balsam (*Impatiens glandulifera*) and great willowherb with overhanging semi-mature crack-willow trees. The banks comprise earth in this location and are ~70cm tall. The water clarity is poor, but the flow is fairly fast. At ST 203445, the Bum Brook joins Bayley's Brook underneath a concrete footbridge.

To the east of this (downstream) there are no trees and scrub on the banks. Instead the banks are vegetated by rough grassland, hence this section is not shaded. The banks are taller in this Section, being between 60cm and 80cm tall, and are a mixture of earth and stone. One bend in the watercourse has been reinforced with a stone wall. The water flow here continues to be fairly fast and the water clarity is good. The base substrate is a mixture of silt and pebbles. Species recorded on the banks include cow parsley (*Anthriscus sylvestris*) and hemlock water-dropwort. Branched bur-reed (*Sparganium erectum*) and fools water-cress occur within the channel. Further downstream, a hedgerow is present on the southern side of the watercourse which again shades the channel.

Water Bodies

There are three water bodies within the SSA (TN16, TN17 and TN18). Further ponds occur within 500m of the SSA. These are described in more detail within the Hinkley Great Crested Newt Report, 2009 (Entec, 2009).

Water Body at TN16

This pond (known as Pixies Pond) is ~12m long by ~8m wide. In 2007 common reed covered an estimated 75% of the water surface with an area of open water in the centre, but clearance in 2008 reduced the common reed cover to 40%. The banks are reinforced using wooden stakes on the northern side and are shallow (~10cm) around the rest of the perimeter. Bulrush (*Typha latifolia*), meadowsweet, marsh-marigold (*Caltha palustris*) and water mint (*Mentha aquatica*) occur around the edges of the pond. The pond is surrounded by a small strip of grassland and scrub.

Water Body at TN17

This water body is a large pond (~15m x 15m) that is approximately 60% vegetated by common reed with only 40% of the pond surface being open water. Plant species diversity is limited due to the dominance of common reed with small amounts of bittersweet (*Solanum dulcamara*) and great willowherb present. The water body is in excess of 1m deep (actual depth could not be determined due to the dense common reed around the pond preventing safe access) and the water clarity is poor. The pond has very shallow margins around the edges without proper banks. The northern and western edges of the water body have overhanging crack willow trees creating some shading.

Water Body at TN18

This pond is located within a hedgerow boundary adjacent to an arable field. The pond has a mixture of willow and hawthorn growing in the centre, the bases of which are currently submerged, which suggest the pond is prone to drying out regularly and in July 2009 the pond was dry. There are very few aquatic or marginal broad-leaved plants and although there are areas of open water, the pond is 90% shaded from the surrounding scrub and hedgerows. The pond is approximately 20m by 8m in size.

3.1.5 Other Habitat Types

Cliff Vegetation

The northern boundary of the SSA comprises a chalk maritime cliff. The top of the cliff and the ledges on the vertical northern face are vegetated by calcareous grassland and scrub (described above). In most places along the edge of the SSA, the high tide line is the bottom of the cliff and therefore marks where the inter-tidal area begins (which is outside the scope of the terrestrial ecology surveys). In a small number of locations there is some vegetation at the base of the cliff.

The eastern end of the cliff (nearest the Power Station - TN 19) is short in height (between 0.4-2m) and has been reinforced with gabions. The high tide strand line is located approximately 2-3m from the base of the cliff. In-between the cliff base and the high tide mark a small number of plants are growing most of which have colonised from the surrounding rough grassland including curled dock (*Rumex crispus*), hogweed (*Heracleum sphondylium*) and cow parsley, with sea-beet (*Beta vulgaris ssp. maritima*) being the only species that is typically found along the strand line.

Between 20-30m west of TN19 the cliff increases in height and remains relatively high along the rest of the SSA boundary, varying in height between 3-10m. The cliff face is vertical and flat and along the majority of the section adjacent to the SSA there are few locations that vegetation could colonise due to the lack of soil. However, where ledges do occur or there have been slippages some vegetation is present.

This vegetation is relatively species-rich and is very similar in composition to the calcareous grassland present along the cliff top. Grasses and ruderal species tend to dominate the vegetated areas with cock's-foot, red fescue and annual meadow-grass abundant. Teasel is also abundant with oil-seed rape (*Brassica napus* subsp. *Oleifera*), ribwort plantain (*Plantago lanceolata*) and bramble common. Low growing herbs are less frequent, but salad burnet, carline thistle, ground ivy, common bird's-foot trefoil and scarlet pimpernel are also present. Species present which occur less frequently (only noted in one or two locations) include dog-rose, stinking iris (*Iris foetidissima*), bittersweet and wild carrot.

With the exception of the area at TN19, the high tide mark is located at the base of the maritime cliff. Therefore, along the vast majority of the cliff adjacent to the site there is no terrestrial vegetation present (because this area is very regularly inundated by sea water).

Tall Ruderal

Small areas of tall ruderal vegetation occur within the SSA. These are often associated with the hedgerow bases, but have not been mapped on Figure 3.1 due to their small size. Species frequently present include nettle, bramble and hemlock. Two areas of tall ruderal vegetation, supporting nettle, creeping thistle and bristly ox-tongue (*Picris echioides*), also occur on the bunds around the edge of the external Power Station car park (TN20).

Swamp

A small area of swamp vegetation occurs to the east of the STW (TN21). This is dominated by common reed, with encroaching scrub. The ground is only seasonally wet.

3.2 Hedgerow Assessment

Within the SSA most of the boundaries are marked by hedgerows, with a few fence lines in the northern area. The hedgerows vary in quality from single-species and heavily managed to relatively unmanaged and species-rich.

Table 3.1 lists every hedgerow surveyed within the SSA and highlights whether it is considered to be ecologically 'important' under the Hedgerow Regulations. If a hedgerow is 'important' the reason why this conclusion has been reached is stated. Appendix D contains all the hedgerow survey pro-forma which details the characteristics of each hedgerow. The location of each hedgerow is shown on Figure 3.2.

Table 3.1 'Important' Hedgerows

Hedgerow Number	Ecologically Important under the Hedgerow Regulations?	Reason for 'Importance'
H1	Yes	4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB
H2	Yes	4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB
H3	Yes	6 WOODY SPECIES AND 3 FEATURES
H4	No	-
H5	Yes	6 WOODY SPECIES AND 3 FEATURES
H6	Yes	7 WOODY SPECIES IN A 30M LENGTH
H7	Yes	7 WOODY SPECIES IN A 30M LENGTH
H8	No	-
H9	Yes	6 WOODY SPECIES AND 3 FEATURES
H10	Yes	7 WOODY SPECIES IN A 30M LENGTH
H11	Yes	7 WOODY SPECIES IN A 30M LENGTH
H12	Yes	6 WOODY SPECIES AND 3 FEATURES
H13	Yes	7 WOODY SPECIES IN A 30M LENGTH
H14	Yes	7 WOODY SPECIES IN A 30M LENGTH
H15	Yes	5 WOODY SPECIES AND 4 FEATURES
H16	No	-
H17	Yes	4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB
H18	No	-
H19[4]	Yes	6 WOODY SPECIES AND 3 FEATURES
H22	No	-
H23	Yes	4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB
H24	Yes	7 WOODY SPECIES IN A 30M LENGTH
H25	No	-
H26	No	-
H27	No	-
H28	Yes	7 WOODY SPECIES IN A 30M LENGTH
H29	Yes	7 WOODY SPECIES IN A 30M LENGTH
H30	Yes	7 WOODY SPECIES IN A 30M LENGTH
H31	Yes	6 WOODY SPECIES AND 3 FEATURES
H32	Yes	7 WOODY SPECIES IN A 30M LENGTH
H33	No	-

[4] Note that Hedgerows 20 and 21 are outside of the SSA.

Table 3.1 (continued) **'Important' Hedgerows**

Hedgerow Number	Ecologically Important under the Hedgerow Regulations?	Reason for 'Importance'
H34	Yes	4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB
H35	Yes	7 WOODY SPECIES IN A 30M LENGTH
H36	Yes	7 WOODY SPECIES IN A 30M LENGTH
H37	Yes	7 WOODY SPECIES IN A 30M LENGTH
H38	Yes	6 WOODY SPECIES AND 3 FEATURES
H39	Yes	-
H40	No	-
H41	Yes	6 WOODY SPECIES AND 3 FEATURES
H42	Yes	7 WOODY SPECIES IN A 30M LENGTH
H43	Yes	7 WOODY SPECIES IN A 30M LENGTH
H43a	Yes	6 WOODY SPECIES AND 3 FEATURES
H44	Yes	6 WOODY SPECIES AND 3 FEATURES
H45	No	-
H46	No	-
H47	No	-
H48	Yes	5 WOODY SPECIES AND 4 FEATURES
H49	Yes	7 WOODY SPECIES IN A 30M LENGTH
H50	Yes	5 WOODY SPECIES AND 4 FEATURES
H51	Yes	-
H52	Yes	7 WOODY SPECIES IN A 30M LENGTH
H53	Yes	6 WOODY SPECIES AND 3 FEATURES
H54	Yes	6 WOODY SPECIES AND 3 FEATURES
H55	No	-
H56	No	-
H57	No	-
H58	No	-
H59	No	-
H60	Yes	5 WOODY SPECIES AND 4 FEATURES
H61	No	-
H62	No	-

Hawthorn and blackthorn are the commonest hedgerow species within the SSA. Field maple (*Acer campestre*), English elm (*Ulmus procera*), dogwood, dog-rose and field-rose (*Rosa arvensis*), wild privet and hazel are also frequently present. Many hedgerows also contain a small number of elder, ash (*Fraxinus excelsior*), wayfaring tree (*Viburnum lantana*) and spindle (*Euonymus europaeus*). Willow, oak (*Quercus* sp.) and gorse (*Ulex europaeus*) are present only rarely.

The ground flora associated with all the hedgerows surveyed is species-poor and generally contains few of the species notable under the Hedgerow Regulations. Of these notable species lords-and-ladies (*Arum maculatum*), wood false-brome (*Brachypodium sylvaticum),* herb-Robert (*Geranium robertianum*) and early dog-violet were recorded. The remaining species present; nettle, bramble, false oat-grass and cow parsley, are ruderal and indicative of the agricultural improvement of the surrounding land.

Many of the hedgerows within the SSA are located on banks or adjacent to ditches or both, but few of the hedgerows contain standard trees. Most of the hedgerows are also intact, with less then 10% gaps along their length, which is likely to be due to management completed by landowners within the SSA (i.e. laying and replanting).

3.3 Woodland Condition Survey

Each of the semi-natural broad-leaved woodlands present within the SSA is described below and their locations are shown in Figure 3.3. A summary of the woodland features is provided in Table 3.2 at the end of this section.

3.3.1 Woodland A (Newclose Covert)

Woodland A is located on a gentle south to north upward slope and is partly sheltered from the prevailing wind by the slope to the north. It is surrounded on all sides by agricultural fields (both pasture and arable). Three hedgerows join the wood, providing some ecological linkage to the wider area.

Whilst the woodland is shown as extant in 1887, all four of its boundaries are marked by remnant hedge banks suggesting it may have previously a field. The hedge banks support primarily hawthorn and field maple (which show evidence of previous hedgerow management through laying), with occasional blackthorn and crab apple (*Malus sylvestris*).

The interior of the woodland is fairly uniform, comprising abundant ash of similar age and structure. Many of the ash trees are approximately 10-15m tall with straight vertical stems, although a number are older and there is evidence that some have been coppiced in the past. A small number of mature oak trees are also present. A number of the ash trees have woodpecker holes and signs of rotten branches and/or trunks. Dead trees have been left *in-situ* within the woodland.

The understorey is sparse and predominantly comprises elder with ash and English elm re-growth. In the northern and south-western parts of the woodland there are fewer mature trees and the understorey comprises dense patches of wild privet with small numbers of dogwood and spindle plants.

The ground flora is impoverished, despite light reaching the ground through the patchy canopy, and is dominated by extensive ivy cover and large dense patches of nettle. Other ground flora species recorded include wood false-brome, wild madder (*Rubia peregrine*), pendulous sedge (*Carex pendula*), enchanter's nightshade (*Circaea lutetiana*), cow parsley and spear thistle (*Cirsium vulgare*).

Whilst the woodland appears to have been managed historically, there is no evidence of recent management. The wood is currently used as shelter for game bird rearing.

3.3.2 Woodland B (Haysgrove Brake)

Similar to Woodland A, Woodland B is located on a gentle north to south upward slope. It is surrounded on all sides by agricultural fields (both pasture and arable) and one hedgerow joins the wood. A ditch is present to the north of the wood, although it only holds water intermittently. Woodland E lies adjacent to the northern edge of Woodland B.

The central part of Woodland B is dominated by English elm trees, all of which comprise tall (~8-10m), thin trunks with few horizontal branches. The trunks are relatively close together and during the summer the elm canopies greatly reduce the amount of light reaching the ground flora. Where elms dominate the canopy of the woodland few understorey species occur, mainly limited to occasional elder. In the south-west corner of the woodland a number of dead elms are present.

The south and west boundaries of the wood appear to comprise remnant hedgerows on banks adjacent to dry ditches. This combined with the information from historical OS maps suggests the woodland may have previously been a field that was encroached by scrub, which has later developed into broad-leaved woodland. Hawthorn and field maple are the commonest species growing on the hedge banks, with occasional dogwood, blackthorn and elder. A second line of hawthorn and blackthorn is present along the outside of the western boundary. The plants here appear to be younger and may have been planted at a later date than the hedge banks.

The eastern edge of the woodland also supports a number of mature field maple and hawthorn trees. Several mature field maples and oak trees also occur along the northern edge of Woodland B, adjacent to the ditch.

Ivy dominates the ground flora throughout the woodland. Where light does reach the ground a slightly more diverse woodland flora is present including hart's-tongue fern (*Asplenium scolopendrium*), hedge woundwort, stinking iris, lord's-and-ladies, herb Robert, ground ivy and soft-shield fern (*Polystichum setiferum*) . Large patches of dense nettle and occasional bramble thickets also occur.

This woodland supports a large main badger sett and as a result many pathways and areas of bare ground occur around the sett in the centre of the wood.

No evidence of historical management was observed within the woodland (e.g. coppicing). However, the woodland has been managed fairly recently as a proportion of the elm trees in the southern part of the wood have been felled and left in small linear stacks between the remaining trees.

3.3.3 Woodland C (Seaberton Brake)

Woodland C is located on a gentle north to south upward slope and is surrounded on all sides by agricultural land (both arable and pasture). A public footpath is present along the south and west outside edges of the woodland. The footpath is bounded by a mature hedgerow on the opposite from the woodland. This hedgerow is parallel to the woodland on the south and west sides. No other hedgerows join the woodland.

A clear bank with mature trees is present along the eastern edge of the wood. Field maple and ash are the predominant species and many comprise several stems, which indicates they have at one time been coppiced.

The interior of the woodland supports few mature trees, limited to scattered mature field maple many of which are located in the centre of the wood. The remainder of the woodland canopy comprises tall, leggy hawthorn and blackthorn trees. Elder also forms part of the canopy in places, although it is more generally restricted to the understorey. Wild privet is locally dominant in the understorey, whilst spindle only occurs along the southern boundary of the wood. A small number of semi-mature pedunculate oak (*Quercus robur*) trees are also present.

The ground flora in Woodland C is dominated by ivy and dense patches of nettle. Stinking iris, lord's-and-ladies, hart's-tongue fern and ground ivy occur regularly in small numbers. At the western edge of the wood the canopy is more open and the ground is slightly more diverse with creeping buttercup, cleavers (*Galium aparine*), wood false brome and field forget-me-not (*Myosotis arvensis*) present.

Woodland C falls within the Hinkley County Wildlife Site and is actively managed by EDF Energy. Recent management of the woodland has included replanting species such as ash within the centre of the wood and clearing dense scrub to create glades where more direct sunlight can reach the ground. The current woodland structure reflects this management such that there are alternate areas of dense scrub and glades, cleared of scrub, present in an east-west orientation through the central part of the wood.

3.3.4 Woodland D (Whitewall Brake)

Woodland D is located adjacent to the coastal strip on flat land, with pasture present on the remaining three sides. An unnamed watercourse flows through the centre of the woodland and discharges to the rocky shore to the north. Two hedgerows link to the southern part of the woodland.

The woodland is very different in character on each side of the watercourse. To the west of the watercourse the wood is dominated by English elm, goat willow (*Salix caprea*) and crack willow. The canopy is relatively open (as many of the elms are dead or diseased), but the shrub layer is restricted to occasional elder. The ground conditions are wet in this area with the frequency of pendulous sedge reflecting this. Nettle, hart's-tongue fern and bramble are also abundant.

The woodland to the east side of the watercourse predominantly comprises mature pedunculate oak and field maple with areas of dense hawthorn, blackthorn and holly (*Ilex aquifolium*). Elder and hazel are frequent in the understorey and ash is occasional in the canopy layer. The ground flora is relatively species-rich (when compared to the other woodlands within the SSA) and supports stinking iris, lord's-and-ladies, hart's-tongue fern, male-fern (*Dryopteris filix-mas*), enchanter's nightshade and wood false-brome.

The woodland to the east side of the watercourse can also be divided into three areas. The southern area has been subject to recent management (see below) and comprises a mixture of mature trees and clearings. The central area comprises predominantly mature oak and field maple with a relatively sparse understorey and a ground flora dominated by ivy and hart's-tongue fern with frequent clumps of male-fern. The northern area (closest to the coast) consists of dense hawthorn and blackthorn bushes with occasional holly and no mature trees.

There is evidence of both historical and more recent management in Woodland D. A number of the older hazel and field maple trees appear to have been coppiced previously, but not recently. British Energy undertook management more recently in the south-eastern part of the wood by removing dead elms in an area ~10m by 20m and replanting it with young oak trees. This area is currently dominated by nettle, bramble and elder. A further smaller area was cleared at the southern edge of the wood in 2008 and is allowing more light to reach the ground flora.

3.3.5 Woodland E

Located adjacent to and north of Woodland B, Woodland E is small and triangular. It is situated on flat ground bounded by a small unnamed watercourse to the south (separating Woodland E from Woodland B). On the remaining sides of the wood lie arable and pasture fields.

The northern boundary of Woodland E is marked by a steep bank supporting mature field maple, hazel, blackthorn and a single pedunculate oak tree. Hazel trees also occur along the southern boundary of the woodland with crack willow present along the watercourse.

The ground flora is very similar to other woodlands in the area, being dominated by ivy, with hart's-tongue fern abundant along the edges of the watercourse. Also present is hedge bedstraw (*Galium mollugo*), wood false-brome, common vetch, creeping thistle, nettle and hemlock water-dropwort.

All the hazel trees within Woodland E have been coppiced in the past. More recently the woodland has been used a cover to raise pheasants but active management does not appear to have been undertaken in last few years.

3.3.6 Woodland F

Woodland F is similar to Woodland E in size and location as it is also situated on flat ground and is bounded to the south by the same unnamed watercourse.

Whilst this area is shown as broad-leaved woodland on the historical Ordnance Survey maps, it does not currently support any mature trees, suggesting that it may have been felled since 1904. At present the woodland appears to have originated as a result of the surrounding hedgerows encroaching into this triangle of land. The dominant species is English elm, which forms the canopy layer, although most of the trees are either dead or diseased. Hawthorn and blackthorn form quite a dense understory and the ground flora is dominated by ivy.

3.3.7 Woodland G (Govetts Copse)

Woodland G is located on a gentle north to south upward slope. Along the southern boundary of the woodland is a public footpath with a dense mature hedgerow and arable fields beyond. Improved grassland pasture is present to the west and east of the wood. The northern boundary is adjacent to a track between fields and also the edge of the Power Station external car park.

The woodland supports few mature canopy trees limited to five ash trees, with a maximum of two trunks per tree and around 12 large, mature hawthorn trees. The understorey is relatively species-rich and dense comprising hawthorn, field maple, wild privet, elder and dogwood, with occasional spindle. Where there are gaps in the understorey and more light reaches the ground, nettle dominates the ground flora. Elsewhere, ivy dominates the ground flora with abundant cleavers, frequent stinking iris, lord's-and-ladies, wood false-brome and ground ivy, and occasional hairy bittercress and ground ivy.

A remnant hedge bank is present along the western boundary of the woodland upon which two of the mature ash trees are located. West of the hedge bank two rows of mature, planted broad-leaved scrub are present, comprising hawthorn, blackthorn, field maple, elder and dogwood.

There is no evidence of historical management of the woodland apparent. However, it was managed by British Energy in recent years, including the clearance and replanting of field maple within the understorey in the northern section, which has resulted in a more diverse ground flora.

3.3.8 Woodland H (Branland Copse)

Woodland H is located on flat ground adjacent to the electricity substation that is part of the existing Power Station complex. The woodland is bounded to the north and west by the power station access road and to the east by the substation. At the southern boundary of the woodland is a poor semi-improved grassland field (Pixies Mound). The south-eastern corner of the wood grades into a scrub and grassland habitat mosaic.

This woodland is characterised by a mature canopy layer comprising pedunculate oak, ash and field maple. Five Monterey pine (*Pinus radiata*) trees also occur in the north-east corner of the woodland. A number of banks and associated ditches occur within the woodland and the mature ash trees are often located upon these banks. Many of the mature trees (particularly ash) have woodpecker holes or broken and rotting branches.

The understorey in the centre of the wood is generally open and relatively diverse with elder, hawthorn and holly frequent, and English elm, hazel and spindle occasionally present. The understorey species create a denser area around the edges of the woodland where there are fewer mature trees creating shade.

The ground flora is dominated by ivy with frequent lord’s-and-ladies, hart’s-tongue fern and stinking iris. Small areas are more species-rich supporting ground ivy, primrose and early purple orchid. Nettle and broad-leaved dock are also frequent in the ground flora.

A pond was historically present within the woodland (as noted in the Hinkley Land Management Reports). This is thought have been located in the central part of the wood near to the western edge where three ditches converge to form a damp hollow. This area no longer holds water throughout the year, although a small amount of water collects temporarily during the wetter, winter months.

The woodland was managed recently by British Energy. Management activities completed include the removal of the dense ivy cover in one part of the ground flora, which has successfully encouraged more species to occur, and selective clearing and replanting of the understorey to maintain the open structure and to continue to allow light to reach the ground. Bird boxes have also been installed on a number of the mature trees.

3.3.9 Woodland I

Woodland I is located to the north of Woodland H, separated from it to the south by the power station access road. This woodland is also located on reasonably flat ground. To the east and north of the wood is the existing power station and to the west is a further access road. The woodland is surrounded by security fencing and is disturbed infrequently.

This woodland is very similar in character to Woodland H, except it appears to have been managed less recently and has a more dense understorey and canopy. The canopy is similar to the other woodlands surveyed, comprising mature ash, English elm, field maple and pedunculate oak. Woodland I also supports small amounts of Monterey Pine (*Pinus radiata*) and sycamore in the southern section.

The understorey is species-rich and supports frequent wild privet, hazel, blackthorn and hawthorn with occasional wayfaring tree, holly and dogwood. The understorey is particularly dense along the east, west and north edges of the woodland.

The field layer is dominated by ivy. The southern part of the woodland (around the pine trees) is much lighter than the rest of the wood and supports a greater diversity of ground flora species include greater periwinkle (*Vinca major*) (probably introduced), perforate St John’s wort, bluebell (*Hyacinthoides non-scripta*), woodruff (*Galium odoratum*) and stinking iris. Nettle and cleavers are common in the ground flora throughout the woodland. In the centre of the woodland hart’s-tongue fern, male-fern and a small area of enchanter’s nightshade are present.

Two banks are present within the wood; one is situated east-west in the southern part of the wood and the other lies north-south through the centre of the wood. Several mature hawthorn trees are located on these banks suggesting they may represent defunct field boundaries. There is also evidence that the hazel within the woodland has previously been coppiced. There is no evidence that the woodland has been significantly managed in the last few years, although it was managed by British Energy through selective felling/clearance and replanting fairly recently.

Table 3.2 Summary of Woodland Condition Features

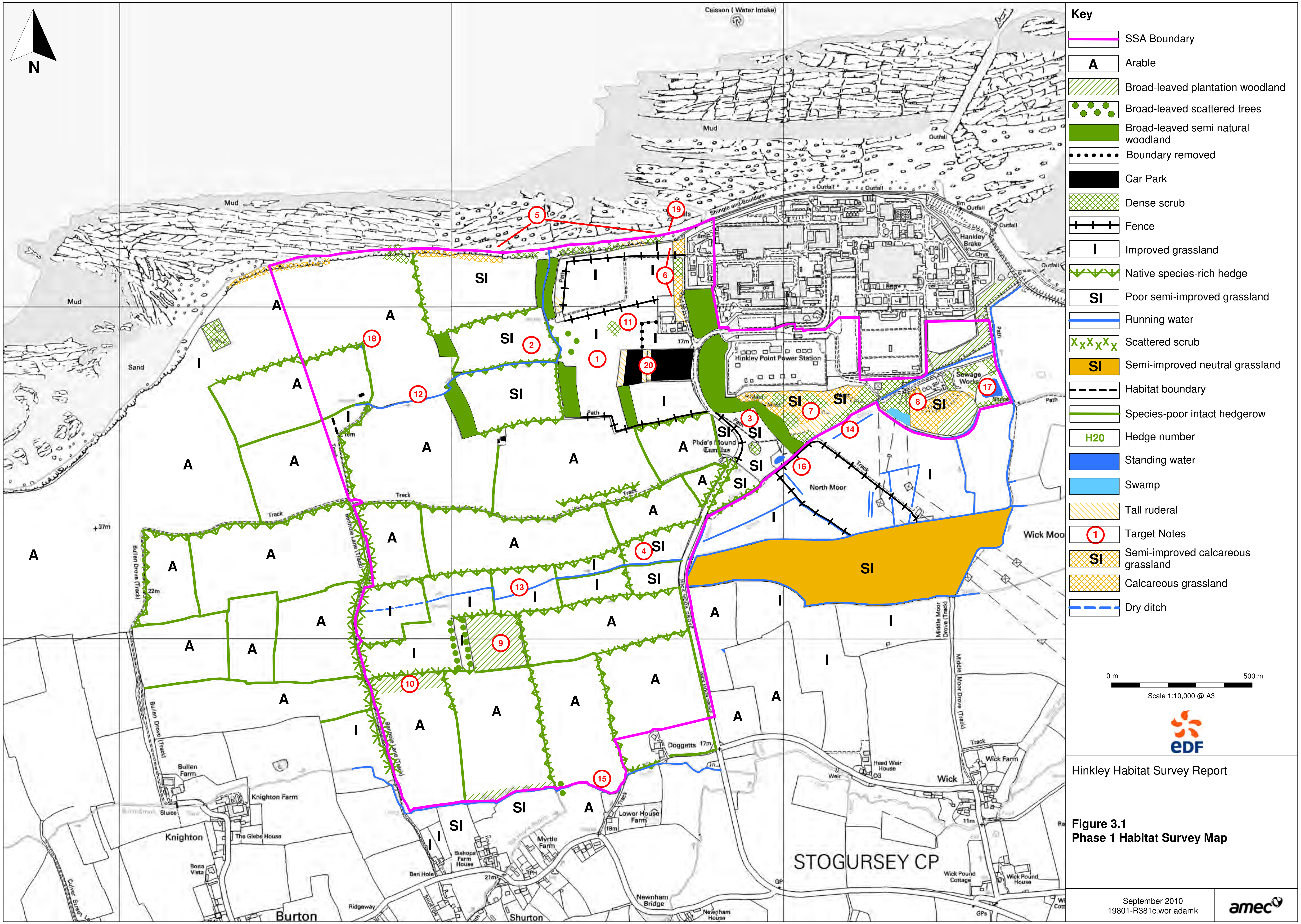
Woodland	Grid Reference	Size (ha)	Current Structure	Woodland Vegetation Types	Other Habitat Types	Adjacent Land Use	Species Present	Current and Past Management	Historical Presence
A	ST199458	0.3	Established woodland dominated by ash. Sparse understory and underground flora.	Closest affinity to NVC community W8 *Fraxinus excelsior-Acer campestre – Mercurialis perennis*.	None	Arable and poor-semi-improved grassland	Common woodland species only.	Evidence of coppicing and hedge laying. No apparent recent management	Broad-leaved trees present from 1904 (conifer in 1887)
B	ST200456	0.9	English elm comprises canopy with limited understorey. Edges more diverse	English elm dominates	Ditch present along northern boundary	Arable and poor semi-improved grassland	Common woodland species only.	Evidence of felling of elms and historical hedge laying around edges	Scrub woodland in 1897, marked as broad-leaved woodland in 1904
C	ST203457	0.9	Established woodland, remnant hedges at the edge and scrub understorey in centre	Closest affinity to NVC community W21 *Crataegus monogyna – Hedera helix* scrub.	None	Arable and poor-semi-improved grassland	Common woodland species only.	Edge remnant hedges previously laid, centre area managed by selective felling, clearance and re-planting to promote diversity.	No woodland shown in 1887 (2 linear fields only), broad-leaved in 1904
D	ST202460	0.9	Open woodland in western part, denser to east with mature oak and field maple	Closest affinity to NVC community W8 *Fraxinus excelsior-Acer campestre – Mercurialis perennis*.	Watercourse through centre of woodland	Arable and poor-semi-improved grassland	Common woodland species only.	Evidence of historical coppicing, recent management through selective felling, clearance and re-planting to increase diversity.	Broad-leaved/ scrub woodland present on east side of stream in 1887 and 1904. Woodland not present on west side until more recently

Table 3.2 (continued) Summary of Woodland Condition Features

Woodland	Grid Reference	Size (ha)	Current Structure	Woodland Vegetation Types	Other Habitat Types	Adjacent Land Use	Species Present	Current and Past Management	Historical Presence
E	ST200457	0.1	Although small the structure is well-developed. Ground flora species-poor	Closest affinity to NVC community W8 *Fraxinus excelsior-Acer campestre – Mercurialis perennis*.	Ditch through centre of woodland	Arable and poor semi-improved grassland	Common woodland species only.	Evidence of previous hazel coppicing.	No woodland shown in 1887, broad-leaved in 1904
F	ST197456	0.1	Many of the elm are either dying or are young and thin. Limited structure and species-poor ground flora	English elm dominated	Damp ditch around southern edge of wood	Arable and poor-semi-improved grassland	Common woodland species only.	No evidence of management	Shown as broad-leaved woodland throughout, size contracts between 1887 and 1904
G	ST205451	0.4	Few mature trees within canopy, dense understorey layer	Closest affinity to NVC community W8 *Fraxinus excelsior-Acer campestre – Mercurialis perennis*.	None	Arable and poor semi-improved grassland	Common woodland species only.	No evidence of past management, currently managed by selective clearance and re-planting to increase diversity.	Conifer and scrub indicated in 1887 in the north part of the wood. Mixed woodland shown in 1904.
H	ST207458	2.8	Predominantly mature standard trees with open understorey.	Closest affinity to NVC community W8 *Fraxinus excelsior-Acer campestre – Mercurialis perennis*.	Glades have been created	Buildings and hard-standing, scrub and calcareous grassland mosaics.	Common woodland species only.	No evidence of past management, currently managed by selective clearance and re-planting to increase diversity.	Present as broad-leaved woodland in 1887 and 1904, size increases in the north between these years

Table 3.2 (continued) Summary of Woodland Condition Features

Woodland	Grid Reference	Size (ha)	Current Structure	Woodland Vegetation Types	Other Habitat Types	Adjacent Land Use	Species Present	Current and Past Management	Historical Presence
I	ST207459	1	Few standard trees in canopy, with a dense understorey and patches of more diverse ground flora	Closest affinity to NVC community W8 *Fraxinus excelsior-Acer campestre – Mercurialis perennis*.	None	Buildings and hard-standing, scrub and calcareous grassland mosaics.	Common woodland species only.	No evidence of past management, currently managed by selective clearance and re-planting to increase diversity.	No woodland present in 1887. Broad-leaved woodland in 1904



Hinkley Habitat Survey Report

Figure 3.1
Phase 1 Habitat Survey Map

September 2010
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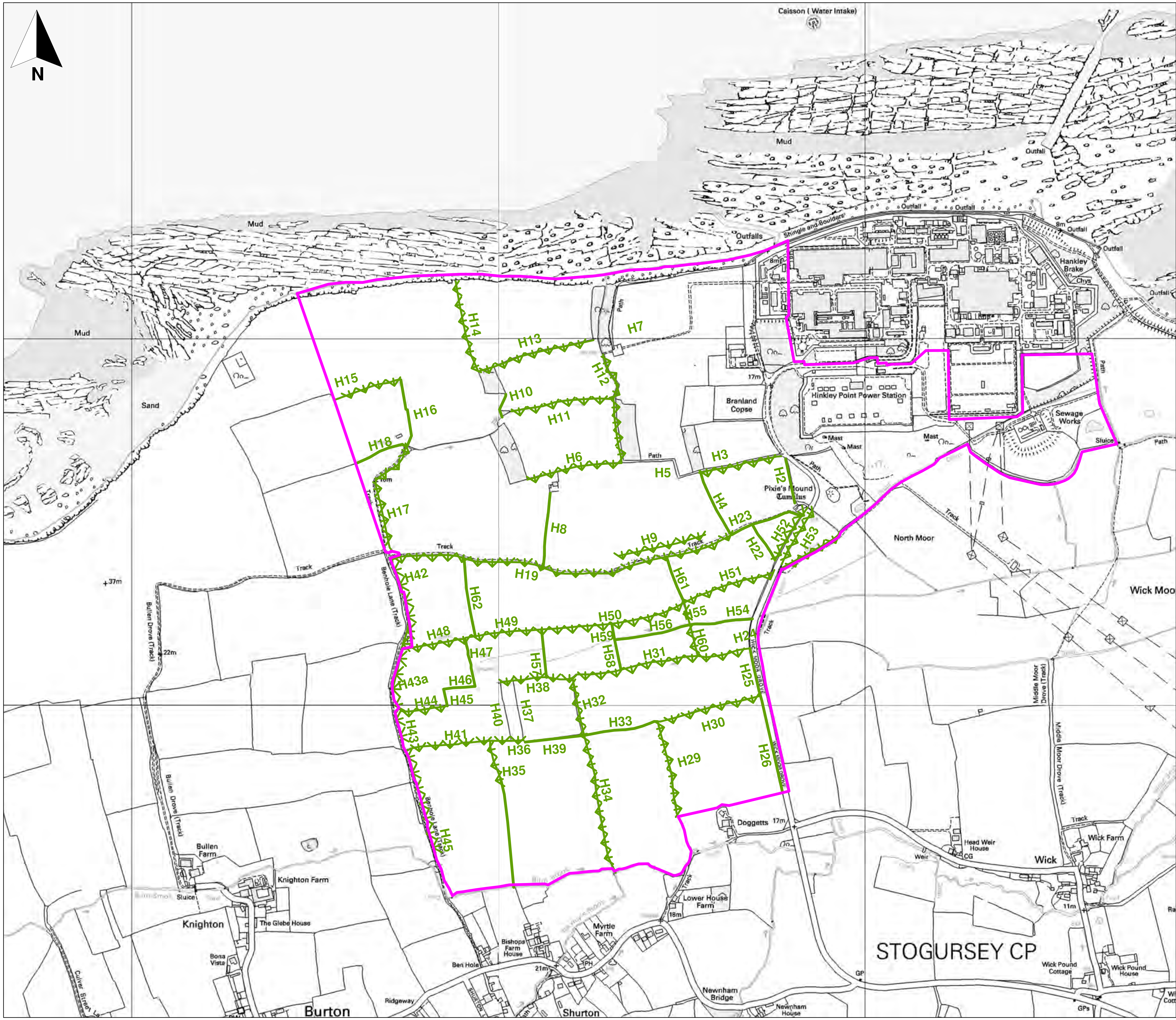

EDF

Hinkley Habitat Survey Report

Figure 3.2
Location of Hedgerows

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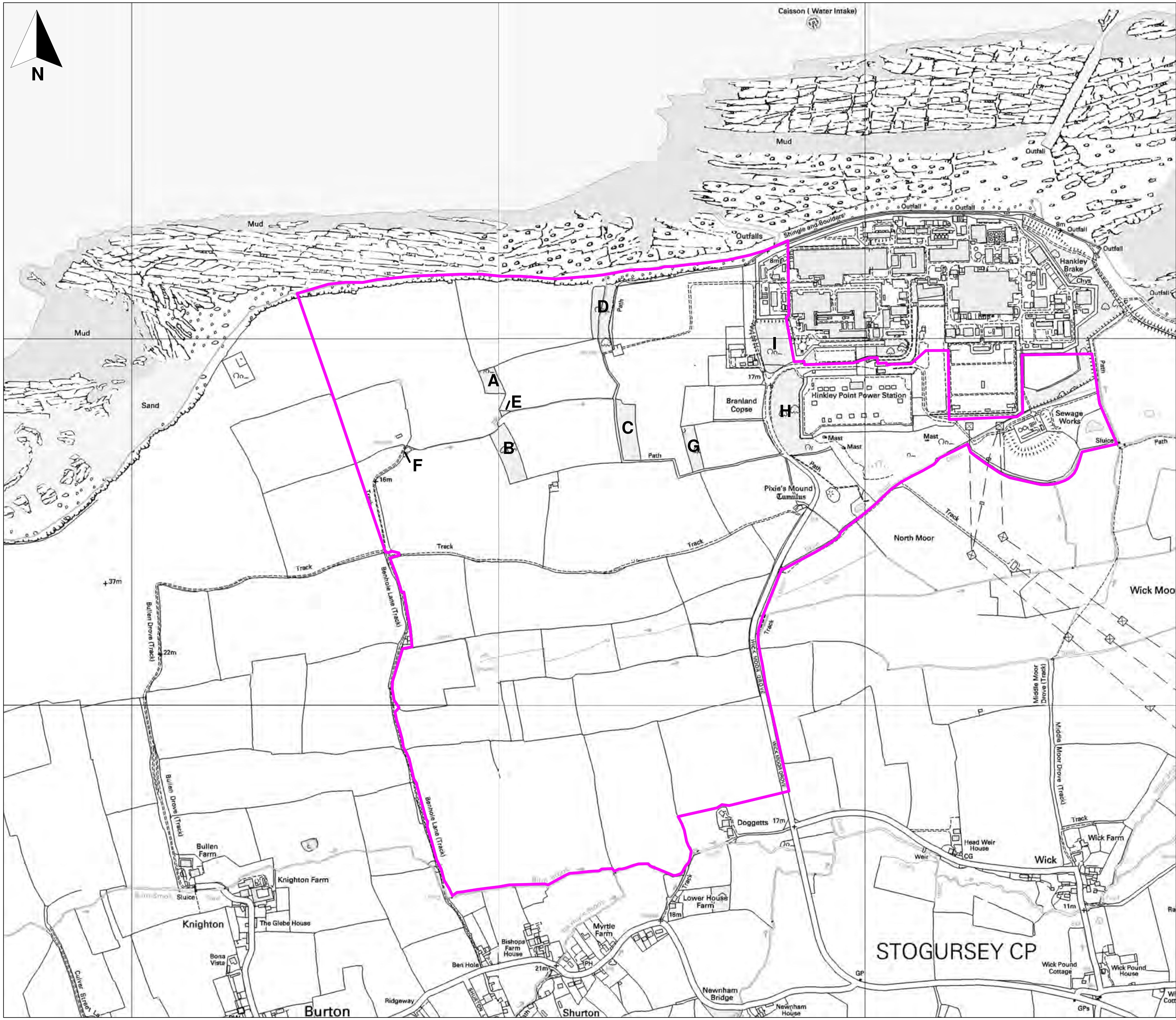


Key

SSA Boundary

Woodland

A - Newclose Covert
B - Haysgrove Brake
C - Seaburton Brake
D - Whitewall Brake
E - Unnamed woodland
F- Unnamed woodland
G - Govetts Copse
H- Branland Copse
I - Unnamed woodland

0 m 500 m

Scale 1:10,000 @ A3

Hinkley Habitat Survey Report

Figure 3.3
Location of Woodlands

September 2010
19801-R383c.wor adamk

amec

4. Conclusions

4.1 Habitats

The Phase 1 Survey found that the vast majority of the habitat within the SSA was a mix of intensively farmed arable and pasture land. These habitats support a limited range of common plant species and their loss would be of no more than local importance. Areas of woodland, scrub, calcareous grassland and linear features such as hedgerows and water courses with associated riparian vegetation are of greater potential importance, and are discussed in greater detail below.

The habitat mosaic to the south of the existing power station, comprising scrub and calcareous grassland, creates a species-rich and structurally diverse habitat that is used by a wide variety of fauna. The other areas of calcareous grassland within the site (including the cliff vegetation) are also species-diverse and, whilst they do not support rare plant species, the combination of species present suggests little agricultural improvement (reflecting their origin[5]).

Apart from within the habitat mosaic south of the existing power station (the eastern arm of the SSA), only small areas of scrub occur within the SSA. Throughout the SSA the scrub supports a fairly diverse range of woody species and provides food and shelter for fauna.

The two watercourses within the SSA are small and seasonal, and the vegetation in both shows signs of agricultural improvement. The northern watercourse in particular dries up along the majority of its length and becomes extensively overgrown with tall grass and ruderals, thereby restricting typical aquatic and emergent vegetation. The central watercourse retains more water and is less overgrown allowing a range of aquatic and emergent plant species to occur. Both watercourses also provide infrequently managed and undisturbed habitat corridors through the SSA.

Conclusions relating to the hedgerows and woodlands are provided below.

4.2 Hedgerows

Of the 60 hedgerows surveyed 37 are considered to be ‘important’ under the Hedgerow Regulations.

A total of 17 of the hedgerows are ‘important’ for supporting seven or more woody species within the 30m survey area(s), although 25 of the hedgerows support seven or more woody species within their entire length. The maximum number of woody species recorded growing in a hedgerow was 12 at Hedgerow 42. Hedgerows 4, 11, 30, 31 and 50 supported 10, 11, 11, 10 and 10 species respectively, which demonstrates the high level of species diversity present within the hedgerows in the SSA.

[5] These communities developed on spoil associated with the building of the existing plant.

Although footpaths are located adjacent to a number of hedgerows, only two hedgerows (numbers 2 and 34) are ‘important’ solely because of this (i.e. they would not be ‘important’ due to the limited species present without the footpath). The remainder of the hedgerows next to footpaths are either not ‘important’ or are ‘important’ because they support a higher number of woody species.

4.3 Woodlands

All of the semi-natural broad-leaved woodlands with the SSA are small in size, ranging from 0.1ha to 2.8ha, although all are connected (or virtually connected), to each other by hedgerows. All the woodlands are also situated adjacent to land that is either bare of vegetation or is intensively managed for agricultural purposes. This contributes to the fragile nature of the woodlands by restricting colonisation of typical woodland species and reducing species-diversity. The few hedgerow connections within the site maintain some connectivity between the woodlands.

Although the structure and characteristic dominant species in each woodland vary slightly, all the woods apart from Woodlands C and F, correspond broadly to National Vegetation Classification (NVC) community W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis.* This is due to the dominance (e.g. Woodland A) or presence of ash and field maple in each of the woods, despite the absence of dog’s mercury (*Mercurialis perennis*). Based on the species-poor ground flora in Woodlands A, D, E, G, H and I, they show most affinity with the *Hedera helix* sub-community of W8. Woodland B supports few ash or field maple trees as it is dominated by English elm. Due to this dominance of elm, Woodland B corresponds more closely to the *Geranium robertianum* sub-community of W8, in which elm frequently occurs in varying abundance.

Woodlands C and F support little ash and field maple, whilst scrub species such as hawthorn and blackthorn are dominant. Therefore, these woodlands correspond better with NVC community W21 *Crataegus monogyna – Hedera helix* scrub. Again, due to the dominance of ivy in the ground flora the woodlands fit best with the *Hedera helix – Urtica dioica* sub-community of W21.

Both these NVC communities occur commonly throughout the UK and can comprise species-rich and structurally diverse woodlands. However, the *Hedera helix* sub-communities of both W8 and W10 present within the SSA are typically species-poor and characteristic of shady, unmanaged woods in south-west Britain, often those of recent origin. The absence of dog’s mercury tends to indicate the recent origin of the woodland.

None of the woodlands within the SSA are considered to be ancient (i.e. documentary evidence indicates they were not present prior to 1600AD) and many have only developed to their current state over the last 100 years. A relatively recent origin of the woodlands is likely to contribute significantly to their species-poor and structurally similar character.

However, it appears from the recent management activities completed in Woodlands C, D, G, H and I that these woodlands have the potential to support a greater diversity of species with suitable management intervention. Additionally, whilst the woodlands are species-poor and do not support rare plant species, they do provide habitat for a range of fauna, including notable bird species such as nightingale and legally protected species such as badger.

Appendix A
River Corridor Survey Key

APPENDIX 2

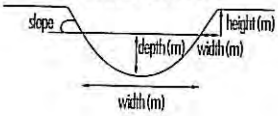
Standard Symbols for use in River Corridor Surveys

AQUATIC AND MARGINAL ZONES

CHANNEL FEATURES

- Bridge (road/track)
- Footbridge
- Lock
- Inlet
- Weir
- Pool
- Riffle
- Rapids
- Run
- Waterfall
- Protruding rock
- Island (with vegetation)
- Direction of flow

CHANNEL CROSS-SECTION



SUBSTRATE

- Mud
- Sand
- Bare gravel/ shingle
- Vegetated gravel/shingle
- Cobbles
- Boulders

CHANNEL VEGETATION

- Emergent Monocots
- Emergent Dicots
- Submerged Monocots
- Submerged Dicots
- Bryophytes
- Floating leaves

SURVEY INFORMATION

- Direction of survey/bank used
- Photograph

BANK AND ADJACENT LAND ZONES

BANK FEATURES

- Base of bank
- Top of bank
- Slump
- Stable earth cliff
- Eroding earth cliff
- Rock cliff
- Artificial bank protection
- Cattle drink
- Shelf / berm
- Spring / flush
- Inflow stream
- Outfall
- Dredgings/spoil

ADJACENT LAND FEATURES

- Fence
- Gate
- Road / track
- Railway
- Footpath
- Power lines
- Building
- S.T.W. Sewage works
- Flood bank
- [ ] Land use category Defined name / Phase 1 code

VEGETATION

Trees

- Conifer
- Broadleaf
- - overhanging
- - fallen
- - exposed roots
- Woodland + symbol for type
- *P + symbol* Pollarded tree
- *(P) + symbol* Tree needs pollarding
- *C + symbol* Coppiced tree
- Sapling

Shrubs/hedgerows

- Shrub (single)
- Dense shrubs
- Sparse shrubs
- Hedgerow
- Hedgerow with trees

Grasses and herbs

- Reed / sedge
- Tall grass
- Tall herb / ruderal
- Tall grass with herbs
- Short grass
- Mown

APPENDIX 4

ABBREVIATED PLANT NAMES

All plants should be recorded using an abbreviated version of their scientific name. The following list is indicative; additions should be abbreviated using the convention of the first letter name (i.e. the first letter of the generic name and the first three letters of the specific name). Duplicate abbreviations thus created should be clarified by using the BSBI abbreviation or code number. Plants not identified to species should be recorded using initial of generic name and (sp) in brackets. Nomenclature follows Stace (1991).

DICOTYLEDONS

Herbs

Anod	*Apium nodiflorum*	Fool's Water-cress
Asyl	*Angelica sylvestris*	Wild Angelica
Bere	*Berula erecta*	Lesser Water-parsnip
Bcer	*Bidens cernua*	Nodding Bur-marigold
Btri	*B. tripartita*	Trifid Bur-marigold
Cobt	*Callitriche obtusangula*	Blunt-fruited Water-starwort
Csta	*C. stagnalis*	Common Water-starwort
Cpal	*Caltha palustris*	Marsh-marigold
Cpra	*Cardamine pratensis*	Cuckooflower
Cdem	*Ceratophyllum demersum*	Rigid Hornwort
Cmac	*Conium maculatum*	Hemlock
Dful	*Dipsacus fullonum*	Wild Teasel
Dpil	*D. pilosus*	Small Teasel
Ehir	*Epilobium hirsutum*	Great Willowherb
Ecan	*Eupatorium cannabinum*	Hemp-agrimony
Fulm	*Filipendula ulmaria*	Meadowsweet
Lped	*Lotus pedunculatus*	Greater Bird's-foot-trefoil
Lfcu	*Lychnis flos-cuculi*	Ragged-Robin
Leur	*Lycopus europaeus*	Gipsywort
Lvul	*Lysimachia vulgaris*	Yellow Loosestrife
Lsal	*Lythrum salicaria*	Purple-loosestrife
Maqu	*Mentha aquatica*	Water Mint
Msco	*Myosotis scorpioides*	Water Forget-me-not
Mspi	*Myriophyllum spicatum*	Spiked Water-milfoil
Nalb	*Nymphaea alba*	White Water-lily
Nlut	*Nuphar lutea*	Yellow Water-lily
Ocro	*Oenanthe crocata*	Hemlock Water-dropwort
Oflu	*O. fluviatilis*	River Water-dropwort
Phyb	*Petasites hybridus*	Butterbur
Pamp	*Polygonum amphibia*	Amphibious Bistort
Phyd	*P. hydropiper*	Water-pepper
Pdys	*Pulicaria dysenterica*	Common Fleabane
Raqu	*Ranunculus aquatilis*	Common Water-crowfoot
Rcir	*R. circinatus*	Fan-leaved Water-crowfoot
Rfla	*R. flammula*	Lesser Spearwort
Rflu	*R. fluitans*	River Water-crowfoot
Rpel	*R. peltatus*	Pond Water-crowfoot
Rpen	*R. penicillatus*	Stream Water-crowfoot
Rsce	*R. sceleratus*	Celery-leaved Buttercup
Rnaq	*Rorippa nasturtium-aquaticum*	Water-cress
Rhyd	*Rumex hydrolapathum*	Water Dock
Saur	*Scrophularia auriculata*	Water Figwort
Sgal	*Scutellaria galericulata*	Skullcap
Sdul	*Solanum dulcamara*	Bittersweet
Soff	*Symphytum officinale*	Common Comfrey
Tfla	*Thalictrum flavum*	Common Meadow-rue
Udio	*Urtica dioica*	Common Nettle
Voff	*Valeriana officinalis*	Common Valerian
Vaaq	*Veronica anagallis-aquatica*	Blue Water-Speedwell
Vbec	*V. beccabunga*	Brooklime
Vcat	*V. catenata*	Pink Water-Speedwell

MONOCOTYLEDONS

Grasses

Aela	*Arrhenatherum elatius*	False Oat-grass
Asto	*Agrostis stolonifera*	Creeping Bent
Caqu	*Catabrosa aquatica*	Whorl-grass
Dces	*Deschampsia cespitosa*	Tufted Hair-grass
Gdec	*Glyceria declinata*	Small Sweet-grass
Gflu	*G. fluitans*	Floating Sweet-grass
Gmax	*G. maxima*	Reed Sweet-grass
Gnot	*G. notata*	Plicate Sweet-grass
Paru	*Phalaris arundinacea*	Reed Canary-grass
Paus	*Phragmites australis*	Common Reed

Sedges & rushes

Cacu BSBI 340	*Carex acuta*	Slender Tufted-sedge
Cacu BSBI 341	*C. acutiformis*	Lesser Pond-sedge
Cfla	*C. flacca*	Glaucous Sedge
Chir	*C. hirta*	Hairy Sedge
Cnig	*C. nigra*	Common Sedge
Cobt	*C. obtrubae*	False Fox-sedge
Cpan	*C. paniculata*	Greater Tussock-sedge
Cpen	*C. pendula*	Pendulous Sedge
Crip	*C. riparia*	Greater Pond-sedge
Epal	*Eleocharis palustris*	Common Spike-rush

Jacu	*Juncus acutiflorus*	Sharp-flowered Rush
Jart	*J. articulatus*	Jointed Rush
Jeff	*J. effusus*	Soft-rush
Jinf	*J. inflexus*	Hard Rush
Slac	*Schoenoplectus lacustris*	Common Club-rush
Ssyl	*Scirpus sylvaticus*	Wood Club-rush

Other monocotyledons

Apaq	*Alisma plantago-aquatica*	Water-plantain
Alan	*A. lanceolatum*	Narrow-Leaved Water-plantain
Bumb	*Butomus umbellatus*	Flowering-rush
Ecan	*Elodea canadensis*	Canadian Waterweed
Hmra	*Hydrocharis morsus-ranae*	Frogbit
Ipse	*Iris pseudacorus*	Yellow Iris
Lgib	*Lemna gibba*	Fat Duckweed
Lmin	*L. minor*	Common Duckweed
Ltri	*L. trisulca*	Ivy-leaved Duckweed
Pcri	*Potamogetan crispus*	Curled Pondweed
Pluc	*P. lucens*	Shining Pondweed
Pnat	*P. natans*	Broad-leaved Pondweed
Ppec	*P. pectinatus*	Fennel Pondweed
Pper	*P. perfoliatus*	Perfoliate Pondweed
Ssag	*Sagittaria sagittifolia*	Arrowhead
Seme	*Sparganium emersum*	Unbranched Bur-reed
Sere	*S. erectum*	Branched Bur-reed
Spol	*Spirodela polyrhiza*	Greater Duckweed
Tlat	*Typha latifolia*	Bulrush
Warr	*Wolffia arrhiza*	Rootless Duckweed
Zpal	*Zannichellia palustris*	Horned Pondweed

TREES & SHRUBS

Acam	*Acer campestre*	Field Maple
Apse	*A. pseudoplatanus*	Sycamore
Aglu	*Alnus glutinosa*	Alder
Ahip	*Aesculus hippocastanum*	Horse-chestnut
Cave	*Corylus avellana*	Hazel
Cbet	*Carpinus betulus*	Hornbeam
Csan	*Cornus sanguinea*	Dogwood
Cmon	*Crataegus monogyna*	Hawthorn
Eeur	*Euonymous europaeus*	Spindle
Fexc	*Fraxinus excelsior*	Ash
Fsyl	*Fagus sylvatica*	Beech
Iaqu	*Ilex aquifolium*	Holly
Palb	*Populus alba*	White Poplar
Pcan	*P. canescens*	Grey Poplar
Pnig	*P. nigra*	Black-poplar
Ptre	*P. tremula*	Aspen
Pspi	*Prunus spinosa*	Blackthorn
Psyl	*Pinus sylvestris*	Scots Pine
Qrob	*Quercus robur*	Pedunculate Oak
Rfru	*Rubus fruticosus*	Bramble
Salb	*Salix alba*	White Willow
Scap	*S. caprea*	Goat Willow
Scin	*S. cinerea*	Grey Willow
Sfra	*S. fragilis*	Crack-willow
Snig	*Sambucus nigra*	Elder
Ugla	*Ulmus glabra*	Wych Elm
Vopu	*Viburnum opulus*	Guelder-rose

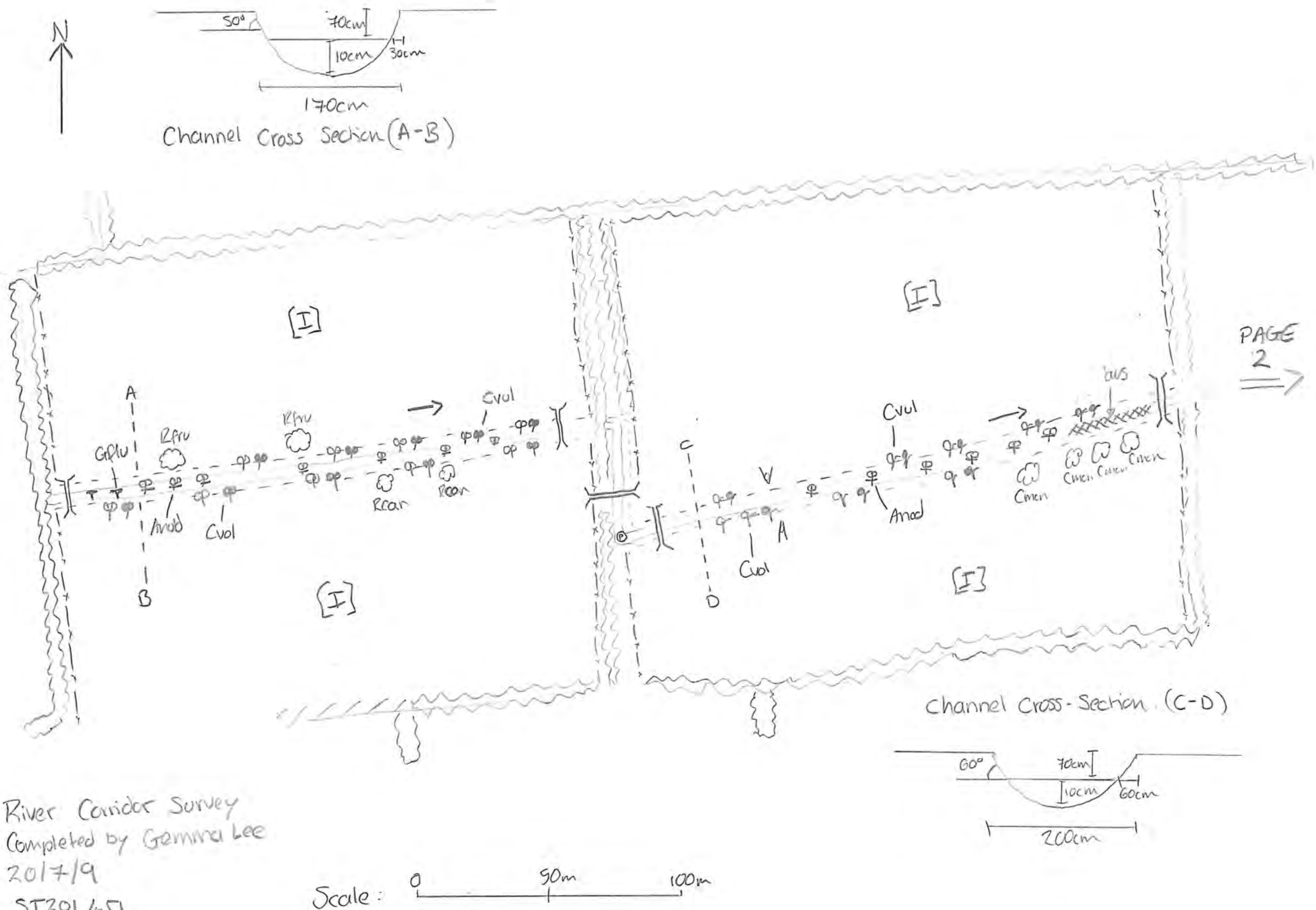
FERNS

Eflu	*Equisetum fluviatile*	Water Horsetail

SELECTED ALIEN PLANTS

Afil	*Azolla filiculoides*	Water Fern
Chel	*Crassula helmsii*	New Zealand Pigmyweed
Fjap	*Fallopia japonica*	Japanese Knotweed
Hman	*Heracleum mantegazzianum*	Giant Hogweed
Icap	*Impatiens capensis*	Orange Balsam
Igla	*I. glandulifera*	Indian Balsam
Mgut	*Mimulus guttatus*	Monkeyflower

Appendix B
River Corridor Survey of TN12 Watercourse



River Corridor Survey
Completed by Gemma Lee
2017/9
ST201 451
PAGE 1

River Corridor Survey

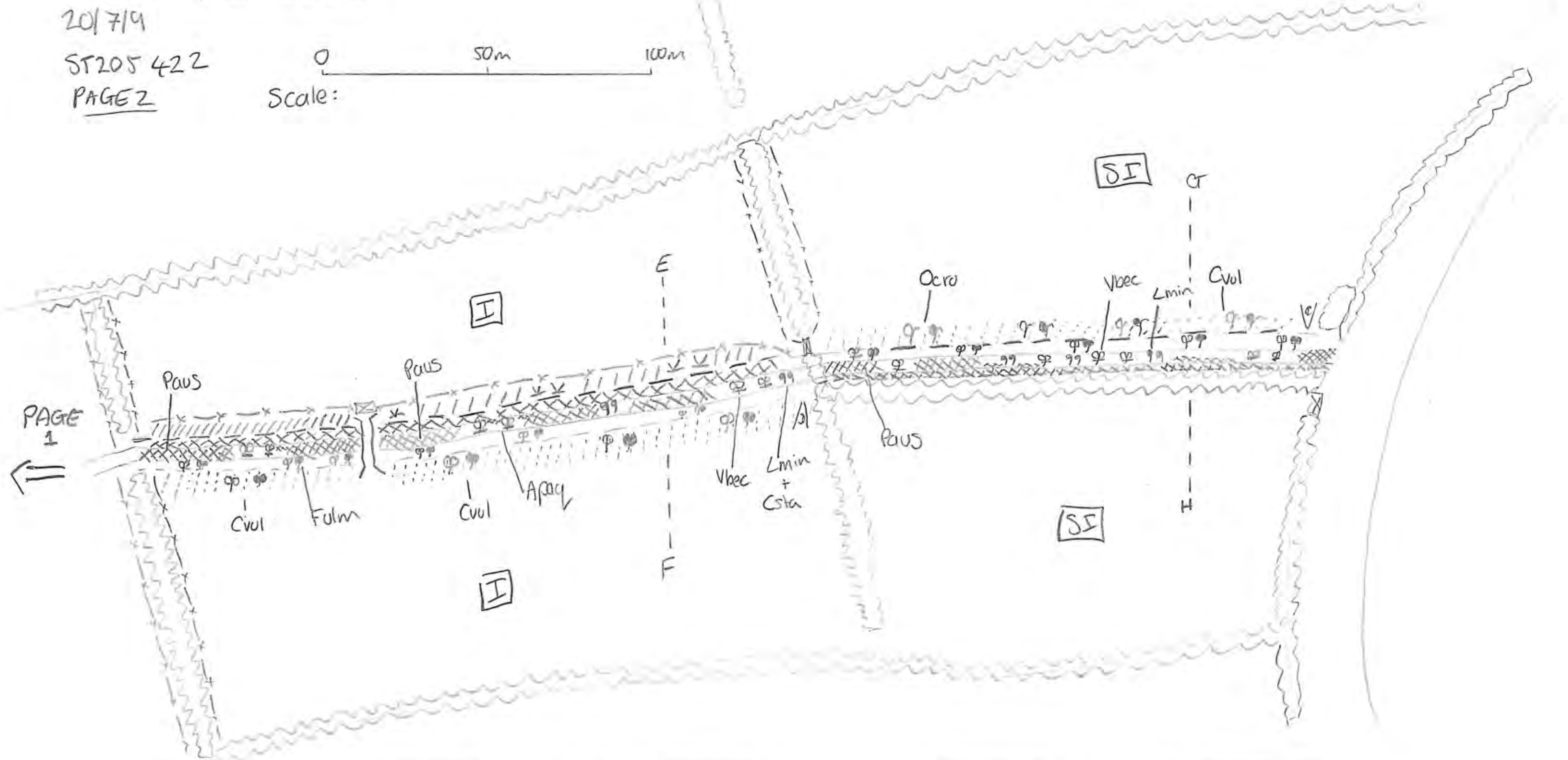
Completed by Gemma Lee

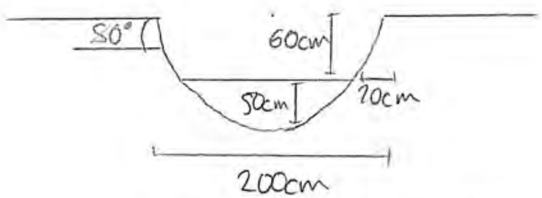
20/7/19

ST205 422

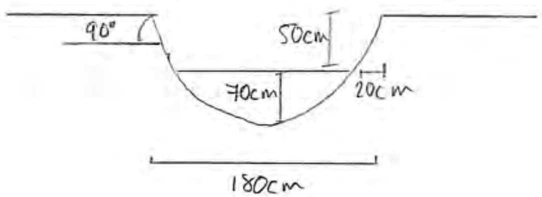
PAGE 2

Scale: 0 — 50m — 100m





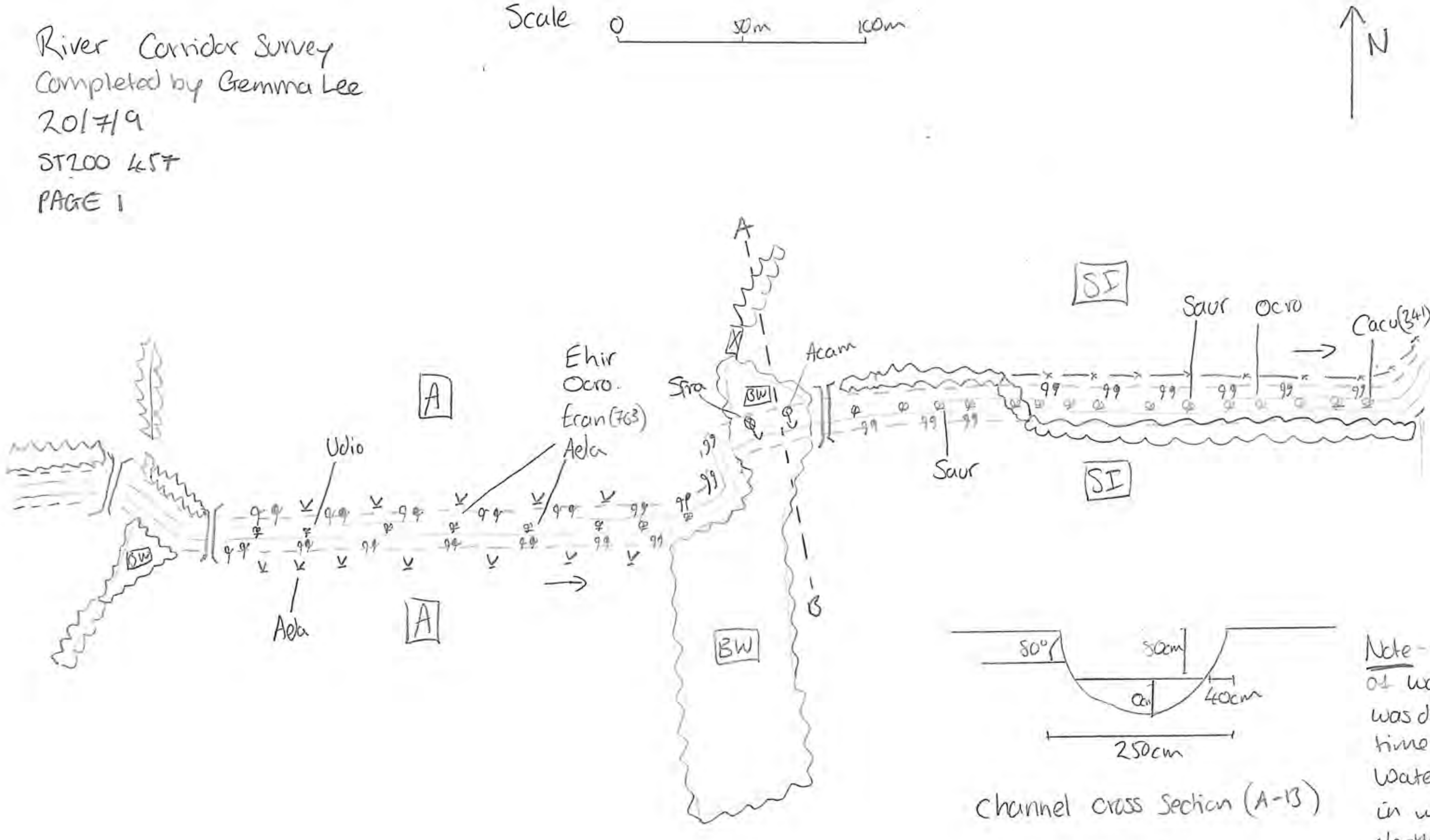
Channel Cross Section (E-F)



Channel Cross Section (G-H)

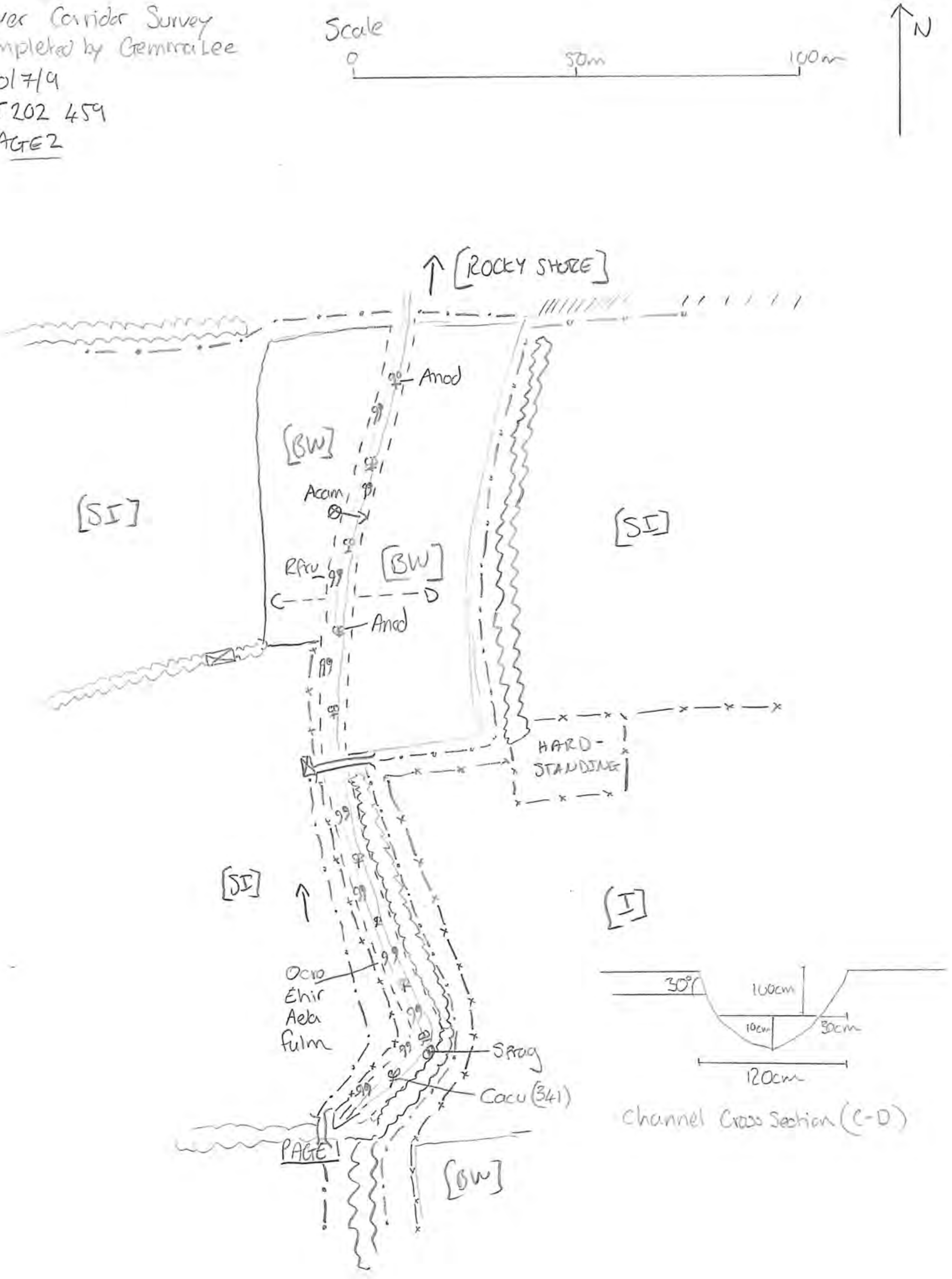
Appendix C
River Corridor Survey of TN13 Watercourse

River Corridor Survey
Completed by Gemma Lee
20/7/9
ST200 457
PAGE 1



Note - This section of watercourse was dry at the time of survey. Water is present in winter to a depth of ~20cm

River Corridor Survey
Completed by Gemma Lee
2017/9
ST202 459
PAGE 2



Appendix D
Hedgerow Survey Results

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 214456	Hedge ref number: H1
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 100m

WIDTH: 1m

PERCENTAGE GAPS: 5%

DESCRIPTION: A short section of hedge that is generally unmanaged adjacent to a public footpath and a watercourse.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog Rose	Blackthorn
Hazel	Elder		
		English elm	**TOTAL: 3 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 208456	Hedge ref number: H2
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 100m

WIDTH: 1m

PERCENTAGE GAPS: 5%

DESCRIPTION: Hedge has some gaps and there is evidence of past management (laying and re-planting)

WOODY SPECIES PRESENT[1]	Hawthorn	Dog Rose	Blackthorn
Ash	English Elm	Hazel	
			TOTAL: 5

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 206456	Hedge ref number: H3
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 5m — LENGTH: 217m

WIDTH: 1m

PERCENTAGE GAPS: 5%

DESCRIPTION: Hedge has evidence of previous management (laying and replanting), with some gaps.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog Rose	Wild privet
Ash	Field Maple	Hazel	
			TOTAL: 6

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD: 2	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST205455	Hedge ref number: H4
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 200m

WIDTH: 2m

PERCENTAGE GAPS: 5%

DESCRIPTION: Southern part of hedge 75% dominated by Elm, top of northern section is more diverse.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog Rose	Elder
English Elm			
	Field Maple	Blackthorn	**TOTAL: 4 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

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Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 204456	Hedge ref number: H5
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 5m

LENGTH: 186m

WIDTH: 1m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Dogwood	Elder
Blackthorn	Field Maple	Hazel	
			TOTAL: 6

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD: 4	POND	**TOTAL: 8**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 201456	Hedge ref number: H6
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 1m

LENGTH: 253m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Dogwood	Spindle
Blackthorn	Field Maple	Hazel	Elder
			TOTAL: 7

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD: 4	POND	**TOTAL: 7**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 203453	Hedge ref number: H7
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2-4m

LENGTH: 511

WIDTH: 2-3m

PERCENTAGE GAPS: 5%

DESCRIPTION: A short section of remnant hedgerow unconnected to other hedgerows and forming part of green lane

WOODY SPECIES PRESENT[1]	Hawthorn	Field-rose	Wayfaring tree
Wild privet	European gorse	Elder	Blackthorn
			Hazel
Sycamore	Field maple	English elm	**TOTAL: 7 (+4)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE	WOOD:	POND	**TOTAL: 0**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST201455	Hedge ref number: H8
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 220m

WIDTH: 2m

PERCENTAGE GAPS: 20%

DESCRIPTION: Northern and southern ends comprise mature, managed hedgerow, central part has been replanted but is gappy and comprises abundant bramble. Black and White Bryony present.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog Rose	Blackthorn
English Elm			
		Field Maple	**TOTAL: 4 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 203457	Hedge ref number: H9
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 171m

WIDTH: 1m

PERCENTAGE GAPS: 0%

DESCRIPTION: A short section of remnant hedgerow unconnected to other hedgerows and forming part of green lane

WOODY SPECIES PRESENT[1]	Hazel	Field maple	Dogwood
Hawthorn	Wild privet	Spindle	
			TOTAL: 6

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 21/05/09
Central NGR: ST 203457	Hedge ref number: H10
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3.5m

LENGTH: 152m

WIDTH: 2m

PERCENTAGE GAPS: 20%

DESCRIPTION: A very short hedgerow connecting two broad-leaved woodlands. Field access through hedge – this accounts for the 20% gap.

WOODY SPECIES PRESENT[1]	Elder	Field maple	Field rose
English elm	Spindle	Hawthorn	Blackthorn
			TOTAL: 7

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 1	WOOD: 4	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST201458	Hedge ref number: H11
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3.5m

LENGTH: 270m

WIDTH: 1m

PERCENTAGE GAPS: 2%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Field Maple
Hazel	Dogwood	Dog Rose	Spindle
			Wayfaring Tree
English Oak	Ash	English Elm	**TOTAL: 7 (+4)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD: 2	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 19/03/07
Central NGR: ST 203458	Hedge ref number: H12
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 137m

WIDTH: 1m

PERCENTAGE GAPS: 0%

DESCRIPTION: A diverse hedge located around a stream that is infrequently managed.

WOODY SPECIES PRESENT[1]	Elder	Dogwood	Hazel
Wild Proviet	Dog rose	Grey willow	
		English Elm	**TOTAL: 6 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD: 2	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 21/05/09
Central NGR: ST 201459	Hedge ref number: H13
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 328m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hazel	Field maple	Dogwood
Hawthorn	Wild privet	Blackthorn	English elm
	Elder	Dog rose	**TOTAL: 7 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE	WOOD: 4	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 21/05/09
Central NGR: ST 199460	Hedge ref number: H14
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2-3m

LENGTH: 247m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Elder	Dog rose	Blackthorn
Hawthorn	Field maple	Spindle	Ash
		Privet	**TOTAL: 7 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE	WOOD: 2	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 21/05/09
Central NGR: ST 196458	Hedge ref number: H15
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2-3m

LENGTH: 186m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Hazel
Field maple	Dogwood		
			TOTAL: **5**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND: 2	**TOTAL:** **4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 20/07/09
Central NGR: ST 197457	Hedge ref number: H16
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2-3m

LENGTH: 168m

WIDTH: 1.5m

PERCENTAGE GAPS: 5%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hazel	Field maple	English elm
			TOTAL: 5

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND: 2	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 20/07/09
Central NGR: ST 196455	Hedge ref number: H17
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2-5m

LENGTH: 337m

WIDTH: 3-5m

PERCENTAGE GAPS: 15%

DESCRIPTION: Hedgerow is mature and comprises predominantly English elm (some of which is dead or diseased). Ground flora does not support typically woodland species but does contain a range of calcareous grassland indicator species including salad burnet, ladies-bedstraw and dwarf thistle

WOODY SPECIES PRESENT[1]	English elm	Blackthorn	Dog-rose
Hawthorn	Field maple		
		Elder	**TOTAL: 5 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND:	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 20/07/09
Central NGR: ST 201454	Hedge ref number: H18
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 199

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Goat willow	Hawthorn	English elm
Blackthorn			
			TOTAL: 4

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND:	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 20/07/09
Central NGR: ST 201453	Hedge ref number: H19
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 1-5m

LENGTH: 326m

WIDTH: 2-4m

PERCENTAGE GAPS: 7%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	English elm	Blackthorn	Hawthorn
Field maple	Dog-rose	Wild privet	
			Hazel
Elder	Spindle	European gorse	**TOTAL: 6 (+4)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 5	WOOD:	POND:	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 17/07/09
Central NGR: ST 207454	Hedge ref number: H22
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2.5m

LENGTH: 125m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Blackthorn	Wild privet	Dogwood
Field maple	English elm		
	Field-rose	Elder	**TOTAL: 4 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND:	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

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Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

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Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 17/07/09
Central NGR: ST 207455	Hedge ref number: H22
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 202m

WIDTH: 1.5m

PERCENTAGE GAPS: 5%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Wild privet
Dogwood	Elder		
			TOTAL: 5

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND:	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 17/07/09
Central NGR: ST 195453	Hedge ref number: H24
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 277m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION: Hedgerow is mature and species-rich. Ground flora does not support typically woodland species but does contain a range of calcareous grassland indicator species including salad burnet, ladies-bedstraw and greater knapweed.

WOODY SPECIES PRESENT[1]	Blackthorn	Hawthorn	English elm
Dog-rose	Elder	Field maple	Wild priver
			TOTAL: 7

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND:	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST207450	Hedge ref number; H25
SURVEYOR; Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 120m

WIDTH: 2m

PERCENTAGE GAPS: 2% (for gate)

DESCRIPTION: Likely to have been planted fairly recently. The hedge is compact, managed and dense. Species-poor ground flora dominated by ivy and nettle.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog rose	Blackthorn
		Black Bryony	**TOTAL: 3 (+1)**

FEATURES

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST207448	Hedge ref number: H26
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 1.5 – 2.5m

LENGTH: 365m

WIDTH: 2.5m

PERCENTAGE GAPS: 2% (for gate)

DESCRIPTION: Managed at northern end, but becomes less managed and taller and wider to the south. Semi-mature in southern section. Species-poor ground flora dominated by ivy and nettle.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog rose	Blackthorn
English Elm	Ash		
			TOTAL: 5

FEATURES

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST207446	Hedge ref number: H27
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 1.5 – 2.5m	LENGTH: 115m
WIDTH: 2.5m	
PERCENTAGE GAPS: 0%	
DESCRIPTION:	

WOODY SPECIES PRESENT[1]	Dogwood	Dog rose	Blackthorn
English Elm	Wild Privet		
Elder	Field Maple	Hawthorn	**TOTAL: 5 (+3)**

FEATURES

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 1	WOOD	POND	**TOTAL: 1**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST205446	Hedge ref number: H28
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m (4m where trees occur) LENGTH: 80m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION: Hedge on south side of stream (outside site boundary) and bordering an improved field. Little apparent management. Abundant bramble. Himalayan Balsam present.

WOODY SPECIES PRESENT[1]	Dogwood	English Oak	Blackthorn
Elder	Field Maple	Hazel	Ash
			TOTAL: 7

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 1	WOOD	POND	**TOTAL: 1**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST204447	Hedge ref number: H29
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 370m

WIDTH: 2m

PERCENTAGE GAPS: 2% (for gate)

DESCRIPTION: Species-diverse regularly managed (but not over-managed) hedge. Grass and ruderal species on both sides. Intermittent ditch and bank.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog rose	Blackthorn
Elder	Field Maple	English Elm	Ash
	Dogwood	Hazel	**TOTAL: 7 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST205449	Hedge ref number: H30
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 280m

WIDTH: 1.5m

PERCENTAGE GAPS: 4%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Dog rose	Blackthorn
Dogwood	Field Maple	Spindle	Ash
			Wayfaring Tree
Wild Privet	English Oak	English Elm	**TOTAL: 7 (+4)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST204451	Hedge ref number: H31
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 480m

WIDTH: 1.5m

PERCENTAGE GAPS: 4%

DESCRIPTION: Mature dead elms. Damp ditch with intermittent water along entire length.

WOODY SPECIES PRESENT[1]	Hawthorn	Dog rose	Blackthorn
Dogwood	Field Maple	Wild Privet	
			English Elm
Wild Privet	Spindle	Elder	**TOTAL: 6 (+4)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 6	WOOD: 2	POND	**TOTAL: 8**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST202449	Hedge ref number: H32
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2 - 3m

LENGTH: 160m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION: Infrequently managed and quite dense

WOODY SPECIES PRESENT[1]	Hawthorn	Dog rose	Blackthorn
Dogwood	Field Maple	English Elm	Elder
	Spindle	Hazel	**TOTAL: 7 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 5	WOOD:	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
NGR: ST203449	Hedge ref number: H33
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 200m

WIDTH: 1m

PERCENTAGE GAPS: 2%

DESCRIPTION: Dominated by Elm and Bramble

WOODY SPECIES PRESENT[1]	Field Maple	English Elm	Dog rose
			TOTAL: 3

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 5	WOOD:	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST202447	Hedge ref number: H34
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2 - 4m

LENGTH: 400m

WIDTH: 1.5m

PERCENTAGE GAPS: 2%

DESCRIPTION: Northern part of hedgerow uniform and managed, southern part is taller. Ground flora dominated by bramble, nettle and cleavers throughout. English Elm is the dominant species with abundant blackthorn.

WOODY SPECIES PRESENT[1]	Field Maple	English Elm	Dog rose
Hawthorn	Blackthorn	Dogwood	
		English Oak	**TOTAL: 6 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST200448	Hedge ref number: H35
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 80m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Field Maple	Wayfaring Tree	Dog rose
Hawthorn	Blackthorn	Wild Privet	Ash
			TOTAL: 7

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST200449	Hedge ref number: H36
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 1.5 - 5m

LENGTH: 40m

WIDTH: 4m

PERCENTAGE GAPS: 0% (but not stock proof)

DESCRIPTION: Wide hedge/broad-leaved woodland, supplemented with additional broad-leaved planting of beech and ash. Possibly not a hedge.

WOODY SPECIES PRESENT[1]	Field Maple	English Oak	Sycamore
Hawthorn	Blackthorn	Apple	Ash
Beech			
			TOTAL: 8

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD: 2	POND	**TOTAL: 6**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

No Photo

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST200449	Hedge ref number: H37
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 5 – 6m

LENGTH: 160m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION: Mature hedge, turning into a tree line.

WOODY SPECIES PRESENT[1]	Field Maple	Dog rose	Wild Privet
Hawthorn	Blackthorn	Dogwood	Goat willow
	Wayfaring Tree	Elder	**TOTAL: 7 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST200449	Hedge ref number: H38
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 160m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION: Similar to H37, boundary between pasture and planted broad-leaved woodland. Likely to have previously been a hedge, which is less managed and is becoming a treeline. Bramble is abundant and willow has been planted.

WOODY SPECIES PRESENT[1]	Field Maple	Crack willow	English Elm
Hawthorn	Blackthorn	Dogwood	
			TOTAL: 6

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 5	WOOD:	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST201449	Hedge ref number: H39
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 160m

WIDTH: 1m

PERCENTAGE GAPS: 5% (not stock proof)

DESCRIPTION: Planted hedgerow (age of planting unknown), fenced and appears to be managed fairly frequently.

NOT IMPORTANT IF PLANTED LESS THAN 30 YEARS AGO - CHECK

WOODY SPECIES PRESENT[1]	Field Maple	Hawthorn	Blackthorn
Sea Buckthorn			
			TOTAL: 4

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 5	WOOD:	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST200449	Hedge ref number: H40
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 160m

WIDTH: 1m

PERCENTAGE GAPS: 40%

DESCRIPTION: Remnant gappy hedgeline, with stock damage and trampling around the base. Bramble is abundant.

WOODY SPECIES PRESENT[1]	Field Maple	Hawthorn	Blackthorn
Dog Rose	Goat Willow		
	Elder	English Elm	**TOTAL: 5 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST198448	Hedge ref number: H41
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2 - 4m

LENGTH: 290m

WIDTH: 2 - 3m

PERCENTAGE GAPS: 10%

DESCRIPTION: Wide hedgerow with a strip of broad-leaved planting to the south. Dense and therefore dark underneath.

WOODY SPECIES PRESENT[1]	Elder	Hawthorn	Blackthorn
Dog Rose	Dogwood	Wayfaring Tree	
	Apple	Ash	**TOTAL: 6 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST197448	Hedge ref number: H42
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2 - 3m

LENGTH: 90m

WIDTH: 1 – 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION: Hedge adjacent to bridleway and is unmanaged (or very infrequently managed) on the track side.

WOODY SPECIES PRESENT[1]	Elder	Hawthorn	Blackthorn
Dog Rose	Dogwood	English Elm	Wild Privet
	Field Maple	Ash	**TOTAL: 7 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST197450	Hedge ref number: H43
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 3 – 5m

LENGTH: 250m

WIDTH: 1 – 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION: Hedge adjacent to bridleway and is unmanaged (or very infrequently managed) on the track side.

WOODY SPECIES PRESENT[1]	Ash	Hawthorn	Blackthorn
Dog Rose	Dogwood	English Elm	Field Maple
		Wild Privet	Hazel
Holly	Goat Willow	Wayfaring Tree	**TOTAL: 7 (+5)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST197446	Hedge ref number: H43a
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 3 – 5m

LENGTH: 300m

WIDTH: 1 – 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Ash	Hawthorn	Blackthorn
Dog Rose	Field Maple	English Elm	
			TOTAL: 6

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD: 2	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST198450	Hedge ref number: H44
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 5m

LENGTH: 120m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Wild Privet	Hawthorn	Blackthorn
Dog Rose	Field Maple	Wayfaring Tree	
			TOTAL: 6

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST198450	Hedge ref number: H45
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

HEDGE STRUCTURE:

HEIGHT: 2.5m

LENGTH: 40m

WIDTH: 2.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Elder	Hawthorn	Blackthorn
Dog Rose	Field Maple		
			TOTAL: 5

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST198450	Hedge ref number: H46
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2m

LENGTH: 70m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION: Hedge is species-poor in terms of woody species but has species-rich ground flora.

WOODY SPECIES PRESENT[1]	Field Maple	Hawthorn	Blackthorn
Dog Rose			
			TOTAL: 4

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST199451	Hedge ref number: H47
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2 - 3m

LENGTH: 130m

WIDTH: 2 - 4m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Field Maple	Hawthorn	Blackthorn
Dog Rose			
	Goat Willow	Ash	**TOTAL: 4 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST198451	Hedge ref number: H48
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2 - 5m

LENGTH: 170m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION: White Bryony

WOODY SPECIES PRESENT[1]	Field Maple	Hawthorn	Blackthorn
Dog Rose	Wild Privet		
Spindle	English Elm	Ash	**TOTAL: 5 (+3)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST200452	Hedge ref number: H49
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 170m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION: White Bryony

WOODY SPECIES PRESENT[1]	Field Maple	Hawthorn	Blackthorn
Dog Rose	Wild Privet	Dogwood	Spindle
Ash	Elder		
			TOTAL: 9

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum)

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST203452	Hedge ref number: H50
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m | LENGTH: 400m

WIDTH: 2m

PERCENTAGE GAPS: 2%

DESCRIPTION: White Bryony

WOODY SPECIES PRESENT[1]	Hawthorn	Dog Rose	Blackthorn
Field Maple	Dogwood		
			Wild Privet
English Elm	Ash	Spindle	**TOTAL: 5 (+4)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 6	WOOD:	POND	**TOTAL: 6**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST206453	Hedge ref number: H51
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 250m

WIDTH: 2m

PERCENTAGE GAPS: 2%

DESCRIPTION: UPDATE

WOODY SPECIES PRESENT[1]	Hawthorn	English Elm	Blackthorn
Field Maple			
	Elder	Dog Rose	**TOTAL: 4 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 5	WOOD:	POND	**TOTAL: 5**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 13/05/09
Central NGR: ST208454	Hedge ref number: H52
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2 - 4m

LENGTH: 180m

WIDTH: 2 - 3m

PERCENTAGE GAPS: 0%

DESCRIPTION: Hedge along Power Station access road, mainly unmanaged and quite wide with many semi-mature trees. Abundant bramble.

WOODY SPECIES PRESENT[1]	Hawthorn	Ash	Blackthorn
Field Maple	Dogwood	Sycamore	Dog Rose
Apple	Wild Privet	Whitebeam	**TOTAL: 7 (+3)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 2	WOOD:	POND	**TOTAL: 2**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

No picture

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST206452	Hedge ref number: H54
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 170m

WIDTH: 1m

PERCENTAGE GAPS: 2%

DESCRIPTION: Hedge is dominated by Elm at the eastern end and blackthorn at the western end.

WOODY SPECIES PRESENT[1]	Hawthorn	English Elm	Blackthorn
Field Maple	Goat Willow	Dog Rose	
	Apple	Elder	**TOTAL: 6 (+2)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley | Date: 14/05/09

Central NGR: ST205452 | Hedge ref number: H55

SURVEYOR: Gemma Lee | No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 60m

WIDTH: 2m

PERCENTAGE GAPS: 10% (for gate)

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	English Elm	Dog Rose
Field Maple			
			TOTAL: 4

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST204451	Hedge ref number: H56
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 1 – 2m

LENGTH: 200m

WIDTH: 1m

PERCENTAGE GAPS: 45%

DESCRIPTION: Defunct/remnant hedge, nearer to a line of scrub. Abundant bramble.

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Dog Rose
			TOTAL: 3

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST201451	Hedge ref number: H57
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m — LENGTH: 120m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Dog Rose
Field Maple	Goat Willow		
		Spindle	**TOTAL: 5 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST203451	Hedge ref number: H58
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m

LENGTH: 90m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Dog Rose
Field Maple	Goat Willow		
		English Elm	**TOTAL: 5 (+1)**

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST203451	Hedge ref number: H59
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 3m — LENGTH: 40m

WIDTH: 1.5m

PERCENTAGE GAPS: 15% (gap for gate)

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Dog Rose
Apple	Ash		
			TOTAL: 5

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 3	WOOD:	POND	**TOTAL: 3**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

No picture

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST205451	Hedge ref number: H60
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 2 - 3m

LENGTH: 90m

WIDTH: 1.5m

PERCENTAGE GAPS: 0%

DESCRIPTION:

WOODY SPECIES PRESENT[1]	Hawthorn	Blackthorn	Dog Rose
Field Maple	English Elm		
			TOTAL: 5

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

Hedge Survey Proforma

Site Name: Hinkley	Date: 14/05/09
Central NGR: ST204453	Hedge ref number: H61
SURVEYOR: Gemma Lee	No. of Photos:

Hedges should be surveyed if they are over 20m in length, are less than 20m but meet another hedge or have gaps less than 20m in length. Hedges around houses or gardens are excluded. Count number of woody species in 30m per 100m of hedge and divide aggregate by 2 (hedges up to 200m) or 3 (hedges over 200m).

APPROXIMATE HEDGE STRUCTURE:

HEIGHT: 4m

LENGTH: 140m

WIDTH: 2m

PERCENTAGE GAPS: 0%

DESCRIPTION: Dense and infrequently managed at the edges, interior is quite open and dominated by ivy and nettle.

WOODY SPECIES PRESENT[1]	English Elm	Blackthorn	Elder
Wild Privet			
			TOTAL: 4

FEATURES (those present in red)

BANK OR WALL (along at least ½ of the length)	1 STANDARD TREE Per/50M	DITCH (along at least ½ of the length)	PARALLEL HEDGE WITHIN 15M
ADJACENT TO BW/FP (only relevant if there are four woody species and two features)	HEDGE INTACT (gaps totalling less than 10%)	3 FLORA SP (within 1m in any direction of the outermost edges of the width of the hedge)	**Box X** BLACK POPLAR, LARGE SMALL LEAVED LIME, WILD SERVICE TREE

CONNECTIONS

a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points. A hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued. Scores of over 4 equal 1 feature.

HEDGE 4	WOOD:	POND	**TOTAL: 4**

SUMMARY OF WHAT CONSTITUTES AN ECOLOGICALLY IMPORTANT HEDGE (in red if applicable)

7 WOODY SPECIES IN A 30M LENGTH	6 WOODY SPECIES AND 3 FEATURES	6 WOODY SPECIES AND ONE IN BOX X	5 WOODY SPECIES AND 4 FEATURES
4 WOODY SPECIES AND 2 FEATURES IF ADJACENT TO BW/FB	CONFIRMED PRESENCE of legally protected species	PRESENCE of endangered, extinct, rare of vulnerable plants or invertebrates listed in the books referenced in the REGs.	

[1] Red text = those within 30m survey area.

WOODLAND FLORA SPECIES

(Those present in red)

Barren strawberry (Potentilla sterilis)

Bluebell (Hyacinthoides non-scriptus)

Broad buckler fern (Dryopteris dilatata)

Broad-leaved helleborine (Epipactis helleborine)

Bugle (Ajuga reptans)

Common cow-wheat (Melampyrum pratense)

Common dog violet (Viola riviniana)

Common polypody (Polypodium vulgare)

Dog's mercury (Mercurialis perennis)

Early dog violet (Viola reichenbachiana)

Early purple orchid (Orchis mascula)

Enchanter's nightshade (Circaea lutetiana)

Giant fescue (Festuca gigantea)

Goldilocks buttercup (Ranunculus auricomus)

Great bell-flower (Campanula latifolia)

Greater wood-rush (Luzula sylvatica)

Hairy brome (Bromus ramosus)

Hairy woodrush (Luzula pilosa)

Hard fern (Blechnum spic*ant)*

Hard shield fern (Polystichum aculeatum)

Hart's tongue (Asplenium scolopendrium)

Heath bedstraw (Galium saxatile)

Herb paris (Paris quadrifolia)

Herb-Robert (Geranium robertianum)

Lady fern (Athyrium filix-femina)

Lords-and-ladies (Arum maculatum)

Male fern (Dryopteris filix-mas)

Moschatel (Adoxa moschatellina)

Narrow buckler-fern (Dryopteris carthusiana)

Nettle-leaved bell-flower (Campanula trachelium)

Oxlip (Primula elatior)

Pignut (Conopodium majus)

Primrose (Primula vulgaris)

Ramsons (Allium ursinum)

Sanicle (Sanicula europaea)

Scaly male-fern (Dryopteris affinis)

Small cow-wheat (Melampyrum sylvaticum)

Soft shield fern (Polystichum setiferum)

Sweet violet (Viola odorata)

Toothwort (Lathraea squamaria)

Tormentil (Potentilla erecta)

Wild strawberry (Fragaria vesca)

Wood anemone (Anemone nemorosa)

Wood avens (Geum urbanum)

Wood false brome (Brachypodium sylvaticum)

Wood horsetail (Equisetum sylcaticum)

Wood meadow grass (Poa nemoralis)

Wood melick (Melica uniflora)

Wood millet (Millium effusum)

Wood sage (Teucrium scorodonia)

Wood sedge (Carex sylvatica)

Wood sorrel (Oxalis acetosella)

Wood speedwell (Veronica montana)

Wood spurge (Euphorbia amygdaloides)

Woodruff (Galium odoratum)

Yellow archangel (Lamiastrum galeobdolon)

Yellow pimpernel (Lysimachia nemorum*)*

PICTURE(S) OF HEDGEROW:

APPENDIX 20B: HINKLEY ORNITHOLOGICAL SURVEY REPORT

EDF Energy Ltd

Hinkley

Ornithological Report

May 2011

AMEC Environment & Infrastructure UK Limited

AMEC Environment & Infrastructure UK Limited

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EDF Energy Ltd

Hinkley

Ornithological Report

May 2011

AMEC Environment & Infrastructure
UK Limited

Document Revisions

19801rr376 revC	Report template changed for consistency reasons but no other changes have been made	Not relevant as content unchanged since original issue date

Contents

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as ‘Hinkley C’) on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now part of AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, excluding coastal/marine biodiversity other than birds. This report summarises the programme of ornithological work undertaken at Hinkley during 2007-09, including the following:

- Breeding bird surveys undertaken between April and July (inclusive) 2007;
- Intertidal and Inshore Marine Surveys undertaken between April 2007 and March 2009 inclusive;
- Daytime Field Surveys undertaken between September 2007 and April 2009 inclusive; and

Nocturnal Field Surveys undertaken between December 2007 and May 2008 inclusive and between August 2008 and March 2009 inclusive.

1.2 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. In 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1.1).

The study area for some of the bird survey work described in this report extends beyond the SSA to include other nearby bird habitats that, at the time that the survey work was undertaken, were assessed as potentially being affected by the construction of Hinkley C. The survey area for each of the bird surveys that was undertaken is described in section 2.2.

1.3 Scheme Description

An area of land directly west of the Hinkley ‘A’ and ‘B’ Power Stations has been identified as having the potential to accommodate nuclear new build. The new power station and the majority of associated permanent terrestrial infrastructure will be situated in fields adjacent to the coast[1], with additional temporary infrastructure located to the south of this (e.g. construction compounds and areas for soil storage).

[1] Extending as far inland as the east-west Green Lane (also a footpath) that runs along the ridge towards the middle of the SSA.

New build will also require additional infrastructure remote from the immediate terrestrial site footprint. This will include a warm water intake and outfall and a marine aggregates jetty extending offshore from the intertidal zone adjacent to the northern SSA boundary.

An upgrade to an exisiting wharf on the River Parrett (to take abnormal indivisible loads) and a bypass around the village of Cannington will also be required to facilitate the construction and operation of the power station. These proposed 'associated developments' have both required considerable ornithological survey work, but this is not summarised in this document.

1.4 Strategic Siting Area Description and Context

The SSA comprises open, gently rolling mixed lowland farmland with hedgerows of variable quality, small scrubby[2] woodlands and occasional standard trees. Much of the area is intensively managed, and there is little semi-natural habitat present away from the cliff edge and the immediate vicinity of the built plant.

The northern SSA boundary lies adjacent to the Bristol Channel from which it is separated by a low cliff, between five and ten metres in height that forms an escarpment between the land and sea. At low tide, the shore adjacent to the SSA comprises a relatively narrow neck of rock (extending to approximately 200m from the cliff and running parallel to it), interspersed with and fringed by muddy sand. Intertidal areas to the west include more extensive areas of mobile sand, while to the east, adjacent to the built nuclear power stations, the intertidal rock platforms, mud and sand extend up to 500m from shore at low water. Further east again, approximately 1km from the proposed build area, the mosaic of intertidal habitats grades into an area of open mud and sand known as Stert Bay.

Areas of land within close proximity to the built nuclear plant have been managed to create a mosaic of habitats. This has been completed through a land management plan; initiatives have included the mowing and harrowing of grassland, establishment and management of scrub and the creation of one of the aforementioned pools. The result has been the establishment of range of habitat types including flower rich grassland (much of which has calcareous influences), woodland, scrub and reedbed.

There are no substantial water-bodies within the SSA boundary, although two streams (Bum Brook on the southern SSA boundary and the Holford Stream in the valley to the south of the Green Lane) run east-west to connect to watercourses within the Bridgewater Bay SSSI. A more substantial drain (or rhyne) forms the boundary between the eastern arm of the SSA and Wick Moor (North Moor). Standing water is also limited in extent, with the largest pools being to the south of the plant sewage works and in the plant nature reserve (Pixies Field).

The eastern boundary of the SSA is formed (moving north to south) by the operational nuclear plant, the Bridgewater Bay SSSI and mixed farmland which has similar characteristics to that found within the SSA boundary. This part of the SSSI consists of an area of flat, open improved grassland which is seasonally grazed. To the south and west of the site there is further mixed farmland and a series of small villages including Wick, Shurton and Knighton.

[2] Given their coastal location it is likely that new growth is intermittently 'burnt off.' As a result the woodlands are dense and have a low canopy. Woodland only occurs (in terms of the planning application boundary) within a few hundred metres of the coast (there is one additional plantation towards the southern boundary – but this is immature).

1.5 Background and Scope

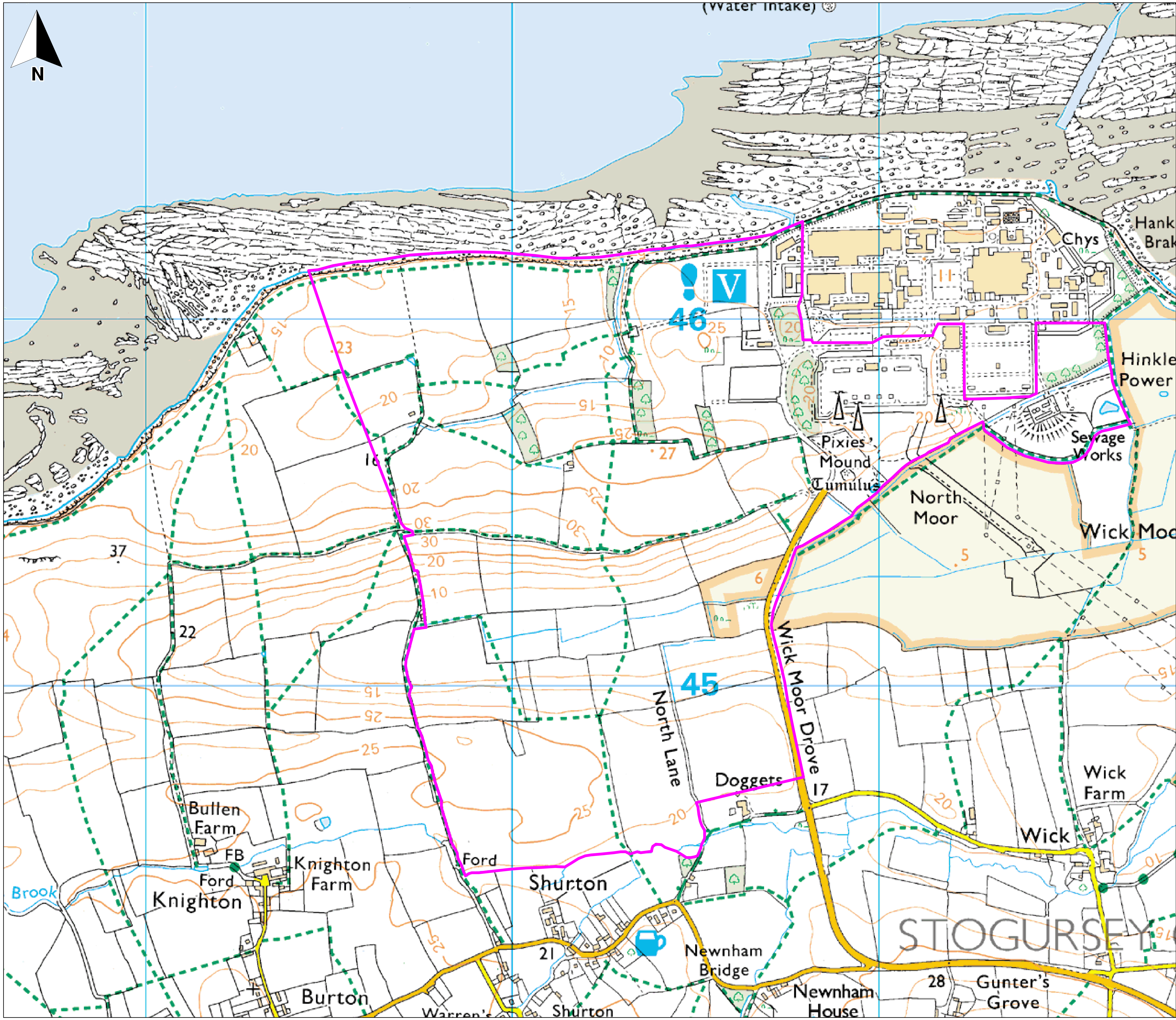
The key potential ornithological issues relating to the development are:

- The effects of direct habitat loss to birds due to land take by the proposed power station, any new access road and construction compounds;
- The effects of indirect habitat loss, i.e. the displacement of birds from the proximity of the proposed development and associated infrastructure as a result of disturbance. Such disturbance may occur as a consequence of construction work, or due to the presence of the power station or associated infrastructure close to nesting or feeding sites or on habitual flight routes;
- The fragmentation of habitat and the potential barrier to movement resulting from a new power station, particularly as a result of the construction of a new access road;
- Thermal regime change (caused by discharge of cooling water) leading to changes in the composition of intertidal benthic communities and the abundance and biomass of individual invertebrate prey species within them; and
- The potential of the impacts identified above to have significant adverse effects on the species that form the cited/designated interest of the European and nationally designated sites adjacent to the planning application boundary.

There is no guidance available that details potentially appropriate methodologies for ornithological survey work aimed at informing EIA for new nuclear power station proposals. The bird survey programme for Hinkley was therefore based on the results of desk study, consultation (with Natural England and RSPB) and professional judgment. The potential for species protected under Schedule 1 of the Wildlife & Countryside Act 1981 (as amended)[3] and/or listed under Annex 1 of the EC Directive on the Conservation of Wild Birds (79/409/EEC), commonly referred to as the Birds Directive[4] to occur within the SSA and surrounding areas was the subject of specific investigation. Migratory water birds forming part of the featured interest of designated sites were also considered. As a result of the desk study, a survey programme incorporating a range of generic bird surveys was instigated.

[3] All species of wild birds are afforded some degree of protection under the Wildlife and Countryside Act 1981 (as amended). Some species are considered to be rare or vulnerable and receive increased protection through their inclusion on Schedule 1 of the Act.

[4] Certain endangered, rare, or vulnerable bird species, which warrant special protection, are included on Annex 1 of the European Communities Council Directive on the Conservation of Wild Birds (79/409/EEC).



Key

SSA Boundary

0 m 500 m

Scale 1:10,000 @ A3

Hinkley Ornithological Survey Report

Figure 1.1
Site location

December 2009
19801-R600b.wor adamk

2. Methodology

2.1 Desk Study

To understand the ornithological context of the SSA, the locations and qualifying features of Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs) within 5km of the boundary were determined through the use of the websites www.magic.gov.uk, www.jncc.gov.uk, www.naturalengland.org.uk, and other published sources. There are no established criteria with regard to the distance from a development site that a search should cover, and 2km has been suggested as a sufficient distance in the past (e.g. IEA, 1995). Due to the known ornithological interest of nearby intertidal habitats, however, this search area was extended to 5km for European and nationally important sites[5]. The ornithological interest of non-statutory designated sites within 3km of the proposed new build and associated infrastructure were also considered. The positions of these designations in relation to the SSA are shown on **Figures 2.1** and **2.2**.

A considerable amount of baseline ecological survey work has been conducted at Hinkley during the past 25 years. This has been undertaken by a range of organisations including British Energy's[6] and EDF Energy's conservation wardens, and ecological consultants (commissioned by Nuclear Electric and latterly by British Energy and EDF Energy.). A great deal of baseline survey work was undertaken between 1981 and 1986 in preparation for the submission of the Hinkley 'C' station planning application. This information was made available to Entec by British Energy to help determine the scope of the ornithological survey programme. Additional data from survey work commissioned by Magnox in association with the decommissioning of Hinkley 'A,' and the West Hinkley Wind Farm Environmental Statement (this wind farm proposal is for land adjacent to the proposed build area) were also used to inform the work.

In addition to this information, a number of further primary sources of data were identified and used to inform the work. These included:

- The results of annual breeding and wintering bird surveys conducted by British Energy's Conservation Warden and ADAS on parts of British Energy's land ownership (summarised in the annual land management reviews by ADAS / British Energy);
- A history of the birds of Somerset (Ballance, 2006);
- Somerset Birds 2005-09 (the annual county bird reports); and
- Wetland Bird Survey annual report 2008/09 (Calbrade *et al.*, 2010).

[5] This allowed greater contextual information with regard to bird populations (e.g. for the potential for movement between sites). This could have been re-evaluated if geese or swans (or large numbers of other species that make considerable daily commutes between feeding and roosting areas) were located during the work.

[6] British Energy became part of EDF Energy in 2009.

A thorough desk study was undertaken with Wetland Bird Survey[7] (WeBS) data obtained from the British Trust for Ornithology and general bird sightings records obtained from the Somerset Ornithological Society.

2.2 Bird Surveys

2.2.1 Overview of Survey Area

The key objective of the bird surveys undertaken at Hinkley during 2007-09 was to establish a suitable baseline for the assessment of the potentially significant effects on birds of a new nuclear power station and associated infrastructure. The breeding bird community within the SSA and surrounding land was characterised though territory mapping surveys. The numbers and diversity of bird species feeding, loafing[8] or commuting through the intertidal zone and inshore waters adjacent to the SSA and the existing power station were investigated through regular watches at a number of suitable coastal locations. In addition, walkover (field) surveys were conducted during daylight hours and at night in order to determine whether any significant congregations of feeding, roosting or loafing birds occurred on fields (in particular wildfowl, waders and raptors) within or in close proximity to the SSA. The area within which each bird survey methodology was undertaken is described in greater detail in Sections 2.2.2-2.2.5.

2.2.2 Territory Mapping

Territory mapping surveys based on the BTO's Common Bird Census (CBC) methodology (Marchant, 1983) were carried out in 2007 in areas within 1km of the land that was owned by British Energy (excluding the built nuclear plant). These surveys therefore covered the entire SSA boundary. Of the area covered in 2007, 75ha / 0.75km^2 of land was under British Energy's ownership (of which the built power station accounted for 42ha / 0.42km^2), and outside this area access permission was only achieved for Wick Moor, which is part of the Bridgwater Bay SSSI.

Within British Energy's land ownership and on the SSSI, transects no further than 50m apart were walked across all open habitats, while all field boundaries, the edge of the small reedbed and the edge of the small belts of semi-natural woodland were also walked. Outside British Energy's land ownership and Wick Moor SSSI, access was restricted, and surveys could only be conducted from public footpaths and bridleways, road and tracks. Therefore, outside areas with access permission, a series of transects were walked to enable characterisation of the wider bird community.

While the areas outside the British Energy land ownership and SSSI are very well served by footpaths, it is clear that robust breeding densities cannot be reliably derived from them as a result of the survey work. The aim of the survey, in conjunction with data from other sources (such as the West Hinkley Wind Farm application) was to characterise the bird community of the area and to provide a basis to assess the value of the community potentially affected by the

[7] WeBS is the main scheme for monitoring the numbers of non-breeding waterbirds in the UK. The principal aims of WeBS are to identify population sizes, determine trends in numbers and distribution and to identify important sites for waterbirds. WeBS counts are predominantly undertaken by skilled volunteers.

[8] Being inactive, but not actually roosting.

build. The survey area for the territory mapping work and British Energy's land ownership boundary (during the 2007 survey), are shown on **Figure 2.3**.

While eight to ten visits are the norm for CBC sites being monitored over the long-term, where territory mapping is being used for the purpose of assessing potential environmental impacts it is generally accepted that three to four visits are sufficient to determine the numbers and densities of breeding birds with reasonable accuracy. Four survey visits were therefore undertaken at Hinkley. It took a total of three man days to complete each survey visit (two surveyors worked together). The dates on which surveys were conducted were as follows:

- 10 and 11 April 2007;
- 23 and 24 May 2007;
- 13 and 15 June 2007;
- 19 and 21 June 2007.

Supplementary records of birds recorded outside timed surveys were also used when compiling the final territory map, along with information supplied by Martin Sage of ADAS (who are responsible for the conservation management of British Energy's land ownership and conduct annual bird surveys in collaboration with the site warden).

2.2.3 Intertidal and Inshore Marine Bird Survey

In order that any potential disturbance effects on birds using the intertidal areas and inshore marine waters adjacent to the SSA could be evaluated, intertidal and inshore marine bird surveys were undertaken between April 2007 and March 2009 inclusive. Surveys were undertaken on a regular basis during the entire survey period from five observation points. OS Grid References of these are as follows:

- ST19131 45837;
- ST19923 46162;
- ST20838 46284;
- ST21468 46318;
- ST21786 46088.

These locations, and the areas surveyed from them are shown on **Figure 2.4**. All waders, wildfowl and seabirds flying over the intertidal area and the inshore waters up to 500m from the shore were systematically recorded[9]. Numbers and apparent behaviour of all species were noted and their position in relation to the survey location estimated (with the aid of rangefinders).

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[9] 500m offshore from each location was selected as the maximum threshold for recording on the basis that all relevant bird species within this distance were generally identifiable in normal sea states and weather conditions, and accurate and comparable counts could therefore be made. It is also apparent that any disturbance effects are most likely to affect birds occurring in relatively close proximity to the proposed power station. During quiet periods surveyors noted the presence of seabirds and large flocks of species outwith this survey area, while the open expanse of mud in Count Sector 5 was generally systematically recorded, meaning low water counts extended to 700-800m from the observation point.

Some limited parts of the survey area, particularly to the east and west of Location 2 were sufficiently distant from the observation point that individual birds, particularly those foraging on pool edges and in gullies could have been missed. In addition, there were several small blind spots in coverage around the upper reaches of the shore, due to the topography of the coast. The surveyors collected supplementary information from these areas during walks between the survey locations, and this is unlikely to have resulted in concentrations of birds being missed.

Table 2.1 Characteristics of the Shore within the Count Sectors[10]

Count Sector	Description of Extent and Characteristics of Shore at Mean High Water	Description of Extent and Characteristics of Shore at Mean Low Water
1	Approximately 10 to 20m of sand remains exposed on the upper shore throughout much of the sector. A strandline, mainly consisting of brown seaweed is present. The area of sand borders a superlittoral[11] storm beach. The eastern part of the sector has more rock at high water than sand.	Approximately 350-400m of open shore with large areas of sand bordered to the east by rock platforms and loose boulders. Some pools are present in the rocky areas, these being dominated by brown seaweeds.
2	Between 0 and 30m of exposed rock platforms partially covered by areas of pebble / boulder storm beach and a strand line dominated by brown seaweeds.	Slightly in excess of 200m of mainly solid rock platforms with some overlying large loose rocks. Some shallow gullies and pools dominated by brown seaweeds.
3	A strip of between 0 and 10m of loose boulders, some rock with pockets of shingle and an intermittent strand line.	Approximately 400-450m of open rock platforms traversed by narrow east-west bands of sand and mud and bordered by an extensive and dynamic area of open sand and mud in the western part of the count sector.
4	A boulder shore / storm beach of between 0 and 15m in width, with a brown seaweed dominated strand line. A relatively linear band of sand runs east from the survey location parallel to the coastal defence of the built nuclear power station.	Approximately 400-450m of exposed shore featuring a mosaic of areas of open rock (particularly around the warm water outfall) and extensive mud covered by loose pebbles and boulders with some pools
5	0 to 5m of sand with occasional boulders and a strand line following neap tides. Some areas of boulder shore/ storm beach in the western part of the sector.	Between 700 and 800m of very extensive open mud. Patchy areas of rock close to the survey location and in the western part of the count sector.

The aim of the survey work was to record the numbers, diversity and activity of birds present and to identify areas of importance for birds (in the intertidal zone and inshore marine waters) during the tidal cycle in relation to the SSA. On each survey day, survey was conducted over six full hours, so that any changes or patterns in bird distribution across the tidal cycle could be identified. During each hour of survey, the intertidal area and inshore waters within each count sector were scanned using binoculars for 45 minutes, and all species present or commuting

[10] This basic summary of the dominant intertidal habitats within each sector is included here to inform the reader. A more formal and scientific description of the shore will be produced as part of the marine **biological studies that will be an integral part of the EIA for the site.**

[11] The supralittoral zone is that area of the shoreline not normally covered by water, being above the tide line.

through were recorded[12]. There was then a ten to fifteen minute break in survey, to allow the surveyor to rest his eyes, walk between survey locations and regain focus before the next snapshot survey commenced.

During the first year of survey (April 2007 to March 2008 inclusive), intertidal surveys were undertaken approximately twice each week. During this period, a total of 495 hours of intertidal survey was completed, equating to 99 hours of observation at each survey location. Results from the surveys indicated that the intertidal area adjacent to the SSA was not used by large numbers of species that appear as cited/designated features of statutory designated sites within 5km, and therefore a less intensive survey programme was carried out in the second year (April 2008 to March 2009 inclusive). During this period, surveys were undertaken approximately once each week, with a total of 187.5 hours of survey completed, equating to 37.5 hours at each location. Table 2.2 presents the dates on which surveys were undertaken in the two survey years.

Table 2.2 Intertidal and Inshore Marine Survey Dates

Month	2007/08	2008/09
April	3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 24 & 25	1, 9, 18 & 24
May	9, 10, 11, 12, 13, 21, 22, 24 & 25	2, 9, 16, 22 & 31
June	12, 14, 15, 16, 19, 20, 21 & 22	7, 13, 22 & 27
July	3, 4, 5, 6, 18, 20, 21 & 30	4, 10, 18 & 24
August	10, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23 & 24	6, 15, 21 & 29
September	5, 6, 14, 19, 20, 22, 23, 24, 25, 26, 27 & 28	5, 11, 19 & 24
October	1, 2, 3, 4, 5, 6, 25, 27, 28, 29, 30 & 31	4, 10, 16, 23 & 31
November	13, 14, 15, 17, 18, 20, 21, 22, 23, 25, 27 & 28	7, 14, 21 & 27
December	4, 5, 7, 8, 10, 11, 13, 14, 15, 16, 18 & 19	5, 11, 18 & 23
January	8, 9, 11, 12, 13, 14, 16, 22, 23, 24, 26 & 27	11, 16, 22 & 30
February	11, 12, 13, 15, 16, 17, 22, 24, 25, 26, 27 & 29	5, 12, 19 & 26
March	2, 3, 10, 12, 13, 15, 16, 18, 19, 20 & 22	11, 13, 19 & 25

2.2.4 Daytime Field Surveys

In order to identify any significant concentrations of birds (particularly bird species listed as part of the qualifying interest of nearby designated sites) that might be using fields adjacent or close to the new build for foraging, loafing or roosting, field-by-field (walkover) surveys were

[12] The surveyor used a telescope to confirm identity and activity of birds as necessary. High quality rangefinders were used throughout the season to improve distance estimation, although these were not generally of use in estimating the distance of individual birds on the sea (due to the more reflective nature of the water than the bird often preventing a confident estimate of distance).

undertaken during daylight hours within approximately 1km of the initial works area (identified by British Energy) at Hinkley. This survey area covered the entire SSA plus the terrestrial part of the Severn Estuary SPA and Ramsar site and Bridgwater Bay SSSI adjacent to the SSA.

The daytime field surveys were carried out as instantaneous counts that recorded a snapshot of the birds present within each field at the time it was surveyed. The surveys involved scanning the fields from suitable local vantage points and recording the birds within them. Each field was given a unique identification number, which was logged onto a recording sheet during each survey, together with details of the species seen, their numbers and activity (e.g. foraging, loafing, roosting, etc.). The habitat and crop types in each of the fields in which birds were seen were also recorded on each visit. Although all species were recorded during the surveys, particular emphasis was given to the following:

- Any species cited/designated in the Severn Estuary SPA, Severn Estuary Ramsar site or Bridgwater Bay SSSI descriptions, either as assemblage species, or for their internationally or nationally important winter or passage populations at these sites;
- UK BAP, Local BAP species and species listed under Section 41(1) of the Natural Environment and Rural Communities Act 2006[13];
- Species of conservation concern (BoCC Red or Amber Listed species);
- Species listed in Schedule 1 of the Wildlife and Countryside Act 1981 (as amended);
- EU Birds Directive Annex 1 species not covered in these categories;
- All other wader species;
- All other wildfowl species (swans, ducks and geese); and
- Flocks of 50 or more birds of any other species (e.g. wintering passerines).

Figure 2.5 shows the field identification numbers and survey area for the daytime field surveys. Each month, a full audit of habitat and crop types within each field was carried out using a predetermined set of habitat/crop type categories, with further categories added during the survey if necessary. The predetermined habitat/crop types included: *Ploughed*, *Winter-sown Cereal*, *Rape*, *Brassicas*, *Pasture*, *Horse Paddocks*, *Set-aside*, *Cereal Stubble*, *Rough Grassland*, *Woodland and Scrub*. The idea of this was that a link could be drawn between any large concentrations of birds or consistently occurring species and crop type.

[13] The Secretary of State for Environment, Food and Rural Affairs was required under Section 41(1) of the Natural Environment and Rural Communities Act (NERC) 2006 to prepare a list of the species and habitats considered to be of principal importance for the purpose of conserving biodiversity in England. Under Section 41 of the act, consultation was required with Natural England in determining the species and habitats to appear on the list and also to take steps (where they are reasonably practicable), and promote the taking of steps by others, to further the conservation of the habitats and species on the list. The Section 41 list was published in 2008 and replaced the list published by Defra in 2002 under Section 74 of the Countryside and Rights of Way (CRoW) Act 2000. Planning Policy Statement 9 (PPS9) refers to the steps that local authorities should take through the planning process in relation to species and habitats of principal importance. The new list of species of principal importance is found at http://www.defra.gov.uk/wildlife-countryside/biodiversity/sect41-nerc.htm.

After initial surveys undertaken on 21 and 24 September (a single survey undertaken over two days) and 26 October 2007, the frequency of survey was intensified to approximately once each week between November 2007 and March 2009 inclusive. Table 2.3 shows the dates on which daytime field surveys were undertaken. When poor weather conditions prevented the survey being completed in one day, the survey was undertaken over two (usually consecutive) days as indicated by the dates enclosed in square brackets.

Table 2.3 Daytime Field Survey Dates

Month	2007/08	2008/09
April	-	1, 10, 14 & 23
May	-	1, 8, 15, 20 & 30
June	-	6, 12, 21 & 25
July	-	5, 9, 17 & 25
August	-	7, [14-15], 20 & 28
September	[21, 24]	4, 10, 14 & 23
October	26	3, 9, 13, 22 & 30
November	[16-17], 19, 24 & 26	6, 15, 20 & 26
December	6, 9, 17 & [21-22]	4, [10-11], 17 & 22
January	10, 15, [17-18] & 25	[10-11], 15, 21 & 29
February	14, [18-19], 23 & 28	[6-7], 11, 18 & 25
March	11, 14, [17-18] & 21	5, [10-11], 18 & 24

2.2.5 Nocturnal Field Surveys

Nocturnal bird surveys were included within the scope of the baseline work at the request of Natural England. The aim of these surveys was to establish whether there was any nocturnal use of coastal fields during the winter period (December to February), particularly in the Wick Moor area[14] (which can be seasonally inundated) which Natural England are responsible for managing, and which is adjacent to the SSA boundary.

These nocturnal field surveys involved scanning the fields using night vision equipment. Surveys followed a predetermined route chosen to cover the coastal development area adjacent to the shoreline, the upper intertidal zone, and Wick Moor area. In addition, a series of vantage-points (which included the five coastal survey locations used during the intertidal surveys) were used to collect further data, with the surveyor stopping at each to scan for several minutes (long enough of the visible area to be systematically scanned several times). During each survey, the numbers of each bird species and the number of the field in which they were present were

[14] This forms an inland spur of the Severn SPA and Ramsar Site and the Bridgwater Bay SSSI.

recorded, together with the activity of the birds (e.g. foraging, roosting, etc.) if apparent. The route used during the nocturnal surveys is shown on **Figure 2.6**.

Due to the limited effectiveness of even the most sensitive night vision equipment, nocturnal visits were generally carried out within a week of full moon to increase the chance of there being good level of background light. During good background light conditions more extensive foraging will occur at night in some species, potentially making them more detectable.

Prior to at least one of the nocturnal surveys each month, a field survey was undertaken. This enabled the observer to identify areas that had recently become inundated (and therefore might be good areas for waterbirds) and feeding areas that were being used in the day that might also be used at night. The surveyor had the freedom to amend the route in response to the findings of these surveys. In the event, however, the same approximate route was followed during each survey, as field use was very limited and the key areas for birds were all on the route of thetransect.

Two survey visits were undertaken each month between December 2007 and May 2008 inclusive and August 2008 and March 2009 inclusive on the following dates, with the nearest date of the full moon in parenthesis.

2007

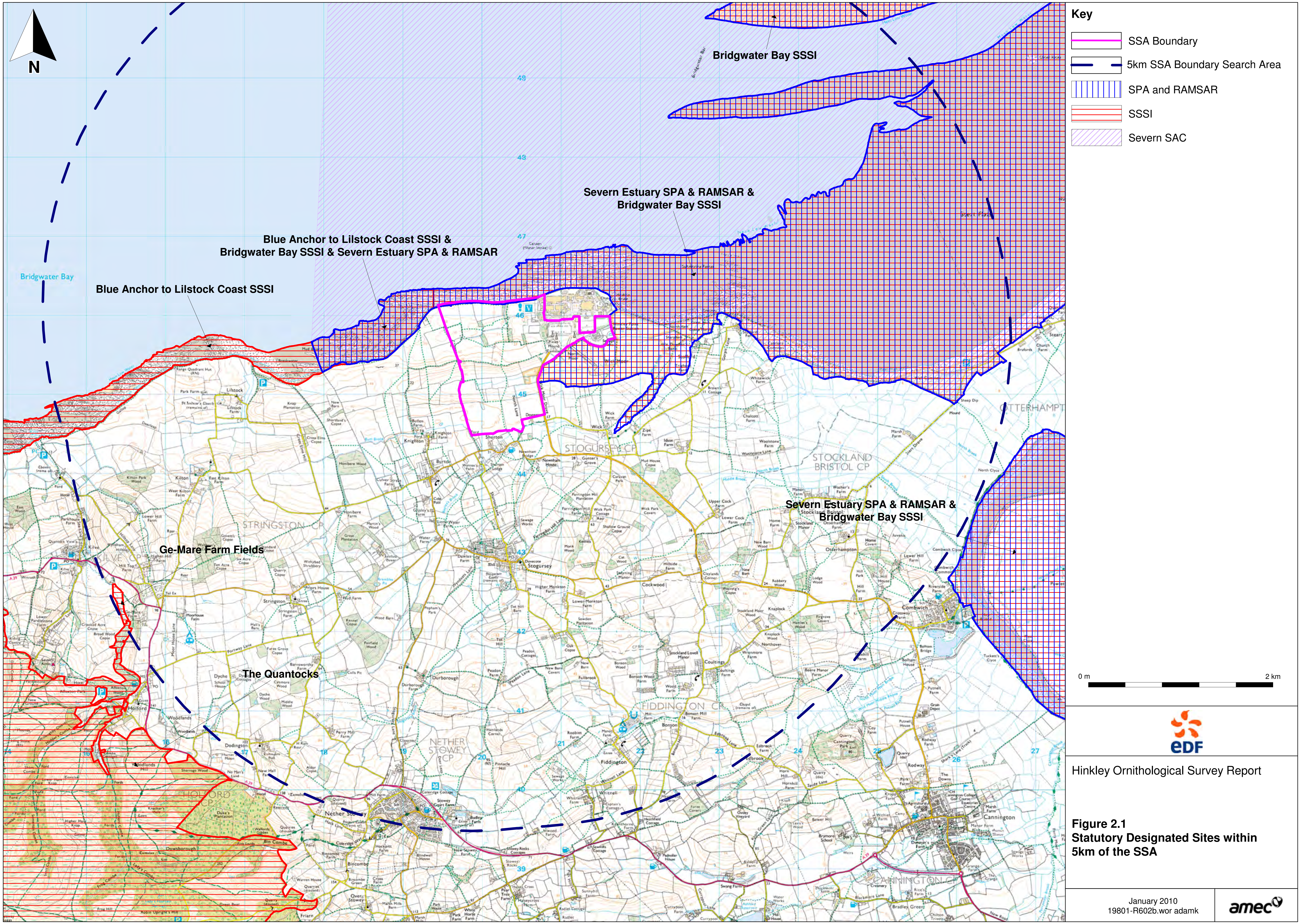
- December 21 & 26 (December 25).

2008

- January 17 & 24 (January 22);
- February 18 & 21 (February 21);
- March 17 & 19 (March 21);
- April 14 & 20 (April 20);
- May 19 & 20 (May 20);
- August 14 & 21 (August 16);
- September 17 & 18 (September 15);
- October 13 & 16 (October 14);
- November 18 & 19 (November 13); and
- December 10 & 13 (December 12).

2009

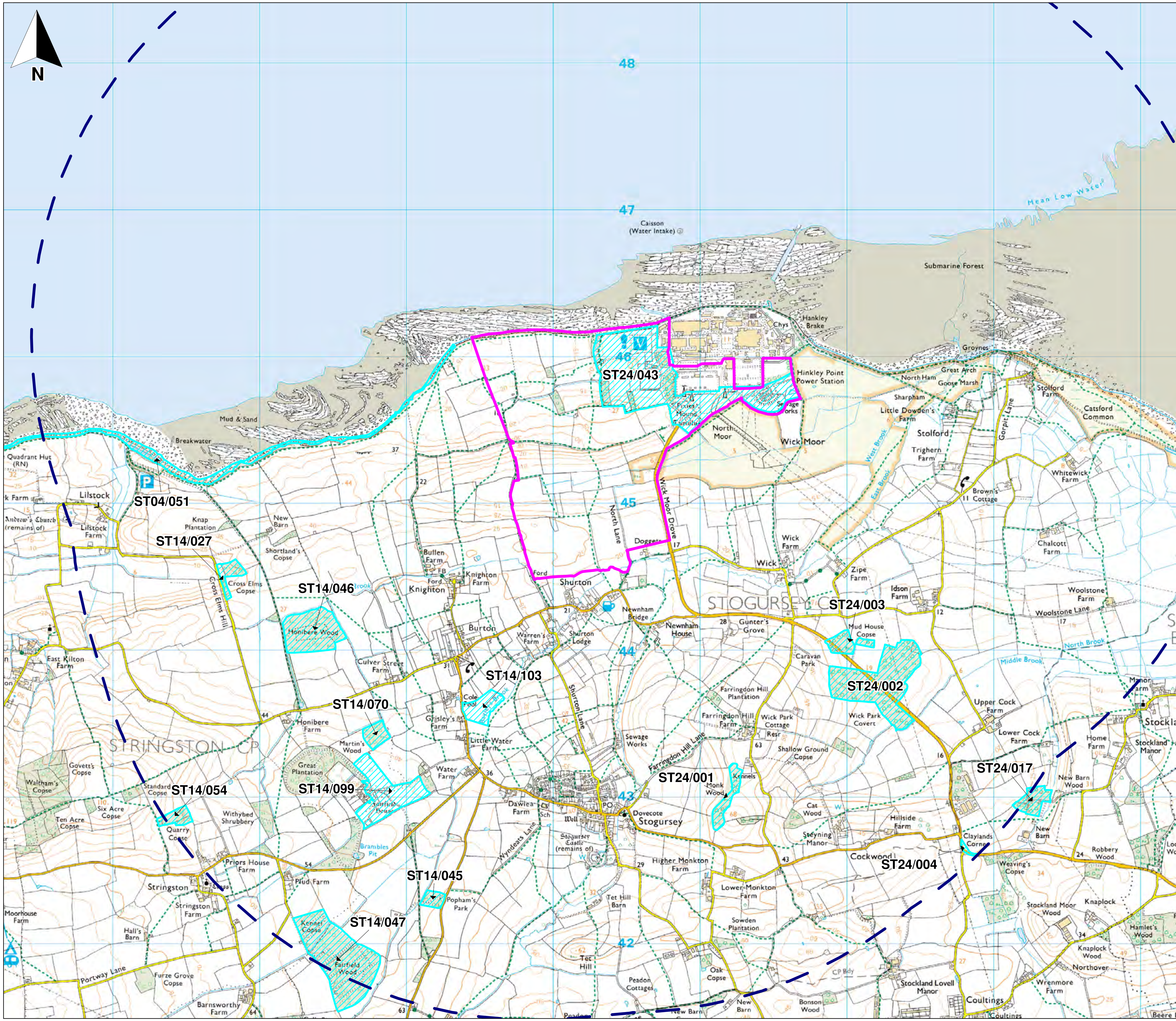
- January 10 & 13 (January 11);
- February 6 & 10 (February 9); and
- March 10 & 14 (March 11).



Hinkley Ornithological Survey Report

Figure 2.1
Statutory Designated Sites within 5km of the SSA

January 2010
19801-R602b.wor adamk



Key

- SSA Boundary
- 3km SSA buffer
- County Wildlife Sites

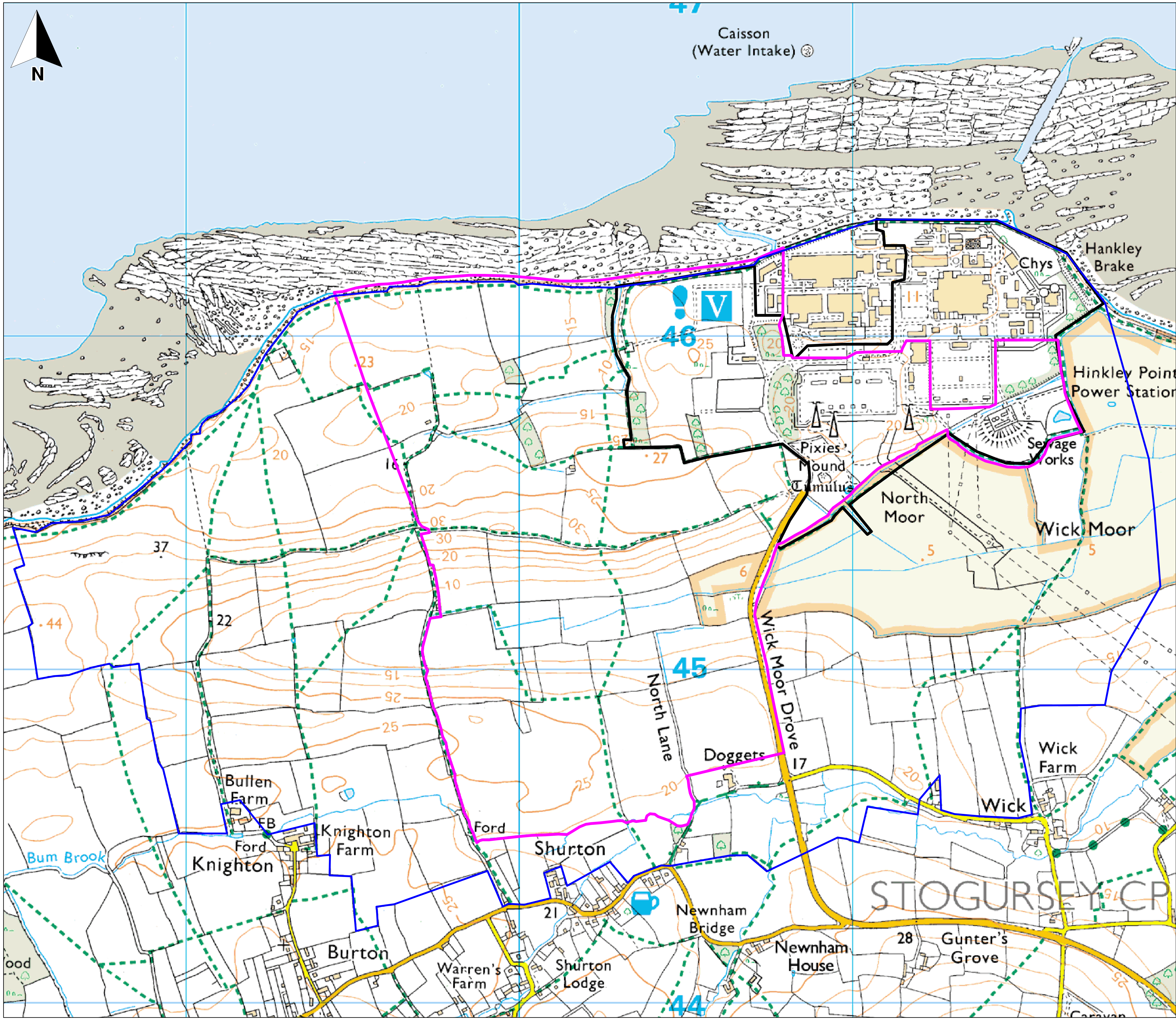
0 m — 1 km

Scale 1:25,000 @ A3

Hinkley Ornithological Survey Report

Figure 2.2
Non-statutory designated sites within 3km of the SSA

December 2009
19801-R603b.wor adamk



Key

- British Energy Land Ownership
- SSA Boundary
- Territory Mapping Survey Area

0 m 500 m

Scale 1:11,000 @ A3

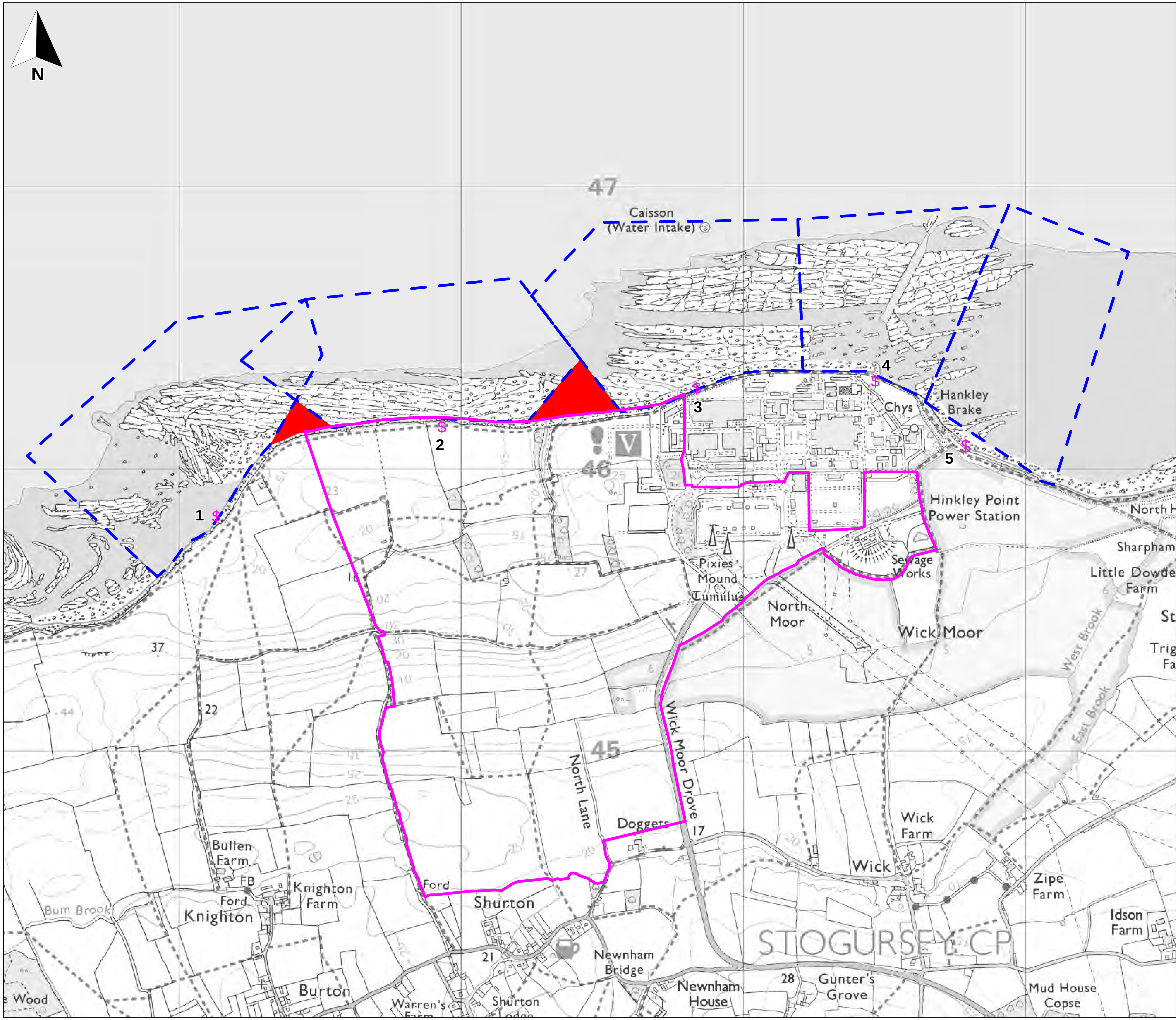
EDF

Hinkley Ornithological Survey Report

Figure 2.3
Territory Mapping Survey Area and BE Land Ownership Boundary

December 2009
19801-R604b.wor adamk

amec



Key

$ Observation Point

Area surveyed from observation point

SSA Boundary

Areas for which supplementary data was collected during walks between observation points

0 m 500 m

Scale 1:13,000 @ A3

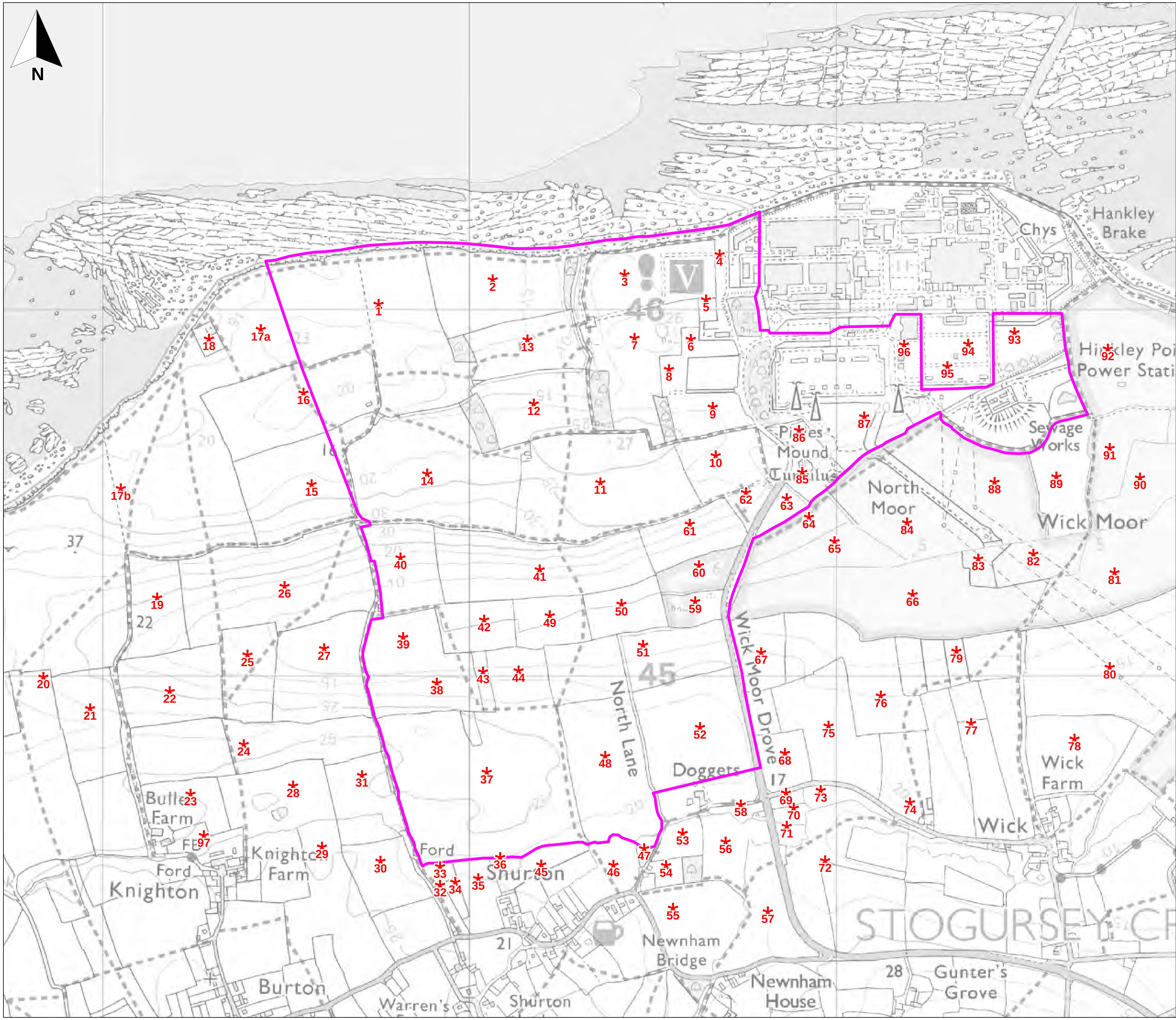
EDF

Hinkley Ornithological Survey Report

Figure 2.4
Coastal Survey Locations and Areas Surveyed from them

January 2010
19801-R605b.wor adamk

amec



Key

SSA Boundary

Field number

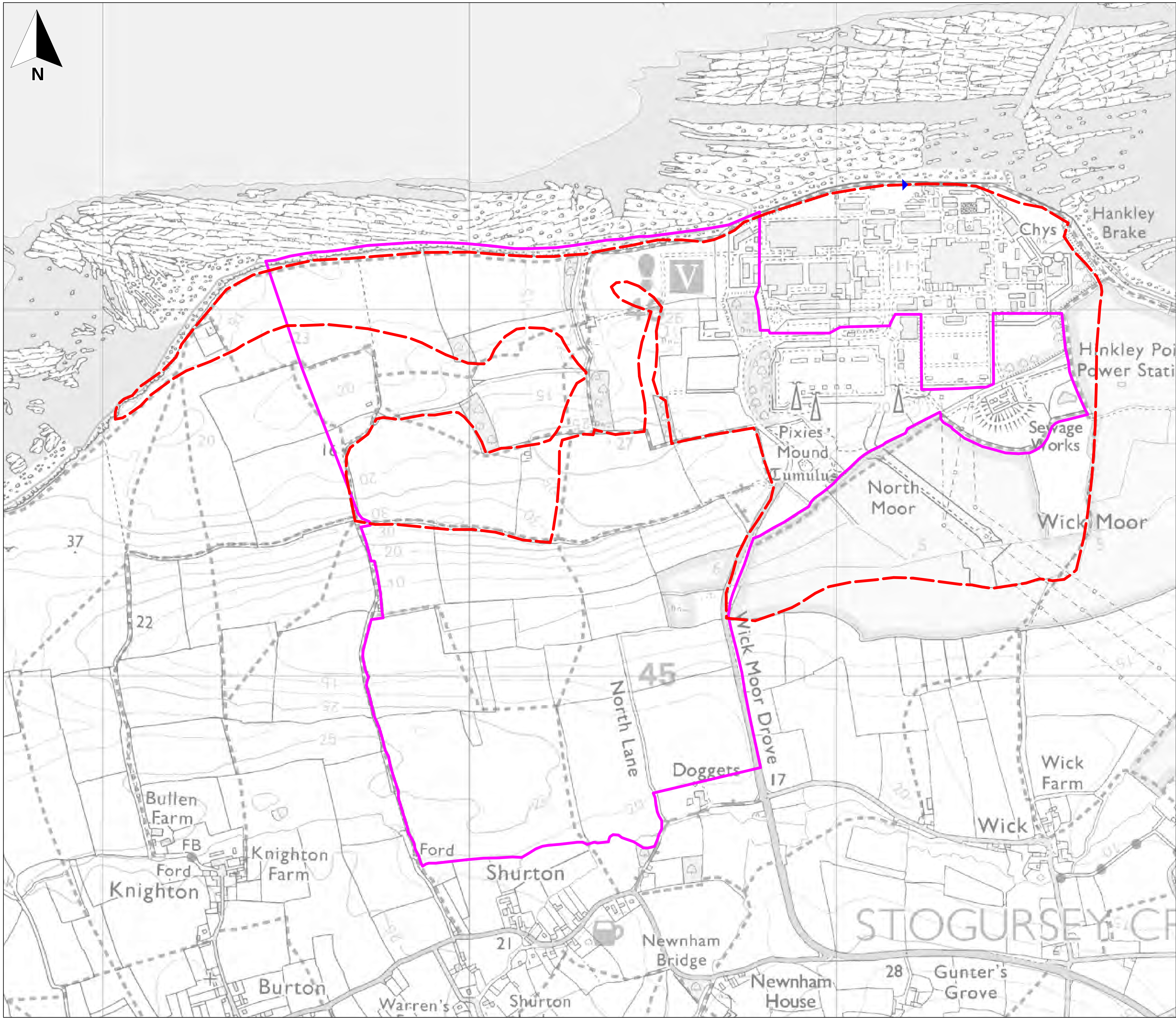
0 m 250 m

Scale 1:10000 @ A3

Hinkley Ornithological Survey Report

Figure 2.5
Daytime Field Surveys
Field Identification Numbers

December 2009
19801-R606b.wor adamk



Key

SSA Boundary

Survey Route

0 m 250 m

Scale 1:10000 @ A3

EDF

Hinkley Ornithological Survey Report

Figure 2.6
Nocturnal Field Surveys, Survey Route

December 2009
19801-R607b.wor adamk

amec

3. Results

3.1 Designated Sites of Ornithological Importance

3.1.1 European Designated Sites

The Severn Estuary SPA is located adjacent to the northern boundary of the SSA. The SPA was classified on the basis of its wintering bird interest and for the large numbers of waterfowl that regularly use the site.

The SPA qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex 1 of the Directive:

Over winter:

- Tundra (Bewick's Swan) (*Cygnus columbianus bewickii*), 280 individuals representing approximately 3.9% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6).

The site also qualifies under Article 4.2 of the Directive by supporting populations of European importance of the following migratory species:

Over winter:

- Russian white-fronted goose (*Anser albifrons albifrons*), 2,664 individuals representing 0.4% of the North-western Siberian. North-eastern European and North-western European wintering population (5 year peak mean 1991/2 - 1995/6);
- Dunlin (*Calidris alpina alpina*), 44,624 individuals representing at least 3.2% of the wintering Northern Siberian, European and Western African population (5 year peak mean 1991/2 - 1995/6);
- Gadwall (*Anas strepera*), 282 individuals representing approximately 0.9% of the wintering North-west European population (5 year peak mean 1991/2 - 1995/6);
- Redshank (*Tringa totanus*), 2,330 individuals representing at least 1.6% of the wintering Eastern Atlantic population (5 year peak mean 1991/2 - 1995/6); and
- Shelduck (*Tadorna tadorna*), 3,330 individuals representing at least 1.1% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6).

The SPA also qualifies under **Article 4.2** of the Directive by regularly supporting at least 20,000 waterfowl:

> *"Over winter, the area regularly supports 93,986 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Gadwall, Shelduck, Pintail, Dunlin, Curlew, Redshank, Bewick's Swan, Wigeon, Lapwing (Vanellus vanellus), Teal, Mallard (Anas platyrhynchos), Shoveler, Pochard, Tufted Duck (Aythya*

fuligula), Grey Plover (Pluvialis squatarola), White-fronted Goose and Whimbrel."

Subsequent to the publication of the data above (as included in the Natura 2000 Standard Data Form), the following changes have been suggested by the SPA Review (Stroud *et al.*, 2001).

Removal of the following species that originally qualified under Article 4.2 of the Directive[15]:

- Russian white-fronted goose;
- Gadwall.

Addition of the following species that now qualify under Article 4.2 of the Directive by supporting populations of European importance:

- On passage:
    - Ringed Plover *Charadrius hiaticula*, 655 individuals representing at least 1.3% of the Europe/Northern Africa wintering population (5 year peak mean 1991/2 - 1995/6).
- Over winter:
    - Curlew *Numenius arquata*, 3,903 individuals representing at least 1.1% of the wintering European population (5 year peak mean 1991/2 - 1995/6);
    - Pintail *Anas acuta*, 599 individuals representing at least 1.0% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6).

The SPA Review has yet to be formally adopted, although in practice SPA Review information (regarding additional species) is given the same credence by nature conservation consultees as that contained on the Natura 2000 Data Sheets.

The Severn Estuary has been recently designated a Special Area of Conservation (SAC), and some limited information is included here for contextual purposes. The area contains species and habitats that are rare or threatened in a European context: migratory fish such as Twaite (*Alosa alosa*) and Allis shads (*Alosa fallax*) and sea (*Petromyzon marinus*) and river lampreys (*Lampetra fluviatilis*); Atlantic salt meadows (often referred to as salt marsh), mud and sandflats, estuaries and subtidal reefs.

3.1.2 Internationally Designated Sites

The Severn Estuary Ramsar Site, which shares a common boundary with the Severn Estuary SPA and Bridgwater Bay SSSI in this location (refer **Figure 2.1**), is adjacent to the north of the SSA. The Severn qualifies as a Ramsar site under Criterions 5 and 6 of the Ramsar Convention due to the internationally important bird assemblage and individual populations that occur.

[15] For the purposes of this assessment, the importance of the survey area to gadwall has still been considered against the Severn Estuary SPA qualifying population. The desk study and surveys found no recent evidence of Russian white-fronted goose using the survey area.

Qualifying ornithological interest listed on the Ramsar Information Sheet is summarised as follows:

- During winter the site supports an assemblage of 70,919 waterfowl (5 year peak mean 1998/999 - 2002/03).

Under Criterion 6, during the winter the site supports internationally important numbers of:

- Tundra (Bewick's) swan (*Cygnus columbianus bewickii*), 229 individuals representing an average of 2.8% of the GB population (5 year peak mean 1998/999 - 2002/03);
- Greater white-fronted goose (*Anser albifrons*), 2,076 individuals representing an average of 35.8% of the GB population (5 year peak mean for 1996/7 - 2000/01);
- Common shelduck (*Tadorna tadorna*), 3,223 individuals representing an average of 1% of the north-western European population (5 year peak mean 1998/99 - 2002/03);
- Gadwall (*Anas strepera strepera*), 241 individuals representing an average of 1.4% of the GB population (5 year peak mean 1998/99 - 2002/03);
- Dunlin (*Calidris alpina alpina*), 25,082 individuals representing an average of 1.8% of the Western Siberian/Western European population (5 year peak mean 1998/99 - 2002/03);
- Redshank (*Tringa totanus totanus*), 2,616 individuals representing an average of 1% of the population (5 year peak mean 1998/99 - 2002/03).

Species identified on the Ramsar Information Sheet for possible future consideration under Criterion 6 are as follows:

- Lesser black-backed gull (*Larus fuscus graellsii*), a breeding season population of 4,617 apparently occupied nests, representing an average of 2.8% of the breeding population (Seabird 2000 Census);
- Ringed plover (*Charadrius hiaticula*), 740 individuals representing an average of 1% of the European/North-west African passage population (5 year peak mean 1998/999-2002/03);
- Teal (*Anas crecca*), 4,456 individuals representing an average of 1.1% of the north-west European wintering population year (5 peak mean 1998/99 - 2002/03);
- Pintail (*Anas acuta*), 756 individuals representing an average of 1.2% of the population (5 year peak mean 1998/99 - 2002/03).

In addition to these species currently and potentially forming the cited/designated interest of the Ramsar Site, a number of species occur at nationally important levels during the breeding season, passage periods and over winter. These are:

- Herring gull (*Larus argentatus argentatus*), 1,540 apparently occupied nests, representing an average of 1.1% of the GB breeding population (Seabird 2000 Census);

- Little egret (*Egretta garzetta*), 17 individuals, representing an average of 1% of the GB passage population (5 year peak mean 1998/99 - 2002/03);
- Ruff (*Philomachus pugnax*), 12 individuals, representing an average of 1.7% of the GB passage population (5 year peak mean 1998/99 - 2002/03);
- Whimbrel (*Numenius phaeopus*), 333 individuals, representing an average of 11.1% of the GB passage population (5 year peak mean 1998/99 - 2002/03);
- Curlew (*Numenius arquata arquata*) 2,021 individuals, representing an average of 1.3% of the GB passage population (5 year peak mean 1998/99 - 2002/03);
- Common greenshank (*Tringa nebularia*), 26 individuals, representing an average of 4.3% of the GB passage population (5 year peak mean 1998/99 - 2002/03);
- Wigeon (*Anas penelope*), 4,658 individuals, representing an average of 1.1% of the GB wintering population (5 year peak mean 1998/99 - 2002/03);
- Northern shoveler (*Anas clypeata*) 297 individuals, representing an average of 2% of the GB wintering population (5 year peak mean 1998/99 - 2002/03);
- Common pochard (*Aythya farina*) 1,118 individuals, representing an average of 1.8% of the GB wintering population (5 year peak mean 1998/99 - 2002/03);
- Water rail (*Rallus aquaticus*), 11 individuals, representing an average of 2.4% of the GB wintering population (5 year peak mean 1998/99-2002/03);
- Spotted redshank (*Tringa erythropus*) 10 individuals, representing an average of 7.3% of the GB wintering population (5 year peak mean 1998/99 - 2002/03).

In addition to the bird interest the site has also been designated for extensive areas of intertidal sand and mudflats, intertidal rock platforms, vegetated shingle beach and maritime grasslands with freshwater and brackish ditches, which support nationally important plant species. Sea lamprey (*Petromyzon marinus*) occurs at the site at an internationally important level.

3.1.3 Nationally Designated Sites

Bridgwater Bay SSSI lies adjacent to the northern boundary of the SSA and also takes in land to the east and south of the SSA, including the Parrett Estuary (which includes Huntspill and Stert Flats) and the open coastal fields at Wick Moor. Hinkley is located at the western end of the SSSI, which extends in a north-easterly direction along the coast to Brean Down, just south of Weston-Super-Mare and covers a total area of 3,574ha (35.74km^2). Its position is shown on **Figure 2.1**.

The SSSI is of national importance for the succession of habitats it supports. These include intertidal mud, wave-cut platforms, cliffs, sand dunes, shingle ridges and extensive areas of saltmarsh. Associated with these habitats are internationally and nationally important assemblages of wintering and passage migrant waders and waterfowl, and a diverse invertebrate fauna. The SSSI supports internationally important numbers of passage whimbrel[16] and black-

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[16] The information contained in the SSSI site description is dated, and for black-tailed godwit may never have been wholly accurate. Since the early 1980s there has been a decline in the whimbrel population using Bridgwater Bay. It is possible that birds have moved to other locations within the estuary, but the precise reason for the decline is

tailed godwit (*Limosa limosa*) and nationally important numbers of overwintering dunlin and wigeon. Shelduck use the bay as a moulting ground, and are also present in nationally important numbers.

The Severn Estuary is used by internationally important numbers of dunlin, shelduck, wigeon, curlew, redshank and teal and nationally important numbers of ringed plover and grey plover. Knot (*Calidris canutus*), turnstone (*Arenaria interpres*), snipe (*Gallinago gallinago*) and mallard also occur. Bridgwater Bay SSSI is used by a substantial proportion of the overall waterfowl and wader populations of the Severn Estuary. The SSSI is also ecologically linked to the Somerset Levels, which provide additional winter-feeding grounds for large numbers of waders and wildfowl.

Blue Anchor to Lilstock Coast SSSI, designated due to its geological interest, is located approximately 350m to the west of the proposed new build site and partially overlaps with Bridgwater Bay SSSI.

3.1.4 Non Statutory Designated Sites

Fifteen non-statutory designated sites (known as County Wildlife Sites in Somerset) are present within 3km of the SSA. A summary of conservation interest from information provided by SERC is included in Table 3.1 below.

Table 3.1 Non-statutorily Designated Sites Information

CWS Reference Number	Name	Brief Description*	Distance from SSA
ST24/043	Hinkley	Species-rich scrub, coastal grassland and broad-leaved woodland with ponds and areas of improved grassland.	CWS lies within the planning application boundary.
ST04/051	Blue Anchor to Lilstock Cliff	Coastal cliffs with unimproved calcareous grassland and scrub habitats from Blue Anchor to Lilstock.	Approximately 2.2k to the west.
ST14/027	Cross Elms	Small field of unimproved grassland and adjacent semi-natural broad-leaved woodland.	Approximately 1.8km to the west.
ST14/045	Pophams Park	A small area of deciduous woodland.	Approximately 2.2km to the south.
ST14/046	Honilbere Wood	A large tract of hedged, embanked and ditched ancient semi-natural woodland occupying very wet-lying ground on coastal strip of county (north of Stringson).	Approximately 1.3km to the west.

unknown. It remains of national importance (Archer, *in litt*). Black-tailed godwit numbers, in contrast, are increasing at regional and national level. This is due to the success of the Icelandic breeding population, and numbers of birds using the area on autumn passage regularly exceed the threshold of national importance, while winter numbers are also approaching this threshold (Archer, *in litt*).

CWS Reference Number	Name	Brief Description*	Distance from SSA
ST14/047	Fairfield Wood	A large tract of high-forest, partly ancient woodland straddling the stream which marks the boundary between Nether Stowey and Stringston parishes on essentially level and rather wet-lying ground amidst arable and grassland.	Approximately 2.7km to the south-west.
ST14/054	Quarry Copse	A small copse of Ancient Woodland on relatively high ground north of Stringston.	Approximately 2.8m to the south-west.
ST14/070	Martin's Wood	A more or less square tract of ancient semi-natural woodland hedge, ditched and embanked all round and with a small stream flowing eastwards along its southern edge.	Approximately 1.4km to the south-west.
ST14/099	Fairfield House Park	Parkland site as marked on the 1st edition Ordnance Survey map with an important assemblage of veteran trees.	Approximately 1.6km to the south-west.
ST14/103	Cole Pool Field	Field with unimproved neutral and marshy grassland and semi-improved areas.	Approximately 0.8km to the south south-west.
ST24/001	Monk Wood	Broad-leaved ancient woodland.	Approximately 1.5km to the south south-east.
ST24/002	Wick Park Covert	Ancient semi-natural broad-leaved woodland bisected by road.	Approximately 1.4km to the south-east.
ST24/003	Mud House Copse	Ancient semi-natural broad-leaved woodland.	Approximately 1.2km to the south-east.
ST24/004	Claylands Corner Verge	Roadside verge with species-rich unimproved neutral grassland supporting diverse invertebrate fauna, flanked by tall hedge/tree-belt and with advancing scrub.	Approximately 2.8km to the south-east.
ST24/017	New Barn Wood	Ancient semi-natural broadleaved woodland with broadleaved plantation.	Approximately 2.9km to the south-east.

*There is no indication from the information received that wintering or passage birds are an important feature of any of these sites.

3.2 Desk Study Data

3.2.1 Wetland Bird Survey and Somerset Ornithological Society Data

The following information was obtained from the BTO's Wetland Bird Survey (WeBS) and from the Somerset Ornithological Society:

- WeBS Core Counts[17] for count sectors within Bridgwater Bay (that are within 2km of the SSA). The Core Count or 'high tide' data for the five most recent years was

[17] The WeBS Core Counts survey is the principal scheme of The Wetland Bird Survey. Counts are made annually at around 2,000 wetland sites of all habitats, primarily estuaries and large still waters. Monthly co-ordinated counts are made at predetermined count sectors, principally from September to March, with fewer observations made during the summer months. Core Counts on estuaries are usually carried out around high tide and the Core Count year runs from July to June of the following year.

obtained (not all sectors have five years of data available). **Figure 3.1** shows the location of the count sectors for which Core Count data were obtained. Table 3.2 provides a summary of the years and months for which these data were obtained;

- WeBS Low Tide Counts[18] for count sectors within Bridgwater Bay (that are at their closest less than 2km from the SSA). Data were obtained for the most recent winter in which the count sector was surveyed (2008/09 for BV691-7 and 2002/03 for BV670 and 690). **Figure 3.1** also shows the location of the count sectors for which Low Tide Count data were obtained. Table 3.2 provides a summary of the years and months for which these data were obtained;

- Somerset Ornithological Society: general bird sightings records within approximately 3km of the initial British Energy works area were obtained from the Somerset Ornithological Society in 2008. These covered the period 1997 to 2007 inclusive (data for 2008 was unavailable at the time of writing the Hinkley Third Interim Bird Report). It should be noted that OS Grid References for the sightings are not available and therefore only broad locations have been provided (i.e. Hinkley Point, Knighton, Lilstock and Stolford). Additionally, no details on the behaviour of the birds recorded were provided.

Table 3.2 WeBS Core Count and Low Tide Counts: Years and Months of Data Obtained

WeBS Count Sector No.	Area Covered	SPAs	Years (months) of Data Obtained[19]
Core Counts			
13411	A large area encompassing much of the Stert Flats in Bridgwater Bay that includes all of Count Sector 5.	Severn Estuary SPA[20]	July 2004 to June 2009
Low Tide Counts			
BV670	Approx. 2km north east of the intertidal survey area	Severn Estuary SPA	2002-03 (Jan-Feb)
BV690	Approx. 1km north east of the intertidal survey area	Severn Estuary SPA	2002-03 (Nov-Dec, Feb)
BV691	Approx. 1km east of the intertidal survey area	Severn Estuary SPA	2008-09 (Dec-Feb)

[18] WeBS Low Tide Counts are co-ordinated counts of feeding and roosting waterbirds on estuaries, each month between November and February. Counts are carried out on pre-established subdivisions (count sectors) of intertidal habitat during the period two hours either side of low tide. The WeBS Low Tide Counts scheme aims to cover most individual estuaries approximately once every six years, although on some sites more frequent counts are made.

[19] All periods are inclusive.

[20] As the SPA, Ramsar Site and SSSI share common boundaries, all surveys covering the SPA also therefore covered the other designated areas.

WeBS Count Sector No.	Area Covered	SPAs	Years (months) of Data Obtained[19]
BV692	Approx. 1km east of the intertidal survey area	Severn Estuary SPA	2008-09 (Nov-Feb)
BV693	Approx. 1km east of the intertidal survey area	Severn Estuary SPA	2008-09 (Nov-Feb)
BV694	Approx. 1km east of the intertidal survey area	Severn Estuary SPA	2008-09 (Nov-Feb)
BV695	Includes much of the southeast corner of the survey area for the daytime field surveys, including Wick Moor and North Moor.	Severn Estuary SPA	2008-09 (Nov-Feb)
BV696	The western half of this WeBS Count Sector includes all of Count Sector 5.	Severn Estuary SPA	2008-09 (Nov-Feb)
BV697	This area is almost contiguous with the area covered by Count Sectors 1, 2, 3 and 4.	Severn Estuary SPA	2008-09 (Nov-Feb)

The peak WeBS Core Count and peak and mean 2008/09 Low Tide counts for each species are presented in **Appendix A, in Tables A1 and A2 respectively**. **Tables B1 and B2 in Appendix B** presents a summary of the data provided by the Somerset Ornithological Society (the maximum count of each species at each location for cited/designated and non-cited/designated species respectively).

WeBS data has indicated that several species forming part of the cited/designated interest of statutorily designated sites occur on the Stert Flats immediately to the east of the Hinkley survey area.

Peak counts during 2004/05 to 2008/09 inclusive, in WeBS Core sector 13411, which covers much of the Stert Flats included:

- 11 Bewick’s swan, 2,900 shelduck, 950 wigeon, 1,800 teal, 70 mallard, , 44 pintail, 21 shoveler, 8,400 lapwing, 780 ringed plover, 520 grey plover, 11,100 dunlin, 148 black-tailed godwit, 1,550 curlew, 28 whimbrel and 950 redshank. Numbers of teal, shoveler, lapwing, ringed plover, black-tailed godwit and whimbrel show considerable variation between years.

Low Tide count data for those sectors counted in 2008/09 that form the western part of the Stert Flats (BV691-7 inclusive) indicated that a number of species forming part of the cited/designated interest of statutorily designated sites occurred in this area. Low tide counts across all these count sectors included:

- 394 shelduck, 727 wigeon, 121 teal, 98 mallard, 131 pintail, 58 ringed plover, 319 grey plover, 155 lapwing, 4,232 dunlin, 355 curlew and 169 redshank.

Low tide counts conducted in Sector BV696 (which covers all of Count Sector 5) included:

- 185 shelduck, 485 wigeon, 73 teal, 57 pintail, 43 lapwing, 230 dunlin, 98 curlew and 36 redshank.

Very few birds were recorded in Low Tide sector BV695 (which covers farmland immediately to the east of the power stations). Low tide counts in Low Tide Sector BV697 (which covers much the same area as Count Sectors 1-4) included:

- 65 shelduck, 185 wigeon, 35 pintial, 35 ringed plover and 28 curlew.

White-fronted goose, gadwall, pochard and tufted duck were not recorded on either Core Count or Low Tide counts during 2004/05 - 2008/09 and 2008/09 respectively

Of the species that do not appear as cited/designated features of either the Severn Estuary SPA/Ramsar site or Bridgwater Bay SSSI, peak counts of 19 cormorant, 42 little egret, 200 oystercatcher, 68 avocet, 1,950 golden plover, 1,650 knot, 140 sanderling, 32 snipe, 43 bar-tailed godwit, 12 spotted redshank, 5 greenshank and 165 turnstone were recorded in WeBS Sector 13411 (although counts of oystercatcher, golden plover, knot, sanderling and turnstone showed considerable between year variation). The Low Tide data indicated that good numbers of knot occurred on the Stert Flats in 2008/09 (combined peak count of 384 birds for sectors BV691-97 inclusive). Peak counts in WeBS count sectors located within the intertidal survey area included: 40 oystercatcher, 12 purple sandpiper and 26 turnstone, all in BV697.

3.2.2 Passage and Wintering Bird Information from the West Hinkley Wind Farm Environmental Statement (Dulas, 2006)

The proposed West Hinkley Wind Farm was a nine turbine scheme for which an Environmental Statement was submitted to the local planning authority in December 2006. This scheme has been bought out by EDF Energy.

The wind farm would have been partially within and partially to the west of the SSA, although there is a considerable degree of overlap between the two planning application boundaries. As a result of this, much of the baseline data collected for the wind farm is of relevance to the new nuclear proposal.

In order to provide baseline information on the bird interest of the wind farm area, breeding bird surveys, walkover field surveys and vantage point surveys were undertaken during 2003-06. The wind farm application area and the SSA for the new nuclear build are shown on **Figure 3.2**.

Breeding Bird Surveys

Two breeding bird surveys were undertaken in relation to the wind farm application, the first by Ecology Consulting in 2003 and the second by Terence O' Rourke Ltd in 2006.

The Ecology Consulting surveys covered the wind farm application area plus a perimeter area of 300m around it. Five survey visits were undertaken during May, June and July 2003 using territory mapping methods employed in the BTO's Common Bird Census (CBC), Marchant, (1983). A supplementary survey of a barn where barn owl pellets had previously been found was carried out in spring 2004 to determine if breeding was likely to occur. Species considered to be breeding within the survey area (numbers of territorial birds are included in brackets) included shelduck (2), buzzard (1), skylark (16), lesser whitethroat (3), linnet (6) and yellowhammer (1). Nightingale was not recorded within the survey area, although three pairs are known to have held territory in scrub in close proximity to the power station from the annual British Energy work. Barn owl was not recorded breeding in the barn that was surveyed. It was considered that the structure was used as an occasional roost and had no potential to support breeding owls.

Terence O' Rourke undertook a ten visit CBC between March and July 2006. This survey work included eight morning and two afternoon visits and covered the wind farm application area only (1.3km^2). Nightingale and lesser whitethroat were not recorded holding territory in the survey area (which did not take in favoured scrub and woodland habitats), but species that were present included skylark (30), song thrush (2), linnet (5) and yellowhammer (1). The density of skylark recorded within the survey area during this study was far higher than during the Ecology Consulting surveys (which covered a larger area). It would therefore seem likely that either the survey results were interpreted differently or that numbers of territorial skylarks in the area fluctuate markedly between years. There is no evidence in the text of the document to suggest that management of the arable fields within the area surveyed might have changed appreciably between the two surveys (e.g. fields might have been put into set aside) which could account for the apparent differences.

In addition to the CBC, Terence O' Rourke undertook a barn owl survey of the four barns and all mature trees within the wind farm application area. This work recorded some old owl pellets, indicating an occasional roost in two of the barns, as well as a dead barn owl (cause of death was not established). It was concluded that the barns did not and were unlikely to be capable of supporting breeding barn owl and that there were no trees in the area with suitable cavities that could accommodate breeding owls.

Field Surveys and Vantage Point Surveys

In order to provide baseline information on the migratory bird interest of the proposed wind farm site, three phases of bird survey were undertaken between 2003 and 2006 inclusive (phases 1 and 2 by Ecology Consulting and phase 3 by Terence O' Rourke Ltd):

- The first phase of survey work undertaken between October 2003 and March 2004, involved 12 visits to record all waders, wildfowl, birds of prey, large flocks or notable species in fields and intertidal habitat within or close to the proposed wind farm site (referred to here as the winter bird study area). In addition, flight observations were carried out from a vantage point over-looking the proposed wind farm site;
- The second phase of survey work also involved counts of target species in fields and intertidal habitat within the winter bird study area, and vantage point surveys from two locations, with 18 visits undertaken between August 2004 and May 2005;
- The third phase of survey work involved field surveys only, with six visits undertaken in March 2006.

The winter bird study area for the wind farm and the SSA for the new nuclear power station are shown on **Figure 3.2**. An overview of the main findings from the wind farm surveys is provided below. The peak counts for waders, wildfowl and other notable species for each of the three phases of fieldwork are presented in Table 3.3.

Table 3.3 Peak Counts during Each Phase of Surveys Undertaken for the Proposed West Hinkley Wind Farm

Species		Phase 1 (2003/04)[21]	Phase 2 (2004/05)[22]	Phase 3 (2006)[23]
Shelduck	*Tadorna tadorna*	421 (9)	450 (7)	104 (6)
Wigeon	*Anas Penelope*	64 (8)	102 (4)	124 (6)
Teal	*Anas crecca*	6 (2)	2 (1)	50 (5)
Mallard	*Anas platyrhynchos*	32 (9)	3 (3)	19 (6)
Pintail	*Anas acuta*	182 (1)	0	70 (5)
Shoveler	*Anas clypeata*	0	0	21 (3)
Common Scoter	*Melanitta nigra*	0	0	2 (2)
Cormorant	*Phalacrocorax carbo*	8 (3)	2 (5)	1 (3)
Little Egret	*Egretta garzetta*	3 (9)	6 (3)	6 (6)
Grey Heron	*Ardea cinerea*	3 (6)	2 (6)	2 (4)
Merlin	*Falco columbarius*	0	0	1 (3)
Peregrine	*Falco peregrinus*	2 (4)	1 (2)	1 (3)
Oystercatcher	*Haematopus ostralegus*	45 (11)	81 (7)	50 (6)
Ringed Plover	*Charadrius hiaticula*	22 (2)	23 (2)	1 (1)
Golden Plover	*Pluvialis apricaria*	0	189 (1)	332 (2)
Grey Plover	*Pluvialis squatarola*	0	0	1 (1)
Lapwing	*Vanellus vanellus*	30 (3)	105 (2)	106 (1)
Knot	*Calidris canutus*	0	0	2 (1)
Purple Sandpiper	*Calidris maritime*	25 (1)	0	0
Dunlin	*Calidris alpine*	1 (1)	0	0
Black-tailed Godwit	*Limosa limosa*	1 (1)	0	1 (1)
Curlew	*Numenius arquata*	22 (12)	37 (7)	70 (6)
Redshank	*Tringa tetanus*	0	1 (1)	5 (1)
Turnstone	*Arenaria interpres*	22 (3)	5 (5)	14 (1)
Black-headed Gull	*Chroicocephalus ridibundus*	101 (12)	P	63 (4)
Common Gull	*Larus canus*	332 (7)	P	15 (4)

[21] Number in parenthesis denotes the number of visits (out of 12) that the species was recorded between 20 October 2003 and 29 March 2004. Approximately two surveys were undertaken in each month.

[22] Number in parenthesis denotes the number of months (out of 9) that the species was recorded between September 2004 and March 2005 inclusive. Approximately, two survey visits were undertaken in each month.

[23] Number in parenthesis denotes the number of visits (out of 6) that the species was recorded between 1-28 March 2006 inclusive.

Species		Phase 1 (2003/04)[21]	Phase 2 (2004/05)[22]	Phase 3 (2006)[23]
Lesser Black-backed Gull	*Larus fuscus*	133 (6)	P	72 (6)
Herring Gull	*Larus argentatus*	205 (12)	P	944 (6)
Great Black-backed Gull	*Larus marinus*	7 (9)	P	8 (5)
Kingfisher	*Alcedo atthis*	1 (2)	0	0
Fieldfare	*Turdus pilaris*	50 (n/a)	45 (1)	
Redwing	*Turdus iliacus*	40 (n/a)	15 (1)	
Raven	*Corvus corax*	2 (4)	4 (3)	
Starling	*Sturnus vulgaris*		2180 (6)	

NB: blank cells do not indicate that the species was not recorded during that phase of surveys, rather that data was not provided for that species, and it is unclear whether it was present or not. P denotes that the species was recorded but no count was undertaken / made available.

Waterfowl

Shelduck were recorded during all three phases of the wind farm survey (2003-06). The intertidal area to the east of the Power Stations supported the largest concentration of foraging birds, particularly the western part of Stert Flats, with the largest numbers recorded around low tide. Small numbers of shelduck were also recorded in 2006 (there were very few records in 2003/04) on the foreshore to the west of the built power station, with numbers generally in the range of 1-15 birds.

Teal were recorded infrequently during the 2003/04 and 2004/05 winter bird surveys but were seen in larger numbers in March 2006. Flocks of 20-50 teal favoured the area around the outfall at Hinkley Point and the open mudflats to the east of this. Movements of small numbers of teal were noted between these intertidal areas and the pools to the south of the Power Stations within Hinkley Point CWS. Shoveler were not recorded during the 2003/04 or 2004/05 winter bird surveys but small numbers including counts of 11 and 21 birds were recorded with teal around the outfall and on the Hinkley Point CWS ponds in 2006.

A count of 182 pintail was recorded on 20 October 2003, but none were recorded during the 2004/05 surveys. During March 2006, a small flock of foraging pintail was present on mudflats to the east of Hinkley Point at low water (mean count 22 birds, peak count 70 birds). No pintail were observed to the west of the operational power stations during any of the winter bird survey work. Wigeon were recorded regularly in all three phases of the survey work, with birds concentrated around the warm water outfall towards the edge of Stert Flats and on the nearby open mud.

Of the other species of waterfowl recorded during the survey period, small numbers of mallard were regularly noted throughout the survey period and 1-2 common scoter were noted offshore on two dates in March 2006. Overall, shelduck, wigeon and mallard made regular use of the winter bird study area throughout the survey period (2003-06), with teal, pintail and shoveler regular only in March 2006 and absent or irregular during the first and second phases of surveys. Shelduck, wigeon and mallard predominantly made use of the intertidal habitat to the east of the plant.

Waders

Curlew and oystercatcher were recorded feeding along the much of the shoreline within the winter bird study area during all three phases of the wind farm survey work. Small numbers of curlew were occasionally recorded in fields close to the shoreline, although there was no evidence of regular use of fields to the west of the built plant for foraging or loafing. Golden plover and lapwing were recorded infrequently during the survey period, although relatively large numbers (332 and 106 birds respectively) of both species were noted during cold weather conditions in March 2006. These counts comprised flocks of lapwing foraging on pasture on Wick Moor, whilst the golden plover were on arable fields to the west of the built plant. Flocks of lapwing (105) and golden plover (189) were recorded in December 2004 and February 2005 respectively[24].

Turnstones were rather irregular in occurrence during the survey period, although a flock of 22 birds was noted on intertidal habitat in front of the built plant on 27 December 2003. A flock of 25 purple sandpipers was also recorded on rocks in front of the built nuclear plant on 27 December 2003 but the species was not recorded subsequently during the survey period. Ringed plover grey plover, black-tailed godwit, dunlin, knot and redshank all made low level use of intertidal habitat within the Winter Bird Study Area during the survey period, being recorded infrequently and in small numbers in the intertidal habitat (see Table 3.3).

Other Species

Up to six little egrets were recorded on at least 19 survey visits throughout the survey period (2003-06). One or two little egrets were frequently recorded feeding in the network of ditches on Wick Moor to the south of the Power Stations, and elsewhere lone birds were occasionally noted on intertidal habitat and pasture to the west of Knighton. Up to three grey heron were recorded on at least 17 survey visits throughout the survey period, and 1-2 loafing cormorants were a frequently recorded on the intertidal habitat within the winter bird study area.

Peregrine were noted on at least nine survey visits[25], particularly around the Power Stations, with the area being used by at least two wintering birds during the survey period (2003-06). Merlin was recorded on three survey visits (around Wick Moor to the south and south-east of the operational power station in March 2006) but not at any other time during the survey period.

Large numbers of herring gulls were recorded around the Power Stations, with birds using the outfall to bathe and drink around low water. A noticeable movement of herring gulls inland from the Bristol Channel during early morning and back again in the evening was noted. Small numbers of great black-backed gull and lesser black-backed gull were recorded during the majority of survey during 2003/04 and in March 2006, the former primarily comprised of immature birds (no data was available for these species for 2004/05). There was one record of a

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[24] Subjective terms such as ‘small’ or ‘large’ numbers,’ ‘regular’ and ‘irregular’ and ‘reasonably frequent’ occurrence have been taken directly from the wind farm ES. Exact numbers of birds have not been provided within the ES, which leaves little alternative but to adopt this nomenclature when reporting results.

[25] It is also not possible to say exactly how many survey visits individual bird species were recorded on, as only peak counts per month are provided in the ES.

relatively large number of common gulls: 332 birds on 9 November 2003. Kingfishers were recorded on two survey visits during the first phase of surveys in 2003/04 but not subsequently.

Spring Migratory Bird Survey

Surveys were also undertaken by Terence O' Rourke on seven days between 19 April 2006 and 17 May 2006 inclusive. These surveys covered all areas of open coast up to approximately 2km east and west of the proposed wind farm. In addition, fields surrounding the proposed wind farm were also surveyed. The field survey area extended approximately 3km to the south-west, 1km to the south and 1.5-2km to the east and south-east of the proposed wind farm. Although there is no detailed methodology set out in the West Hinkley Wind Farm Environmental Statement it seems likely that instantaneous counts were made of birds using areas of open shore and agricultural fields from a series of local vantage-points and by walking transects through the survey area. This is consistent with earlier winter survey work undertaken by Ecology Consulting as part of the same application.

The commonest species recorded by Terence O' Rourke was herring gull, with 135-383 birds present during each survey visit. Herring gulls favoured the open coast, where they mixed with smaller numbers of lesser black-backed gull, but were also recorded commuting inland and flocking in some areas of farmland, such as on Wick Moor. The surveys recorded small numbers of little egret (4-6) using the rock platforms and gullies off the built nuclear facility and the intertidal creeks to the east of it. Wildfowl included maximum counts of 8 mallard, 4 shoveler, 10 pintail and 2 wigeon in the intertidal zone and inshore waters. Shelduck was recorded with regularity along most sectors of the coast, with counts of 30-110 birds during surveys in April 2006 and 36-84 birds in May 2006. A range of wader species were also noted during this work of which oystercatcher, curlew and whimbrel were the most consistently recorded. The peak count of oystercatcher was of 82 birds roosting on the foreshore at the western end of the existing power station on 17 May. Small numbers of curlew (1-2 birds) were generally recorded during each survey, while whimbrel numbers peaked on 9 May, with 18 birds recorded, and 1-10 birds present on an additional five (of six) survey days. Within the survey area, whimbrel appeared to favour the mudflats on the western edge of Stert Bay, and also used the area of intertidal rock at the western end of the built nuclear power station.

3.2.3 Breeding Birds (British Energy Sources)

Successive British Energy Conservation Wardens have undertaken breeding bird surveys of scrub and woodland habitats to the south and west of the built nuclear power stations at Hinkley on an annual basis since 2000, and the results of these are included in the annual land management review (British Energy/ADAS 1999-2007). Prior to the initiation of annual surveys, ornithological survey work had been conducted sporadically, (e.g. Robins 1986, Somerset Ecological Consultants 1993). Annual surveys are undertaken in two areas of woodland and two areas of scrub; Seaberton Brake (referred to by successive site wardens as site 1); Branland Copse (site 2), scrub near Pixies Pond (site 3) and an unnamed triangular area of scrub (site 4). Surveys are conducted using CBC methodology (Marchant, 1983). The annual survey area is shown on **Figure 3.3**.

The number and diversity of breeding species within the area surveyed by the warden varies between years. In 2004, 35 species were considered to have bred, which is the highest total to date. The commonest species in these annual monitoring plots are generalist species with relatively wide ranging habitat preferences such as blue tit, blackbird, chaffinch and greenfinch. Some species that also favour scrub and woodland edge habitats such as chiffchaff, blackcap and bullfinch are also well represented. The features of the bird community of greatest interest from a national and regional perspective are lesser whitethroat, which is close to the western limit of its national breeding range (Ballance, 2006), and nightingale, which has a restricted national distribution. Nightingale numbers fluctuate, with a maximum of six territories in 1998 (five in 2005, four in 2004 and three in 2003, 2002 and 2000[26]). One pair of lesser whitethroats (occasionally two pairs) consistently breeds in scrub within the annually monitored area and black redstart, which is protected under Schedule 1 of the Wildlife and Countryside Act, bred within the built power station in 1996.

During the 2008 ADAS breeding bird surveys, two territories of nightingale and lesser whitethroat were recorded in site 4. These results were not markedly different to those of the 2007 Entec surveys, for the same species within the same area. The locations of the two nightingale territories recorded in 2008 were very similar to those identified during the 2007 Entec breeding bird surveys (both within the SSA). The two lesser whitethroat territories recorded in 2008 were in a similar location to one of the territories found in the 2007 Entec surveys (all within the SSA).

This annual monitoring work undertaken by the site warden built on baseline surveys of the same woodland and scrub habitats undertaken by Somerset Ecology Consultants (SEC) in 1992 and 1993 (SEC, 1993). These surveys were also undertaken to CBC methodology, and (in 1992) ran in conjunction with a ringing programme. Six nightingale territories were recorded in 2002 and three in 2003. Two lesser whitethroat territories were recorded in 2002. Willow and marsh tit, which are red listed species of conservation concern (Gregory et al., 2002), were recorded as breeding species during the work. Willow tit is on the verge of extinction at county level, while marsh tit is uncommon (Ballance, 2006). Neither species appears to have been recorded breeding in the area since this time[27]. The report by SEC has little interpretation or discussion of results and some data errors and these combined with the fact that it is now rather outdated, indicate it is not considered a key document for informing the baseline.

Robins (1986) conducted a CBC of the whole of the land now considered as the SSA, plus a perimeter zone of approximately 500m to the west and south and 1km to the east in connection with the original Hinkley C Station proposal. Nine survey visits were undertaken between 25 March and 30 May 1985. The commonest species recorded were those with wide ranging habitat preferences such as chaffinch, wren, blackbird, dunnock and woodpigeon. Features of the bird community at that time were nightingale, with six territories located (five in woodland and one in scrub[28]) and lesser whitethroat, with nine territories (eight of which were in hedgerow and one in scrub). Farmland birds included 1 pair of corn bunting, which is now extinct as a breeding species in Somerset (Ballance, 2006), and a number of red-listed species of conservation concern (Gregory *et al.*, 2002) since included on the Section 41 (NERC Act) list including grasshopper warbler (1), bullfinch (2), spotted flycatcher (3), song thrush (4), grey partridge (5), yellowhammer (7) and starling (10). Skylark was present at low density in the

[26] Although both 3 and 6 pairs are quoted for 2000 depending on the source that is referenced.

[27] Marsh tit continue to occur on an occasional basis. E.g. 2 birds were ringed in this area in autumn 2009 (Owain Gabb, pers comm.).

[28] Two in Branland Copse and one each in Whitewall Brake, Seaberton Brake, scrub south of Power Station and Haysgrove Brake.

agricultural fields[29]. Reed warbler, which is now common in wetland habitats throughout the area, was not recorded during the work.

Robins (1986) also noted that barn owl was regularly recorded hunting over the survey area and had formerly nested in a barn at ST208 456. This barn is still extant and accessible to barn owl, and a couple of old pellets found during a preliminary site visit in 2007 suggest an occasional roost site. There is little opportunity for owls to currently nest in this location however, as there is no roof space or appropriate box or recess that would allow them to do so.

3.2.4 Other Information

No novel bird survey work was conducted in preparation for the Environmental Statement for the decommissioning of the Hinkley A Station. Some ornithological information has been received from the Somerset Environmental Records Centre (SERC) relating to bird sightings within 3km of the proposed build area, but many records are not contemporary and lack behavioural context, hence are of limited value and are not summarised here.

3.3 Breeding Bird Surveys

The survey programme resulted in 45[30] species of breeding bird being recorded across an area approximately 4.6km^2 in extent. The location of breeding territories is shown in **Figure 3.4 and Figures 3.4(a-e)**. A key indicating the species that each code refers to is also provided. It should be remembered when considering the figures that the two letter registrations refer to the apparent centre of territorial activity rather than nest sites. It should also be noted that the aim of this survey was to characterise the bird community rather than derive exact densities, which would require a considerably more involved survey programme and is not necessary to inform an EIA. It is inevitable that the densities of some mobile, vocal species have therefore been overestimated due to the precautionary approach that has been taken in interpreting the data, where peak counts of apparently territorial birds have been used to derive densities. Where potential overestimation is considered likely this is acknowledged in the text.

The results of the surveys are presented in Table 3.4.

[29] 12 pairs were recorded at an overall density of 5.8 per km^2.

[30] It is possible that several additional species bred. Figures for swallow and house martin, which forage regularly over the area, are not included in Table 3.4, as domestic properties and farm buildings were not generally entered or walked around, so no accurate census was possible. Feral pigeon and swift may also breed within these buildings, but were not recorded doing so.

Table 3.4 Numbers of Breeding Bird Territories Recorded in the Survey Area

Species	Number of Territories Recorded in Survey Area	Number of Territories Recorded in SSA	Wildlife and Countryside Act Schedule 1 / Annex 1 of EU birds Directive	UK BAP Priority Species	Birds of Conservation Concern Red List	Birds of Conservation Concern Amber List
Buzzard	1	1				
Pheasant	15	9				
Moorhen	3	1				
Oystercatcher	1	0				4
Woodpigeon*	23	18				
Stock dove	3	3				4
Cuckoo*	3	2		4		4
Green woodpecker*	2	1				4
Great spotted woodpecker	2	1				
Skylark	58	25		4	4	
Meadow pipit	1	0				4
Rock pipit	2	0				
Pied wagtail	1	0				
Wren	97	67				
Dunnock	56	32		4		4
Robin	60	44				
Nightingale	5-6	2				4
Blackbird	41	25				
Song thrush	16	13		4	4	
Cetti's warbler	3	3	4			
Sedge warbler	5	5				
Reed warbler	34	15				
Garden warbler	1	0				
Lesser whitethroat	7	3				
Whitethroat	70	47				
Blackcap	36	26				
Willow warbler	13	5				4
Chiffchaff	42	26				
Goldcrest	4	4				4

Species	Number of Territories Recorded in Survey Area	Number of Territories Recorded in SSA	Wildlife and Countryside Act Schedule 1 / Annex 1 of EU birds Directive	UK BAP Priority Species	Birds of Conservation Concern Red List	Birds of Conservation Concern Amber List
Blue tit	29	18				
Great tit	21	13				
Long-tailed tit	2	2				
Starling	2	1		4	4	
Magpie	4	2				
Jackdaw	1	1				
Carrion crow	2	1				
Rook	122	109				
House sparrow	3	0		4	4	
Chaffinch	65	41				
Greenfinch	28	18				
Goldfinch	22	13				
Bullfinch	3	2		4	4	
Linnet	20	10		4	4	
Yellowhammer	27	11		4	4	
Reed bunting	13	7		4	4	

* These species can be difficult to accurately census as they are high mobile, vocal and / or have complex breeding ecology. Therefore, it is probable that the number of pairs of each has been overestimated to some extent.

Territory mapping found that the commonest species in the survey area were a mixture of farmland birds and ubiquitous species with wide ranging habitat preferences. The large rookery in Branland Copse (109 nests) within the SSA and a smaller rookery of 12 nests at Wick resulted in rook being the most abundant breeding species in the survey area. Other common species included wren, whitethroat, chaffinch, robin and dunnock which bred in the woodland, scrub and hedgerow habitats throughout the survey area. The commonest species (other than rook) with a strong association with open farmland were skylark and yellowhammer.

Skylark was generally sparsely distributed in the survey area, with a notable aggregation of registrations in arable fields to the east and south-east of the SSA. Despite the fact that full access was not possible to this part of the survey area, the network of public footpaths that exists allowed a number of transects to be walked, and the audibility of the species resulted in numerous registrations being plotted. Yellowhammers were mainly found in farmland in the southern and south-western parts of the survey area. Concentrations of breeding records occurred along Wick Moor Drove (the access road for Hinkley A & B) and along a footpath just to the north of Bullen Farm. The mature and extensive hedgerows that occur in these locations, combined with the proximity of arable farmland for foraging provide suitable local breeding conditions for the species.

The density of breeding birds was greatest in the mosaic of scrub and wetland habitats to the south of the built nuclear power stations (outside the SSA). Notable species breeding in this area included four pairs of lesser whitethroat (two pairs were recorded during the Entec surveys and an additional two pairs were recorded by ADAS with a total of seven pairs across the entire survey area), two pairs of nightingale and three pairs of Cetti's warbler[31] as well as red-listed passerines such as bullfinch and linnet. It is acknowledged that nightingale numbers were underestimated during the Entec survey work, as the May territory mapping survey missed the peak song period as a result of bad weather. Complementary survey data collected by ADAS suggests that 4-5 pairs were present in annually surveyed areas (Martin Sage, pers comm.). In total it seems likely that 5-6 pairs were present within the survey area (one of the Entec registrations is likely to be one of the birds recorded by ADAS, but the other registration was out with the annually surveyed area).

Reed warbler occurred in wetland habitats (ditches and reedbed) in the eastern half of the survey area, with the highest density of registrations being around the Sewage Works of the operational plant. Other species with a wetland association such as sedge warbler and reed bunting were also present, but occurred in lower numbers. Grasshopper warbler, which was recorded 'reeling' from ditch-side vegetation on Wick Moor, may have bred, but is more likely to have been a passage migrant given the regional status of this species, the timing of the record and the sub-optimal breeding habitat in which it occurred.

3.4 Intertidal and Inshore Marine Bird Surveys

Intertidal and inshore marine surveys conducted between April 2007 and March 2009 inclusive (the survey period) resulted in a total of 14 species of wildfowl, 17 species of wader, two species of heron, 10 species of gull and tern, and eight additional species of seabird and water bird being recorded. A summary account of use of each count sector by each of the species that appear as cited/designated interest of at least one of the statutory sites within 5km of the SSA is provided below. The peak monthly counts of cited/designated and non-cited/designated species in each count sector are presented in **Tables C1 and C2** respectively in **Appendix C**.

3.4.1 Qualifying/Assemblage Species

Of the species that appear as designated features of the Severn Estuary SPA during either the winter and/or passage periods; shelduck, dunlin and redshank were recorded during the intertidal surveys undertaken at Hinkley between April 2007 and March 2009. In addition, ringed plover, curlew and pintail (which appear in the SPA Review) were also noted. Bewick's swan, white-fronted goose and gadwall (which appear as designated features for their populations of European importance in the Severn Estuary SPA) were not noted during the intertidal surveys. Wigeon, teal, mallard, shoveler, grey plover, lapwing and whimbrel which are listed in the winter assemblage qualification for the SPA were also recorded, but not pochard or tufted duck.

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[31] Cetti's warbler is the only highly protected species considered to breed within the survey area. It is included on Schedule 1 of the Wildlife and Countryside Act.

Lesser black-backed gull which appears on the Natura 2000 Data Form as a possible future addition to the designated interest of the Severn Estuary Ramsar site during the breeding season was recorded using the survey area during the intertidal surveys (this species has been included in the non-cited species, Section 3.4.2.). In addition, black-tailed godwit, which appears as a cited feature of the Bridgwater Bay SSSI was also recorded.

Shelduck *(Tadorna tadorna)* [SPA, Ramsar and SSSI Qualifying Species]
During the first survey year (April 2007 to March 2008 inclusive), shelduck was recorded on 127 (of 132) intertidal survey dates. The largest numbers were present during August and September 2007, with peak counts of 400 and 700 birds respectively, both in Count Sector 5. In addition, just outside the survey area, counts of 600 and 650 birds were recorded loafing more than 500m offshore from Count Sector 2 on 30 and 21 July 2007 respectively (these counts have been included in **Table C1**). Shelduck were observed in all count sectors, although the largest numbers were recorded in Count Sector 5, both loafing on the water and foraging in the intertidal habitat. The three largest counts of shelduck within the survey area were all of foraging birds in Count Sector 5 (700 birds on 22 September 2007, 530 birds on 6 September 2007 and 400 birds on 23 August 2007). Birds were seen foraging on the intertidal habitat in all count sectors although the vast majority were recorded in Count Sector 5 with very low level use of Count Sectors 1, 2 and 3. Relatively small numbers were seen commuting along the shoreline with no notable movements recorded. Roosting birds were noted on only two occasions, with the largest count being of 13 birds seen 150m offshore on 2 October 2007. Shelduck were recorded throughout the tidal cycle, with the largest numbers recorded foraging in Count Sector 5 approximately two hours either side of low tide. Relatively small numbers were recorded foraging in other count sectors during this part of the tidal cycle. In contrast, numbers of loafing birds were relatively evenly spread across the count sectors and tidal cycle.

During the second survey year (April 2008 to March 2009 inclusive), shelduck was recorded throughout the survey period, being noted on 48 (of 50) intertidal survey dates. The largest flocks were noted during July, August and September 2008, with peak counts of 219 birds feeding in Count Sector 5 on 4 July, 500 birds recorded loafing on the sea in Count Sector 2 on 6 August and 280 birds feeding in Count Sector 5 on 19 September. Numbers in excess of 50 birds were regularly recorded in Count Sector 5 (on 22 occasions) involving birds foraging in intertidal habitat and loafing on the water close inshore. Foraging shelduck were recorded in all count sectors although only regularly in large numbers in Count Sector 5. Foraging activity was concentrated at low tide, with the largest numbers observed three hours either side of low water. In contrast, the largest numbers of loafing shelduck were recorded three hours either side of high water when suitable foraging areas on nearby intertidal habitat were covered by the sea. The numbers of shelduck counted loafing on the sea and on intertidal habitat was more evenly spread across the five count sectors, and not concentrated in Count Sector 5 as for foraging activity. Very few roosting birds were recorded, but included 16 birds in Count Sector 1 on 18 December 2008 and 13 birds in Count Sector 3 on 24 July 2008.

Wigeon (*Anas penelope*) [SPA Assemblage and SSSI Qualifying Species]
During the first survey year (April 2007 to March 2008 inclusive), 2-3 birds were consistently recorded on surveys prior to 12 April 2007 (loafing in Count Sectors 2-5). Wigeon were then recorded on most survey visits from 20 September 2007 to 22 March 2008, with the largest numbers present between November and February inclusive. The three largest counts of wigeon involved 220 birds loafing on the sea close to high tide in Count Sector 4 on 26 January 2008, 170 birds loafing on the sea close to high tide in Count Sector 5 on 15 November 2007 and 150

birds foraging in Count Sector 5 close to low tide on 27 November 2007. Wigeon were observed in all count sectors, although the vast majority (91% of birds) were seen in Count Sectors 4 and 5, most records involving birds loafing on the sea around high tide or foraging on the water close to the tide line. Individuals were also seen feeding on the beach and mudflats, however. Foraging birds were not observed in Count Sectors 1 or 2. Relatively small numbers were seen commuting, usually east along the shoreline with no movements involving large numbers of birds. Roosting birds were noted on only two occasions, including a count of 75 birds on intertidal habitat in Count Sector 4 during high tide on 22 November. The other records of roosting, involved 6 birds on the sea in Count Sector 5 and 27 birds on the sea in Count Sector 3. Wigeon were recorded throughout the tidal cycle with no discernable pattern in numbers of foraging birds, but with larger numbers of loafing birds (usually on the sea) recorded three hours either side of high tide.

During the second survey year (April 2008 to March 2009 inclusive), wigeon were recorded in the intertidal survey area on a total of 24 (of 50) survey dates. Wigeon were noted between 19 September 2008 and 25 March 2009 and were seen on every visit between 23 October and 25 March. The largest numbers were recorded between November and March inclusive, including peak counts of 150 birds foraging in Count Sector 4 on 30 January, 121 birds foraging in Count Sector 4 on 26 February and 110 birds foraging in Count Sector 5 on 12 February. Wigeon were observed loafing on the sea in all count sectors, although the large majority (95% of birds) were seen in Count Sectors 4 and 5. Foraging birds were seen on intertidal habitat and close inshore across much of the tidal cycle in Count Sectors 4 and 5 with no discernable pattern of occurrence. Loafing birds tended to congregate offshore within two hours either side of high water, particularly in Count Sectors 4 and 5. Relatively small numbers were seen commuting, usually east or west along the shoreline with no movements involving large numbers of birds. Roosting birds were noted on two occasions, involving 75 birds in Count Sector 5 on 11 March 2009 and (possibly the same) 75 birds, 1km offshore from Count Sector 1 on the same date.

Teal (*Anas crecca*) [SPA Assemblage and Possible Future Ramsar Site Qualifying Species, SSSI Qualifying Species]

During the first survey year (April 2007 to March 2008 inclusive), teal were recorded irregularly during the survey period. A total of 36 teal were recorded within the intertidal survey area on five occasions as follows: 25 birds on the sea in Count Sector 4 on 27 January 2008, one bird loafing on the sea in Count Sector 2 on 27 February 2008, six birds foraging in Count Sector 4 and three birds loafing on the sea in Count Sector 5 on 2 March 2008 and finally, one bird foraging in Count Sector 5 on 3 March 2008. Teal were not recorded during the second year on intertidal surveys undertaken between April 2008 and March 2009 inclusive. Too few birds were recorded during 2007-09 to identify any patterns in occurrence or use of the intertidal survey area.

Mallard (*Anas platyrhynchos*) [SPA Assemblage Species]

During the first survey year (April 2007 to March 2008 inclusive), mallard were recorded consistently throughout the survey period on 62 (of 132) survey dates, with occurrence being most frequent during January, February and March 2008. Most records involved small numbers of birds, with the largest counts including: 27 birds loafing in Count Sector 5 on 15 June 2007, 20 foraging in the same count sector on 22 June 2007, 17 flushed from the shoreline in Count Sector 5 on 12 February 2008 and 15 birds loafing on the sea in Count Sector 4 on 12 January 2008. Mallard were recorded in all count sectors, with the largest numbers noted in Count Sectors 2, 4 and 5. Most records related to loafing birds and very few mallard were seen roosting, foraging or commuting along the shoreline. Sightings of foraging birds were primarily confined to Count Sectors 4 and 5 and the only records of roosting birds involved a pair in Count Sector 2 on 23 January 2008 and six birds in Count Sector 4 on 24 February 2008.

During the second survey year (April 2008 to March 2009 inclusive), mallard were recorded on 16 (of 50) survey dates in the intertidal survey area: irregularly between April and October but on a more regular basis from November until February. Mallard were recorded in all count sectors, although the majority (93% of birds) were seen foraging or loafing in Count Sectors 4 and 5. The largest counts included 51 birds loafing on the sea in Count Sector 5 on 22 June 2008, 32 birds loafing in Count Sector 4 on 4 July 2008 and 30 birds foraging in Count Sector 5 also on 4 July. However, in general, small numbers of mallard were recorded, with 1-4 birds being seen on most occasions. No roosting mallards were observed, and birds were recorded across much of the tidal cycle with no discernable pattern of occurrence.

Pintail (*Anas acuta*) [SPA Review and Possible Future Qualifying Ramsar Site Species]

During the first survey year (April 2007 to March 2008 inclusive), pintail was recorded on a total of 30 (of 132) survey dates, being present between 4 and 13 April 2007 and 20 September 2007 and 12 March 2008. The three largest counts were of birds loafing on the sea, with 35 birds in Count Sector 4 on 29 October 2007 and 25 birds in Count Sector 5 on 30 October and 16 December 2007. Birds were observed in Count Sectors 2, 3, 4 and 5, although the majority were seen in Count Sectors 4 and 5 (86% of birds). Most records related to birds either loafing on the sea or foraging along the tide-line in Count Sectors 4 and 5. No birds were observed in Count Sector 1 and very few in Count Sectors 2 and 3. Relatively small numbers were seen commuting, usually along the shoreline, with no movements involving large numbers of pintail recorded. Roosting birds were noted on only two occasions, including 12 birds on the water, 150m offshore in Count Sector 5 on 16 December 2007. Pintail were recorded throughout the tidal cycle with the largest numbers of foraging birds occurring three hours either side of low tide in Count Sectors 4 and 5, whereas the majority of loafing birds were recorded on the sea in these count sectors, two hours either side of high tide.

During the second survey year (April 2008 to March 2009 inclusive), pintail were recorded in the intertidal survey area on a regular basis between 19 September 2008 and 19 March 2009 (on 16 of 26 survey dates during this period). Pintail were noted in Count Sectors 3, 4 and 5, with the majority of records (83% of birds) involving individuals loafing or foraging on intertidal habitat or close inshore in Count Sectors 4 and 5. However, the largest count was of 60 pintail loafing in Count Sector 3 on 30 January 2009. No roosting was observed and commuting birds were seen on two occasions, including 40 birds flying east through Count Sector 4 on 30 January 2009. Pintail were recorded across the tidal cycle, although the majority of loafing birds were seen on the sea, two hours either side of high tide and most foraging birds were on intertidal habitat 2-3 hours either side of low water.

Shoveler (*Anas clypeata*) [SPA Assemblage Species]

During the first survey year (April 2007 to March 2008 inclusive), a total of seven shoveler were recorded within the intertidal survey area on four occasions, all in Count Sector 5, as follows: single birds loafing on the sea on 13 February 2008 and commuting offshore on 22 February and 25 February, and 4 loafing birds also on 25 February.

During the second survey year (April 2008 to March 2009 inclusive), a total of five shoveler were recorded on two survey dates as follows: four birds loafing in Count Sector 3 on 11 December 2008 and one bird foraging in Count Sector 5 on 19 March 2009. Too few birds were recorded during 2007-09 to identify any patterns in occurrence or use of the intertidal survey area.

Ringed Plover *(Charadrius hiaticula)* [SPA Review and Possible Future Qualifying Ramsar Site Species]

During the first survey year (April 2007 to March 2008 inclusive), ringed plover was recorded on 37 (of 132) survey dates, and occurred in all months except July. The largest count was of 35 birds commuting east over the sea through Count Sector 2 on 30 October 2007. Birds were observed in all count sectors, although most frequently in Count Sector 1 (48% of birds), with very few birds observed in Count Sectors 3 and 5 (on one date each). Records of foraging birds were almost confined to the beach and rocks in Count Sector 1 with none seen in Count Sectors 3 or 5. Roosting was observed on three occasions, involving 10 birds in Count Sector 4 on 23 September 2007 and 2-3 birds in Count Sector 1 in February and March 2008.

During the second survey year (April 2008 to March 2009 inclusive), ringed plover were recorded in the intertidal survey area in all months of the survey period, and on 27 (of 50) survey dates. The largest count was of 33 birds roosting in Count Sector 1 on 19 September 2007. Ringed plover were recorded in all count sectors, although Count Sectors 1, 2 and 5 received the largest number of records (55%, 22% and 14% of birds respectively). The majority of feeding birds were observed on intertidal habitat in Count Sectors 1 and 2 (76% of birds) with very few seen in Count Sectors 3 and 4 and none in Count Sector 5. Small numbers of ringed plover were observed commuting along the shoreline in all count sectors and roosting was recorded in all but Count Sector 3. Roosting was recorded on eight occasions, five of which were in Count Sector 1 involving 2, 2, 4, 12 and 33 birds respectively. The remaining records of roosting birds were from Counts Sectors 2 (8 birds on 18 December 2008), 4 (1 bird on 5 February 2009) and 5 (4 birds on 27 November 2008). During both survey years, ringed plover were recorded across the tidal cycle with no discernable pattern of occurrence for foraging or loafing birds, although roosting was primarily confined to a period two hours either side of high water.

Grey Plover *(Pluvialis squatarola)* [SPA Assemblage Species]

During the first survey year (April 2007 to March 2008 inclusive), grey plover were recorded on two occasions within the intertidal survey area: a single bird was foraging amongst rocks near the shoreline in Count Sector 2 on 19 December 2007 and three birds roosted in Count Sector 1 on 25 February 2008. Grey plover were not recorded during the intertidal surveys undertaken in the second survey year. Too few birds were recorded during 2007-09 to identify any patterns in occurrence or use of the intertidal survey area.

Lapwing *(Vanellus vanellus)* [SPA Assemblage Species]

During the first survey year (April 2007 to March 2008 inclusive), lapwing were recorded in the intertidal survey area on 18 dates between 19 September 2007 and 12 March 2008 inclusive. Although the species was noted in Count Sectors 1 and 4, all but three sightings came from Count Sector 5. The largest counts were all recorded in Count Sector 5, and included: 40 loafing birds on 23 November 2007; 37 loafing birds on 26 January 2008 and; 36 roosting birds on 22 November 2007. Of the very few foraging birds recorded, all were in Count Sector 5. The only record of roosting birds outside Count Sector 5 involved two lapwings in Count Sector 4 on 15 December 2007. Small groups of 1-4 birds were also seen commuting along the shoreline through Count Sector 5.

During the second survey year (April 2008 to March 2009 inclusive), lapwings were recorded in the intertidal survey area on 7 (of 50) survey dates. Lapwing were seen on 10 July and 18 July 2008, and then on six dates between 7 November 2008 and 16 January 2009. Records were confined to Count Sectors 4 and 5 and foraging birds were only observed on intertidal habitat in Count Sector 5, including 36 birds on 11 December 2008, 18 birds on 11 January 2009 and 45 birds on 16 January. Roosting was recorded on two occasions involving three birds in Count Sector 4 on 18 July 2008 and five birds in Count Sector 5 on 27 November 2008. Too few birds were recorded to identify any detailed patterns of occurrence or use of the intertidal survey area through the tidal cycle.

Dunlin (*Calidris alpina*) [SPA, Ramsar Site and SSSI Qualifying Species]
During the first survey year (April 2007 to March 2008 inclusive), dunlin were recorded on six (of 132) survey dates, as follows: two birds commuting through Count Sector 4 on 24 April and 22 June 2007, seven foraging in Count Sector 1 on 20 July, 13 foraging in Count Sector 2 on 30 July, one foraging in Count Sector 1 on 14 August and two birds commuting through Count Sector 1 on 17 August.

During the second survey year (April 2008 to March 2009 inclusive), small numbers of dunlin (1-9 birds) were recorded on seven (of 50) survey dates. Foraging birds were noted on four occasions, including one bird in Count Sector 1 on 27 June 2008, five birds in Count Sector 1 and another three in Count Sector 2 on 19 September 2008 and nine birds in Count Sector 5 on 24 September. One roosting bird was observed in Count Sector 1 on 23 October 2008. Too few birds were recorded during the intertidal surveys in 2007-09 to identify any clear patterns in occurrence or use of the intertidal survey area. However, the data suggests that dunlin predominantly use the survey area during passage, with very few recorded during winter (one record of two birds commuting through the area on 21 November).

Black-tailed Godwit (*Limosa limosa*) [SSSI Qualifying Species]
During the first survey year (April 2007 to March 2008 inclusive), six black-tailed godwit were recorded commuting west through Count Sector 3 on 13 December 2007. During the second survey year (April 2008 to March 2009 inclusive), black-tailed godwit were recorded in the intertidal survey area on two dates: 15 birds foraging in Count Sector 5 on 27 June 2008 and 100 birds foraging in Count Sector 5 on 21 August 2008. Too few birds were recorded during 2007-09 to identify any detailed pattern of occurrence or use of the intertidal survey area.

Whimbrel *(Numenius phaeopus)* [SPA Assemblage and SSSI Qualifying Species]
During the first survey year (April 2007 to March 2008 inclusive), whimbrel was recorded on 16 (of 132) survey dates. During the spring passage period (primarily April-May), whimbrel were seen on all but one survey date between 24 April and 25 May 2007 inclusive, with a total of 90 birds counted. Birds were recorded in all count sectors, but most frequently in Count Sectors 4 and 5 where 1-5 birds were seen regularly. Foraging birds were recorded in Count Sectors 2-5, with a peak count of 15 birds in Count Sector 5 on 12 May 2007. During autumn passage, whimbrels were noted between 10 and 17 August 2007. All records involved single birds, including individuals commuting through Count Sectors 2 and 5 and foraging birds in Count Sectors 4 and 5.

During the second survey year (April 2008 to March 2009 inclusive), whimbrel was recorded on a total of 12 (of 50) survey dates. During spring passage, a total of 45 birds were counted, with birds recorded on all six visit dates between 9 April and 16 May 2008, with an additional record of two birds on 13 June. During autumn passage, a total of nine birds were recorded on six (of seven) survey dates between 10 July and 21 August 2008. Foraging or loafing whimbrel were observed in all count sectors, with the largest numbers of birds (excluding commuting birds) from Count Sectors 2, 4 and 5 (30%, 27% and 34% of birds respectively). Foraging birds were noted on six occasions, including four birds in Count Sector 5 on 24 April 2008 and three birds also in Count Sector 5 on 9 May. A roosting bird was in Count Sector 4 on 18 July 2008. Whimbrels were recorded across much of the tidal cycle during 2007 and 2008, with foraging in Count Sector 5 primarily taking place during low water.

Curlew *(Numenius arquata)* [SPA Review Qualifying Species, Potential Future Ramsar Qualifying Species]

During the first survey year (April 2007 to March 2008 inclusive), curlew were recorded on all 132 survey visits. The largest counts were of 29 birds roosting in Count Sector 4 on 5 September 2007, 28 roosting there on 15 November and 27 commuting through Count Sector 2 on 22 September. Foraging, roosting and commuting birds were observed in all count sectors. The largest numbers of foraging birds were recorded on the intertidal mud and sand in Count Sector 5 (66% of birds), whilst 61% of roosting birds were noted in Count Sector 4 where a regular high tide roost was identified. Groups of 10-29 roosting birds were recorded regularly two hours either side of high tide in Count Sector 4 from August 2007 to February 2008 inclusive. Small numbers of 1-10 birds were observed commuting either east or west along the shoreline on a regular basis.

During the second survey year (April 2008 to March 2009 inclusive), curlew were recorded on 48 (of 50) survey dates. Numbers were at their lowest during April, May and June 2008 when on average, a total of 7, 2 and 4 birds were recorded on each visit date respectively, compared to 33 in February, 29 in December and 25 in September. The largest counts were all of foraging birds in Count Sector 5 and included 63 birds on 5 February 2009, 34 birds on 23 December 2008 and 31 birds on 11 March 2009. Foraging curlews were observed on a regular basis in all count sectors, with numbers in excess of 15 birds recorded in Count Sector 5 (on eight occasions). Curlews were recorded roosting on 18 occasions, of which 11 were from Count Sector 4, involving up to 20 birds. Elsewhere roosting was much more sporadic, but did include groups of 13 birds on intertidal habitat in Count Sector 1 on 25 March 2009, 17 birds in Count Sector 2 on 19 September 2008 and 16 birds in Count Sector 3 on 16 October 2008. Small numbers of curlew (usually involving 1-20 birds) were also seen on a regular basis commuting along the shoreline in Count Sectors 1, 2 and 3. Curlew were recorded foraging and loafing on intertidal habitat across much of the tidal cycle, although nearly all observations of roosting birds were during the period, 2-3 hours either side of high water.

Redshank *(Tringa totanus)* [SPA and Ramsar Site Qualifying Species]

During the first survey year (April 2007 to March 2008 inclusive), no redshank were seen in the intertidal survey area during spring passage (April and May). During autumn passage and winter, redshank were recorded infrequently and in low numbers, with 16 birds noted on 15 dates between 21 June 2007 and 10 March 2008. One or two birds were seen in all count sectors foraging, roosting, commuting and loafing.

During the second survey year (April 2008 to March 2009 inclusive), redshank were recorded in the intertidal survey area on seven (of 50) survey dates, between 29 August 2008 and 12 February 2009. All but one of the records was from Count Sectors 4 and 5, and involved 1-2 birds. The largest count was of 22 redshanks foraging on intertidal habitat in Count Sector 5 on 11 December 2008. Roosting was observed on one occasion, involving one bird in Count

Sector 4 on 10 October 2008. Too few birds were recorded during 2007-09 to identify any detailed pattern of occurrence or use of the intertidal survey area.

3.4.2 Non-Cited/Designated Species

A range of species that do not appear as cited/designated features of the Severn Estuary Ramsar/SPA or Bridgwater Bay SSSI were recorded during the intertidal surveys undertaken between April 2007 and March 2009 inclusive. A summary account of use of each count sector by each of the species that were recorded on a regular basis in the intertidal survey area is provided below.

Other Waterfowl

A further 13 species of waterfowl that do not appear as specific cited/designated features or within the assemblage qualification of statutory sites (and are not mentioned as potential future interest of the Severn Ramsar Site) within 5km of the SSA were recorded during the survey period. Of these, whooper swan (*Cygnus cygnus*), Canada goose (*Branta canadensis*), red-breasted merganser (*Mergus merganser*), ruddy duck (*Oxyura jamaicensis*), shag (*Phalacrocorax aristotelis*) and great crested grebe (*Podiceps cristatus*) were recorded irregularly in small numbers, each on no more than three occasions during the survey period.

The following species were also recorded during 2007/09:

- Mute swan (*Cygnus olor*). Up to three birds were seen on six dates during 2007-09, including 1-3 loafing birds in Count Sectors 1 and 5;
- Brent goose (*Branta bernicla*). Up to 14 brent geese were seen foraging in Count Sector 5 on three dates during winter 2007/08 (27 January, 13 February and 20 March). This was followed by one brent goose on 24 September 2008, and up to 20 birds foraging or loafing on intertidal habitat in Count Sector 5 on five dates between
11 December 2008 and 11 March 2009;
- Common scoter (*Melanitta nigra*). This species was seen throughout the survey period (2007-09) although in much larger numbers in the first survey year (April 2007 to March 2008). Up to four birds were seen on the sea in Count Sector 4 on three dates in April 2007 and a single bird was also recorded on 21 and 30 July 2007. This was followed by a total of 271 birds on 25 dates between 14 November 2007 and 22 March 2008, with counts of 20-25 birds present during November and December. Many of the records related to birds feeding distantly (i.e. more than 500m) offshore from Count Sectors 4 and 5 which were recorded as incidentals during survey work. However, groups of birds were noted closer inshore on a number of occasions, including 25 feeding 300m offshore in Count Sector 5 on 14 November. During the second survey year (April 2008 to March 2009), up to eight common scoters were seen loafing on the sea on six dates widely spread across the survey period;
- Scaup (*Aythya marila*). A group of four scaup were observed foraging/loafing on the sea in Count Sectors 1 and 2 on four dates between 23 December 2008 and 19 February 2009;

- Grey heron (*Ardea cinerea*). Up to two birds were seen on a regular basis foraging or loafing in all count sectors during 2007-09.

Cormorant and little egret were noted on a more regular basis, further details are provided below.

Cormorant

During the first survey year (April 2007 to March 2008 inclusive), cormorants was recorded on 120 (of 132) survey dates. Birds were seen in all count sectors although most records involved 1-10 birds loafing on intertidal rocks or on the intake tower off Count Sector 3 and approximately 700m north of the SSA (there was a peak count of 15 birds from the sector on 27 October 2007).

During the second survey year (April 2008 to March 2009 inclusive), cormorants were recorded on 41 (of 50) survey dates. Birds were seen in all count sectors, although were only recorded with regularity in Count Sectors 3 and 4. Groups of 1-5 birds were regularly seen loafing or roosting on the intake tower in Count Sector 3, with 12 counted there on 5 December 2008 and 11 on 16 October 2008. Elsewhere, 1-3 birds were regularly observed roosting or loafing on intertidal habitat or commuting along the shoreline in Count Sectors 3 and 4, and less regularly in the other count sectors. Relatively few foraging birds were recorded, with 1-2 birds noted on six occasions on the sea in Count Sectors 3, 4 and 5. During 2007-09, cormorants were recorded in the intertidal survey area throughout the tidal cycle.

Little Egret

During the first survey year (April 2007 to March 2008 inclusive), little egrets were recorded within the intertidal survey area on 105 (of 132) survey dates, and were present on almost every survey between 10 August and 5 December 2007, after which, sightings became less regular. Peak numbers were recorded in August, September and October, with the largest count involving six birds commuting along the shoreline in Count Sector 5 on 20 September 2007. Birds were observed in all count sectors, although Count Sector 4 (29% of birds) and Count Sector 5 (31% of birds) were the most favoured areas, particularly for foraging egrets. Many of the records involved 1-3 little egrets foraging amongst rocks and other intertidal habitat. In addition, 1-2 birds were seen commuting along the shoreline in all count sectors. Roosting birds were noted on only three occasions (involving 1-2 birds in Count Sector 4).

During the second survey year (April 2008 to March 2009 inclusive), little egrets were recorded within the intertidal survey area consistently throughout the period, on 40 (of 50) survey dates. Little egret were observed in all count sectors, with records evenly spread across the different count sectors. The majority of records involved 1-2 birds foraging or loafing on intertidal habitat, or commuting across the survey area (61% of birds were recorded loafing or foraging). Foraging birds were seen across much of the tidal cycle although few were observed one hour either side of high tide (2 individuals) when much of the suitable intertidal feeding areas were covered by water. Few roosting birds were recorded, involving two birds in Count Sectors 2 and 4 on a total of four occasions.

Waders

A further eight species of wader that do not appear as cited/desognated features of statutory sites within 5km of the SSA were recorded during the survey period.

- Golden plover (*Pluvialis apricaria*). One bird was seen alighting briefly in Count Sector 1 on 12 August 2008 before flying south-west;
- Common sandpiper (*Actitis hypoleucos*). In the first survey year, during autumn passage, one bird was seen loafing in Count Sector 5 on 30 July 2007, two in Count Sector 4 on 13 August 2007 and two in Count Sector 5 on 15 August 2007. In the second survey year, a bird was recorded roosting in Count Sector 4 on 21 August 2008;
- Knot (*Calidris canutus*). In the first survey year, knot were recorded on five occasions, including 40 birds flying west through Count Sector 3 on 7 December 2007 and a flock of 100 birds in Count Sector 4 on 19 September 2007. In the second survey year, knot were recorded on two occasions: one bird foraging in Count Sector 1 on 19 September 2008 and another foraging in Count Sector 5 on 5 February 2009;
- Sanderling (*Calidris alba*). A flock of 40 birds was flushed from the shoreline in Count Sector 1 on 8 April 2007. This record was followed by 52 loafing on the shoreline in Count Sector 4 on the following day, and 40 commuting through Count Sector 3 on 11 April. The only other record of this species during 2007-09 was of 6 foraging birds in Count Sector 3 on 30 July 2007; and
- Snipe (*Gallinago gallinago*) were recorded on two occasions, one commuting through Count Sector 5 on 11 December 2008 and another roosting in Count Sector 1 on 18 December 2008.

Oystercatcher, purple sandpiper and turnstone were recorded on a more regular basis. Details are provided below.

Oystercatcher

During the first survey year (April 2007 to March 2008 inclusive), oystercatchers were recorded during all 132 survey visits. The largest counts all involved flocks of roosting birds, with 95 in Count Sector 3 on 29 October 2007 and 89 in Count Sector 1 on 23 September 2007. Roosting birds were observed in all count sectors, with flocks of 20-50 birds recorded regularly in Count Sectors 1, 2, 3 and 4. Flocks of up to 20 birds were also seen on a regular basis foraging and loafing in all count sectors, and commuting birds were frequently observed flying along the shoreline. Groups of 20-50 birds were recorded roosting on a regular basis, two hours either side of high tide in Count Sectors 3 and 4.

During the second survey year (April 2008 to March 2009 inclusive), oystercatchers were recorded in the intertidal survey area on all 50 survey dates. The largest counts were of 100 birds foraging in Count Sector 2 on 18 December 2008, 79 birds roosting in Count Sector 3 on 16 October 2008 and 60 birds roosting in Count Sector 4 on 16 October 2008. Numbers were at their lowest during May and June, but were reasonably constant outside this period (April and July to March). Up to ten oystercatchers were regularly observed foraging on intertidal habitat in all count sectors. Roosting birds were recorded in Count Sectors 1, 2, 3 and 4 but most regularly in Count Sectors 3 and 4, where numbers exceeded 20 birds on five and four occasions respectively and where peak counts of 79 and 60 birds respectively were counted on 16 October 2008. The vast majority of roosting birds (512 of a total of 520 birds) were observed during the period two hours either side of high tide. For foraging and loafing oystercatcher, there was no discernable pattern of occurrence across the tidal cycle.

Purple Sandpiper
During the first survey year (April 2007 to March 2008 inclusive), purple sandpipers were recorded on 16 (of 57) survey dates undertaken between 15 November 2007 and 22 March 2008 inclusive. All but two of the sightings were of loafing birds on the intake tower in Count Sector 3, with the other records being of two birds foraging on rocks in Count Sector 1 on 21 November 2007 and two birds roosting in Count Sector 4 on 15 November 2007. Numbers peaked on 12 January 2008 with a maximum count of 15 birds recorded on the intake tower off Count Sector 3 (after which numbers fell to a peak of seven birds in February and March 2008).

During the second survey year (April 2008 to March 2009 inclusive), purple sandpiper were recorded on five (of six) survey visit dates undertaken between 9 April and 16 May 2008 inclusive, and again on 11 (of 19) visit dates between 14 November 2008 and 25 March 2009 inclusive. Up to nine birds were recorded on 13 dates, loafing, roosting and occasionally foraging on rocks or on the intake tower in Count Sector 3. The remaining observations were all in Count Sector 2, involving seven birds commuting east along the shoreline on 5 February 2009 and single birds foraging and roosting on rocks on 11 December and 18 December 2008 respectively.

Turnstone
During the first survey year (April 2007 to March 2008 inclusive), turnstone was recorded on 48 (of 132) survey dates. Up to eight birds were noted during spring passage (between 4 April and 21 May 2007) with larger numbers recorded during autumn passage and winter (between 16 August 2007 and 22 March 2008). Numbers peaked between January and March, with the highest counts including, 20 birds roosting in Count Sector 1 on 12 March 2008 and 15 foraging birds there on 15 February 2008. Turnstones were recorded in all count sectors, with most sightings relating to 1-10 birds. Small groups of foraging birds were noted on the intertidal shore in Count Sectors 1 and 2 and similarly small groups of roosting and loafing birds were seen in Count Sectors in Count 1, 2 and 4.

During the second survey year (April 2008 to March 2009 inclusive), turnstones were recorded on 30 (of 50) survey dates, between 1 April and 16 May 2008 (spring passage) and between 27 June 2008 and 25 March 2009 (autumn passage and winter). Turnstone were recorded in all count sectors, with the largest counts involving 21 birds foraging in Count Sector 1 on 19 September 2008 and 20 birds roosting in Count Sector 1 on 25 March 2009. Foraging birds were recorded in Count Sectors 1, 2, 3 and 4 but most frequently in Count Sectors 1 and 2 (92% of birds). Roosting and loafing birds were also recorded in all but Count Sector 5, with the majority of records from Count Sectors 1, 2 and 3 and very few from Count Sector 4. Foraging birds were recorded throughout much of the tidal cycle with no discernable pattern of occurrence, although all roosting activity was observed within three hours of high water.

Gulls, Terns and Other Seabirds
Fourteen species of seabirds that do not appear as cited/designated features of statutory sites within 5km of the SSA were recorded during the survey period (many were incidental records from outside the core survey area):

- Manx shearwater (*Puffinus puffinus*). A total of 130 birds were recorded commuting 1-1.5km offshore on 6 July 2007;
- Gannet (*Morus bassanus*). A total of 51 birds were recorded commuting 1-1.5km offshore on three dates between 8 and 13 April 2007;

- Great skua (*Stercorarius skua*). Single birds commuted through the intertidal/ inshore marine survey area on 12 May and 24 September 2007;
- Kittiwake (*Rissa tridactyla*). During the first survey year, kittiwakes were seen on four occasions, with single birds seen flying well offshore on 20 September 2007, 25 November 2007 and 12 March 2008 and five birds on 7 December 2007. During the second survey year, kittiwake was seen on one occasion: a bird commuted west through Count Sector 5 on 22 January 2009;
- Mediterranean gull was recorded on three dates, involving single birds commuting through the intertidal survey area on 30 July 2007, foraging in Count Sector 2 on 23 December 2008 and loafing in Count Sector 5 on 24 September 2008;
- Sandwich tern (*Sterna sandvicensis*). Up to three birds were noted commuting offshore on 12 August 2007 and a total of nine birds commuting through the intertidal survey area on 9 May 2008; and
- Guillemot (*Uria aalge*). One bird was seen offshore on 24 August 2007.

Black-headed, common, herring, lesser black-backed and great black-backed gulls and common and Arctic terns were all recorded on a more frequent basis, details of which are provided below:

Black-Headed Gull

During the first survey year (April 2007 to March 2008 inclusive), black-headed gulls were recorded on 112 (of 132) survey dates, primarily between June and March. Black-headed gulls were predominantly noted in Count Sectors 4 and 5 (where 25% and 54% of birds were recorded respectively). The majority of records were of loafing and foraging birds; groups of up to 50 birds were regularly seen feeding around the outfall in Count Sector 4. Relatively small numbers of birds were seen commuting along the shoreline and no large congregations of roosting birds were located. Roosting birds, when noted, were primarily confined to Count Sectors 4 and 5 although large numbers of loafing birds were observed on intertidal habitat and the sea in all count sectors.

During the second survey year (April 2008 to March 2009 inclusive), black-headed gulls were recorded on 39 (of 50) survey dates in the intertidal survey area between 13 June 2008 and 25 March 2009. Black-headed gulls were recorded foraging and loafing in all count sectors, although the largest numbers were seen in Count Sectors 4 and 5 (32% of birds each). Counts in excess of 100 birds were noted on six occasions, including 120 birds roosting in Count Sector 4 on 21 August 2008, 110 birds loafing in Count Sector 4 on 16 October 2008 and 105 birds on the same date foraging in Count Sector 5.

Common Gull

During the first survey year (April 2007 to March 2008 inclusive), common gulls were recorded on 30 July (one bird) and then in larger numbers on 22 survey dates between 6 September 2007 and 3 March 2008. Sightings were most frequent during December and January. This was the scarcest of the gull species, with most records relating to small numbers of birds commuting along the shoreline and sea. Very few foraging birds were observed and these were confined to the area, in and around the outfall in Count Sector 4.

During the second survey year (April 2008 to March 2009 inclusive), common gulls were recorded on 11 survey dates between 19 September 2008 and 11 March 2009. Most records related to 1-2 birds foraging or loafing on the sea or in intertidal habitat, or commuting along the shoreline or through the inshore waters. Common gulls were noted in all count sectors, with the largest count involved 13 birds loafing in Count Sector 1 on 24 September 2008. Common gulls were recorded throughout much of the tidal cycle during 2007-09 with no discernable pattern of occurrence.

Herring Gull

During the first survey year (April 2007 to March 2008 inclusive), herring gulls were the most abundant species recorded during the intertidal surveys, occurring on all 132 survey dates. The largest count involved 350 birds loafing in Count Sector 3 on 13 March 2008. Large numbers of birds were seen in all count sectors, with a high proportion of the records relating to loafing birds or individuals commuting along the shoreline. Foraging birds were observed in all count sectors, particularly in Count Sectors 1, 3, 4 and 5, usually involving up to 30 birds feeding on the shoreline. Large numbers of herring gulls were seen loafing on rocks, the shoreline and the intake tower, but particularly in and around the Power Stations. Groups of up to 40 herring gulls were recorded loafing in all count sectors on a regular basis. The largest counts of loafing birds were 130, 90, 350, 200 and 48 in Count Sectors 1-5 respectively. No sizeable roosts of herring gulls were identified, with the largest counts of roosting birds involving 120 in Count Sector 3 on 29 October 2007 and 100 in Count Sector 1 on 24 August 2007.

During the second survey year (April 2008 to March 2009 inclusive), herring gull was again the most abundant species recorded during the intertidal surveys, being noted on all 50 survey dates. Counts of 100 or more herring gulls were noted on 20 occasions, with 14 of these coming from Count Sector 3 mostly involving birds loafing on the sea or in intertidal habitat. The largest count, however, was of 276 birds foraging in Count Sector 3 on 15 August 2008. Foraging, loafing and roosting birds were recorded in all counts, with the largest roost count involving 138 birds in Count Sector 3 on 19 February 2009. During the breeding season (April to July 2008 inclusive) foraging and loafing herring gulls were recorded in all count sectors, particularly in Count Sector 3, where a peak of 185 loafing birds was counted on 1 April 2008. Large counts were also noted in Count Sectors 4 and 5, with peak counts of 174 and 111 loafing birds respectively, both on 1 April 2008. Herring gulls were recorded throughout the tidal cycle during 2007-09 with no discernable pattern of occurrence.

Lesser Black-Backed Gull [Possible future Ramsar Site Qualifying Species]

During the first survey year (April 2007 to March 2008 inclusive), lesser black-backed gulls were recorded on 104 (of 132) survey dates. Birds were seen throughout much of the year, although sightings were less frequent and the species was present in smaller numbers between October 2007 and February 2008 inclusive. The peak count was of 50 birds loafing in Count Sector 3 on 13 March 2008. Lesser black-backed gulls were observed in all count sectors with most records relating to loafing birds on intertidal habitat and the sea, or to small groups of birds commuting along the shoreline and sea. Very few foraging or roosting birds were noted.

During the second survey year (April 2008 to March 2009 inclusive), lesser black-backed gulls were recorded on 42 (of 50) survey dates. Birds were recorded in all count sectors although the largest count was of 35 birds loafing in Count Sector 4 on 1 April 2008. The majority of records related to birds loafing on the sea or intertidal habitat, or commuting through the survey area. Relatively few birds were observed foraging or roosting (1-3 birds were noted on ten and five occasions respectively). Counts of ten or more birds were noted on seven occasions, with all but one record involving loafing birds in Count Sectors 3 and 4. During the breeding season (April to July 2008 inclusive), 1-5 foraging and loafing birds were recorded regularly in Count Sectors 3, 4 and 5 but none in Count Sectors 1 and 2. Counts in excess of 10 birds were noted on three occasions (twice in Count Sector 3 and once in Count Sector 4). Lesser black-backed gulls were recorded throughout the tidal cycle with no discernable pattern of occurrence.

Great Black-Backed Gull

During the first survey year (April 2007 to March 2008 inclusive), great black-backed gulls were recorded on 87 (of 132) survey dates through much of the period. Birds were seen in all count sectors, with a large proportion of the records relating to birds loafing on, or commuting along the shoreline and sea. Very few foraging or roosting birds were observed. Small groups of 1-2 birds were frequently seen loafing on the intake tower in Count Sector 3, with a maximum count of 12 birds there on 13 August 2007. Great black-backed gulls were recorded throughout the tidal cycle with no discernable pattern of occurrence.

During the second survey year (April 2008 to March 2009 inclusive), great black-backed gull were recorded on 35 (of 50) survey dates throughout much of the survey period. Birds were observed in all count sectors, with numbers being relatively consistent throughout. The majority of records were of 1-2 birds loafing on intertidal habitat or the sea, or commuting through the survey area. Few foraging birds were recorded, with 1-3 birds noted on ten occasions, the majority of which were in Count Sector 5. Great black-backed gulls were recorded throughout the tidal cycle with no discernable pattern of occurrence.

Common and Arctic Terns

During the first survey year (April 2007 to March 2008 inclusive), single common terns were recorded on 6 and 30 July and then occurred in larger numbers on 14 dates between 23 August 2007 and 31 October 2007. The vast majority of records related to groups of birds feeding around the outfall in Count Sector 3 in September and October, with a maximum count of 48 birds noted on 25 September. The pattern of occurrence for Arctic tern was very similar to that of the common tern, with birds recorded on 12 dates between 14 September 2007 and 31 October 2007. The vast majority of records related to groups of birds feeding around the outfall in Count Sector 3 during 14-25 September and 3-6 October, with a maximum count of 38 birds noted on 25 September. In addition, a further 111 unidentified terns, likely to be either Arctic or common terns were recorded between 26 September and 2 October[32]. All of these records related to birds feeding around the outfall, with a maximum count of 35 birds there on 28 September.

During the second survey year (April 2008 to March 2009 inclusive), common terns were recorded on three dates, as follows: 9 May 2008 (two birds loafing in Count Sector 2), 16 May (32 birds commuting east and ten birds foraging offshore in Count Sectors 3 and 4) and 19 September 2008 (four birds foraging offshore in Count Sector 4). Arctic terns were noted on one date, involving five birds foraging offshore in Count Sector 4 on 21 August 2008.

[32] Common and Arctic terns are difficult to identify to species at distance, particularly when they are present in wheeling flocks such as those seen around the outfall. Both juvenile and adult birds show similar plumage characteristics that at distance or in poor light often make reliable separation very problematic.

3.5 Daytime Field Surveys

A wide range of target species (as defined in Section 2.2.2) were recorded in the survey area during the daytime field surveys undertaken between September 2007 and March 2009 inclusive. Table 3.5 shows the peak count[33] for each month within the survey area. **Figure 3.5a-b** shows the location within the survey area of any cited/designated[34] species during the first and second survey years (2007/08 and 2008/09 respectively) and **Figures 3.6a-b** illustrates any notable congregations (i.e. flocks of 50 or more birds) of non-cited/designated, target species[35] recorded within the survey area during 2007/08 and 2008/09 respectively.

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[33] The peak count has been derived from the sum of all counts within the field survey area on a single survey date.

[34] Cited/designated species - qualifying or assemblage species for statutory sites of nature conservation value within 5km of the site.

[35] Non-cited/designated, target species - species that were targeted during the daytime field surveys (as defined in section 2.2.2), but not cited in statutory sites of nature conservation value within 5km of the site. Flocks of wood pigeon and rook have been excluded because both species are considered to be of limited conservation value.

Table 3.5 Daytime Field Survey Results (Peak Monthly Counts within the Survey Area)

Species[36]		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mute Swan	*Cygnus olor*	2008/09	2	2	4				2	2	2	2	3	
Shelduck	*Tadorna tadorna*	2007/08												3
Shelduck	*Tadorna tadorna*	2008/09	2	25	16						4			
Gadwall	*Anas strepera*	2007/08									1			
Teal	*Anas crecca*	2007/08								9	30	70	27	8
Teal	*Anas crecca*	2008/09						6	12	35	60	110	70	
Mallard	*Anas platyrhynchos*	2007/08								2	18	7	5	3
Mallard	*Anas platyrhynchos*	2008/09	3	7					5	8	6		2	4
Little Egret	*Egretta garzetta*	2007/08								2	2	3	1	1
Little Egret	*Egretta garzetta*	2008/09	1	3	1	2	1	2	9	5	9	3	4	1
Marsh Harrier	*Circus aeruginosus*	2008/09					1							
Merlin	*Falco columbarius*	2007/08						2		1			1	1
Merlin	*Falco columbarius*	2008/09							1	1	1	1		
Hobby	*Falco subbuteo*	2008/09		1		1								
Peregrine	*Falco peregrinus*	2007/08								1	3	1	1	3
Peregrine	*Falco peregrinus*	2008/09	1		1		1	1	2	1	1	1	3	

[36] NB: some species (such as mute swan) were recorded in one survey year only. No large counts (i.e. 50 plus birds) of black-headed, common or lesser black-backed gulls were recorded during 2007/08. Large counts of stock dove, pied wagtail, swallow, jackdaw, house sparrow and goldfinch were recorded in one survey year only.

Species[36]		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Water Rail	*Rallus aquaticus*	2008/09											2	
Coot	*Fulica atra*	2008/09						1						
Oystercatcher	*Haematopus ostralegus*	2007/08										5		1
Oystercatcher	*Haematopus ostralegus*	2008/09				2						4		2
Golden Plover	*Pluvialis apricaria*	2007/08									7		27	1
Golden Plover	*Pluvialis apricaria*	2008/09										37	127	6
Lapwing	*Vanellus vanellus*	2007/08								147	63		44	
Lapwing	*Vanellus vanellus*	2008/09					3		5		26	135	161	3
Snipe	*Gallinago gallinago*	2007/08								3	2	1	4	
Snipe	*Gallinago gallinago*	2008/09						1		1	10	29	12	1
Whimbrel	*Numenius phaeopus*	2008/09		3										
Curlew	*Numenius arquata*	2007/08								10	21	10	14	3
Curlew	*Numenius arquata*	2008/09			1	1		2	3	10	19	20	14	8
Redshank	*Tringa tetanus*	2008/09										1		
Black-headed Gull	*Chroicocephalus ridibundus*	2008/09				39	30	90	30	37	15	75	74	
Common Gull	*Larus canus*	2008/09										65	51	
Lesser Black-backed Gull	*Larus fuscus*	2008/09		10										
Herring Gull	*Larus argentatus*	2007/08										110		
Herring Gull	*Larus argentatus*	2008/09	14	100	15	20	170	34	110	450	40	105	152	
Stock Dove	*Columba oenas*	2007/08								45	130			
Little Owl	*Athene noctua*	2008/09												1

Species[36]		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Kingfisher	*Alcedo atthis*	2007/08									1	1		1
Kingfisher	*Alcedo atthis*	2008/09							1				1	
Skylark	*Alauda arvensis*	2007/08								61	155	150	60	
Skylark	*Alauda arvensis*	2008/09						31	78	22	62	50	1270	20
Swallow	*Hirundo rustica*	2008/09							100					
Meadow Pipit	*Anthus pratensis*	2007/08										40	57	105
Meadow Pipit	*Anthus pratensis*	2008/09	60							30				35
Pied Wagtail	*Motacilla alba*	2008/09											51	
Nightingale	*Luscinia megarhynchos*	2008/09		2										
Black Redstart	*Phoenicurus ochruros*	2007/08									1			
Redstart	*Phoenicurus phoenicurus*	2008/09				1								
Stonechat	*Saxicola torquatus*	2008/09												5
Fieldfare	*Turdus pilaris*	2007/08									44			
Fieldfare	*Turdus pilaris*	2008/09	11							300	150	20	215	140
Song Thrush	*Turdus philomelos*	2007/08									20			
Song Thrush	*Turdus philomelos*	2008/09									50			
Redwing	*Turdus iliacus*	2007/08									19		60	
Redwing	*Turdus iliacus*	2008/09							60	82		10	373	
Cetti's Warbler	*Cettia cetti*	2007/08							1	1		1		1
Cetti's Warbler	*Cettia cetti*	2008/09	2	3				2	2		1			1
Firecrest	*Regulus ignicapilla*	2007/08												1

Species[36]		Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Marsh Tit	*Poecile palustris*	2008/09										1		
Jackdaw	*Corvus monedula*	2008/09					60							
Starling	*Sturnus vulgaris*	2007/08								125	750	200	80	
Starling	*Sturnus vulgaris*	2008/09					40		345	700	200	200	700	35
House Sparrow	*Passer domesticus*	2008/09						120	25					
Chaffinch	*Fringilla coelebs*	2007/08								120			50	
Chaffinch	*Fringilla coelebs*	2008/09							140	50	50			
Goldfinch	*Carduelis carduelis*	2008/09								50				
Linnet	*Carduelis cannabina*	2007/08						450		120		35		
Linnet	*Carduelis cannabina*	2008/09			30		80	75	135	140	50	110	50	14
Yellowhammer	*Emberiza citronella*	2007/08									25	30		
Yellowhammer	*Emberiza citronella*	2008/09									15			

Nine species forming part of the cited/designated of the Severn Estuary SPA and Ramsar Site and/or the Bridgwater Bay SSSI, were recorded during the daytime field surveys, as follows:

- SPA qualifying species: shelduck, gadwall, curlew (SPA Review) and redshank;
- SPA assemblage qualification species: teal, mallard, lapwing and whimbrel;
- Ramsar site qualification species: shelduck, gadwall and redshank;
- Possible future Ramsar site qualification species: teal and lesser black-backed gull; and
- SSSI qualification species: shelduck and whimbrel.

Overall, the survey area was used by relatively small numbers of (mostly) common and widespread species, few of which formed part of the cited/designated interest of locally designated areas. Large flocks of birds were not recorded on a regular basis feeding, loafing or roosting in the fields. Different species were associated with the two dominant habitat types in the survey area: improved grassland and pasture (e.g. lapwing) and arable fields (e.g. curlew), which at the time of the surveys were predominantly ploughed or given over to stubble/set-aside, rape and winter-sown wheat.

3.5.1 Detailed Summary of Results

A summary of the occurrence during the first survey year (September 2007 to March 2008 inclusive) and second survey year (April 2008 to March 2009 inclusive) of those species listed above (i.e. designated or possible future designated features of the Severn Estuary SPA/Ramsar site and/or Bridgwater Bay SSSI) is as follows:

- Shelduck [SPA and Ramsar site qualifying species]. During the first survey year, shelduck were recorded on two survey dates: 2-3 birds feeding in Field 1 on 11 and 14 March 2008. During the second survey year, shelduck were recorded on eight survey dates, predominantly involving small groups of birds loafing in fields, including 20 birds in Field 13 on 8 May 2008 and 16 birds in Field 3 on 12 June 2008. There was one record of foraging shelduck, involving 4 birds in Field 2 on 22 December 2008;
- Gadwall [SPA and Ramsar site qualifying species]. One bird was on the pool east of the sewage works on 22 December 2007;
- Teal [SPA assemblage and possible future Ramsar site qualifying species, SSSI qualifying species]. During the first survey year, teal were recorded from 19 November 2007 onwards, particularly on the pool to the east of the sewage works, where a maximum of 70 birds were observed on 15 January 2008 and 40 birds were present on 25 January 2008. Elsewhere, up to six teal were seen in ditches to the south of the Power Stations. During the second survey year, teal were regular visitors to the pool, east of the sewage works between September 2008 and February 2009 although were rarely seen elsewhere. Counts in excess of 20 birds were recorded on the pool on ten dates, with a peak of 110 birds noted on 21 January 2009 and 70 birds on 6 and 18 February 2009;

- Mallard [SPA assemblage species]. Small numbers (usually 1-10 birds) were seen on a regular basis on the pool east of the sewage works and in ditches around Wick Moor, in the east of the survey area;
- Lapwing [SPA assemblage species]. During the first survey year, lapwing were recorded on a regular basis, with most records of foraging birds being on pasture and arable fields south of the Power Stations, in the east of the survey area. Flocks in excess of 50 lapwings were recorded on four occasions foraging on pasture and fields containing winter-sown cereal in the south and south-east of the survey area. Maximum counts of feeding birds included 67 in Field 48 on 16 November 2007. During the second survey year, small flocks of foraging lapwing were noted on 24 occasions (on 17 dates). On 10 January 2009, a total of 125 birds were counted across a number of coastal fields to the west of the built plant (within the likely build area). Flocks of foraging lapwing were recorded on a regular basis (on 14 survey dates) particularly between October and February, primarily in fields of pasture to the south of the Power Stations around Wick Moor (outside the likely build area), and in fields immediately to the south of the SSA (within the likely build area);
- Curlew [SPA Review qualifying species, potential future Ramsar qualifying species]. During the first survey year, all but five of the 15 records of curlew came from large arable fields adjacent to the seawall to the west of the built plant, including four records of 1-10 foraging birds in Fields 1 and 2 and six records of 1-14 foraging birds in Field 17 immediately to the west of it. Elsewhere, records of curlew were very sporadic but included 21 birds at Wick Moor (Field 81) on 21 December 2007. During the second survey year, curlew were recorded on a more regular basis (on 26 occasions) with most records involving 1-15 birds foraging in Fields 1 and 2 (October to March) and Fields 17 and 39 (September to January). The peak count was of 20 curlew foraging in Field 17 on 21 January 2009;
- Whimbrel [SPA assemblage and SSSI qualifying species] was recorded on one survey date involving three birds loafing in Field 2 on 8 May 2008;
- Redshank [SPA and Ramsar site qualifying species] were recorded on one survey date, involving a bird in Field 16 on 10 January 2009.

Non-cited/designated species recorded in the SSA during the daytime field surveys included waders, raptors and farmland passerines. A summary of the more notable activity for the entire survey period (September 2007-March 2009 inclusive) is included below:

- Little egret. During the first survey year, 1-2 little egrets were regularly seen in the ditches in and around Wick Moor. Little egrets were seen on 13 occasions during November 2007 to March 2008 inclusive, with most sightings being of single birds loafing or foraging in ditches and on pastures immediately south of the Power Stations. Little egrets were also occasionally seen in fields north of Myrtle Farm in Shurton. During the second survey year, little egrets were regularly seen foraging around Field 92 (Wick Moor) where a peak count of eight birds were feeding on 22 October 2008 (8 birds were also noted commuting through this field on 4 December 2008);

- Golden plover. During the first survey year, records of foraging golden plover were infrequent (up to seven birds recorded on a total of three survey dates in December 2007 and February 2008) and confined to coastal fields of winter-sown cereal in the western part of the survey area. During the second survey year, flocks of golden plover were noted on 17 occasions between January and March 2009: including 30 birds foraging in Field 26 on 10 January, and regular small flocks in Fields 37 and 48. The vast majority of golden plover were seen on two dates, with a total of 98 and 127 birds recorded primarily in two areas (Field 17 and Fields 31/37/48) on 6 and 7 February 2009 respectively;

- Snipe. Small numbers of snipe (usually 1-3 birds) were recorded regularly in both winters between November and February in fields and ditches on Wick Moor to the south of the Power Station. Twenty snipe in Field 13 on 10 January 2008 and ten birds loafing in Field 37 on 11 December 2007 were the most notable counts;

- Notable raptors. During the first survey year, single hunting or commuting merlins were recorded on five occasions, and peregrine on nine occasions within the survey area. The records suggest that up to two peregrines were using the survey area during the 2007/08 winter period; they were most often noted in and around the immediate vicinity of the power stations. During the second survey year, a minimum of two peregrine were regularly recorded hunting in the survey area throughout the survey period. These birds showed a clear association with the operational plant, but are not considered to have bred (Dick Best, British Energy Warden, *pers comm*). Also during the second survey year, there were six winter records of merlin, a marsh harrier was noted commuting through the area on 14 August and hobby was seen on 20 May and 9 July 2008;

- Lesser black-backed gull [Possible future Ramsar site qualifying species]. The only record of note was of ten birds foraging in Field 56 on 8 May 2008;

- Other gull species. During the first survey year, very few large flocks of gulls were seen within the survey area. During the second survey year, counts of 50 or more black-headed gulls were recorded on four occasions, all in autumn and winter. Large numbers of common gull were not recorded although considerable numbers of herring gulls were frequently recorded foraging or loafing in the fields throughout the survey period. Counts in excess of 100 herring gulls were noted on five occasions, including 300 foraging birds in Field 78 on 20 November 2008 and 170 loafing birds in Field 48 on 14 August 2008. During the breeding season, large counts of herring gull were recorded infrequently, but included a peak count of 50 foraging birds in Field 56 on 8 May 2008;

- Kingfisher. During the first survey year, single kingfishers were seen or heard on four occasions between December 2007 and March 2008 inclusive, all along water-filled ditches south of the Power Stations. During the second survey year, single birds were recorded in ditches in and around Wick Moor on 22 and 30 October and 6 February;

- Cetti's warblers were heard on a regular basis throughout the survey period (2007-09) in the mosaic of habitats to the south of the power station, usually calling or singing from reedy ditches forming the boundaries of fields 66 and 89 and in scrub near the Sewage Works;

- Winter farmland passerines (2007/08). During the first survey year, flocks of wintering skylark and linnet were associated with the large arable fields in the west of the survey area. Peak counts of linnet in this area included: 250 birds in Field 1 on 21 September 2007 and 80 in Field 17 on 19 November 2007. Peak counts of skylark included: 120 birds in Field 1 on 21 December 2007 and 10 January 2008 and up to 150 birds in Field 17 on four occasions in January 2008. Seventy linnets were also recorded in Field 80 in the south-east corner of the survey area on 16 November 2007, and a flock of 25-30 yellowhammers was recorded on two occasions in Field 46, north of Myrtle Farm in the south of the survey area. Meadow pipit numbers were highest between January and March 2008, with a peak count of 95 birds foraging on pasture (Field 84) on 17 March. Flocks of 35-95 meadow pipits were recorded in pastures in or near North Moor on five occasions. This species was widespread, although most of the larger counts were on pasture in the east of the survey area. Foraging starlings were usually associated with pasture and included flocks of 100-600 birds on five occasions in winter 2007/08 and 15 occasions in winter 2008/09, usually in fields around Wick Moor;

- Winter farmland passerines (2008/09). During the second survey year, skylarks were recorded widely across the survey area, with the largest numbers again seen in arable fields in the western part of the survey area, with a total of 600-700 birds counted in fields 17, 21, 22, 23, 27 and 28 on 7 February 2009 and 300 birds in this area on 11 February. Flocks of 30-80 linnets were seen foraging in fields on a regular basis during August to March inclusive, with the more notable counts being 80 birds in Fields 14 and 15 on 14 August 2008, 70 birds in Fields 16 and 17 on 20 November 2008 and 140 birds in Field 17 on 15 November 2008. Linnet flocks were particularly frequent in Field 17;

- Winter thrushes. Large flocks of wintering thrushes were occasionally observed feeding in fields within the SSA. Flocks included: 300 fieldfares in Field 65 on 20 November 2007 and 110 redwings in Field 45 during 6-7 February 2008. During the second survey year, flocks of 100-300 redwings and fieldfares were noted on four survey dates (20 November 2008 and on three dates in February 2009);

- Additional species of interest included: up to two water rails on 6-7 February 2008 in typical wetland habitat to the south of the built plant; a black redstart along the seawall near Hinkley Bridge on 22 December 2007, and a firecrest (presumably a migrant bird) in the hedge by Fields 32/30 on 18 March 2008.

3.6 Nocturnal Field Surveys

Results from the nocturnal surveys undertaken within the survey area in 2007-09 provide no evidence to suggest that the fields or adjacent upper intertidal habitat were being used by large numbers of roosting or foraging birds at night. Due to the limitations of even the most sensitive of night vision equipment, and the difficulties in locating small waders hidden in tidal creeks at night, the counts obtained from the intertidal survey are indicative, as is behaviour assigned to all of the species recorded during the survey work. Nevertheless, the consistency of the results and the experience of the surveyor in undertaking nocturnal work in Somerset (on behalf of

Natural England and others) gave considerable confidence that the results are an accurate reflection of the level of interest present.

Table 3.6 and Table 3.7 show the total number of each species recorded on each visit during the first and second survey years respectively, and **Figure 3.7a-b** shows the location and numbers of target species recorded in the first and second survey years respectively.

A wide range of target species (as defined in Section 2.2.2) were recorded during the nocturnal surveys, either in fields within the survey area, or on intertidal habitat within the intertidal survey area. The following provides a summary of nocturnal bird activity[37] on the intertidal area adjacent to the SSA during the first survey year (December 2007 to March 2008 inclusive) and second survey year (April-May 2008 and August 2008 to March 2009 inclusive):

- Shelduck. During the first survey year, the only notable count of shelduck as of 19 birds in Count Sector 1 on 24 January 2008. Up to four birds were recorded on a further three survey dates during December 2007 and in January to February 2008. During the second survey year, 20-24 shelduck (two records of loafing birds and the other record of birds being flushed) were noted on three dates (10 and 13 December 2008 and 10 January 2009) also in Count Sector 1. Roosting shelduck were noted on one occasion, involving five birds in Intertidal Count Sector 4 on 21 August 2008;

- Oystercatcher. During the first survey year, oystercatchers were recorded on five survey dates between December 2007 and February 2008. Peak counts of roosting birds in Count Sector 1 included: 100 birds on 24 January 2008 and 65 birds on 21 February 2008. During the second survey year, 20-80 oystercatcher were recorded on 11 dates (all in Intertidal Count Sector 1), including counts of 30-80 roosting birds on ten dates;

- Whimbrel (single calls) was heard in the intertidal area on 14 April 2007 and 14 August 2007;

- Small numbers of wigeon, golden plover, lapwing, redshank, dunlin, snipe and turnstone were noted infrequently during 2007-09;

- Ringed plover, grey plover, turnstone and curlew were noted on a more regular basis (3, 1, 2 and six dates respectively in the first survey year, and 11, 5, 5 and 13 dates respectively in the second survey year).

Nocturnal use of the coastal fields (as opposed to the intertidal covered above) by waders and other target or notable species is summarised as follows:

- Golden plover. During the first survey year, small numbers of golden plover (1-8 birds) were recorded on all nocturnal surveys in arable fields and pasture adjacent or close to the seawall in the west of the survey area (all of which were either in or immediately adjacent to the SSA). The frequency of golden plover records from the nocturnal surveys was appreciably greater than that for the daytime field surveys during 2007/08, indicating that the survey area (including the SSA) was probably being used by small numbers of foraging and/or roosting birds. During

[37] In practice, even with high quality night vision equipment, it is very difficult to assign behaviour to species.

the second survey year, golden plovers were recorded in fields within the survey area on a regular basis (on nine dates), particularly in Fields 17 and 2 (both within the SSA). Peak counts included 21 foraging and loafing golden plover in Field 2 on 10 December 2008 and 13 foraging birds in nearby Field 17 on the same date. The total number of golden plover counted on any one date, rarely exceeded 15 birds, but included 37 birds counted on 10 December 2008 and 19 birds on 10 March 2009;

- Lapwing. During the first survey year, 1-3 lapwings were recorded on a regular basis, primarily in pasture to the south of the Power Stations in the eastern part of the survey area. During the second survey year, lapwing were noted widely across the survey area on eight dates, including 14 birds in Field 60 on 10 January 2009 with an overall total of 55 birds in all fields on that date;

- Snipe. During the first survey year, small numbers of snipe were recorded on all nocturnal survey visits, again in pasture areas, but also along ditches to the south of the Power Stations, with the largest count involving 15 birds in Field 66 on 21 February 2008. Two counts in excess of ten snipe were recorded in the ditch between Fields 66 and 83, also in this area. During the second survey year, snipe (usually 1-3 birds) were flushed from ditches in and around Wick Moor on a total of 13 dates between September 2008 and March 2009. The largest counts of snipe all came from Field 66 (North Moor), and included 12 birds on 10 December 2008, 20 birds on 13 January 2009 and 15 birds on 6 February 2009;

- Other wildfowl. During the first survey year, up to 14 mallard were recorded on four dates between December 2007 and March 2008. Two teal were seen on two dates (January and February 2008), with all but one record of mallard and teal derived from ditches south of the Power Stations. During the second survey year, small numbers of wigeon (1-2 birds on three dates), teal (1-2 birds on three dates) and mallard (up to nine birds on five dates) were also recorded in fields and ditches, again primarily to the south of the Power Station around Wick Moor;

- Barn owls were recorded over Field 85 (part of the Hinkley Nature Reserve) on 17 March 2008 and loafing in Field 7 (within the SSA) on 21 August 2008;

- Woodcock. No woodcock were recorded during the first survey year. During the second survey year, 1-2 woodcock were flushed from Fields 1 and 17 (within the SSA) on four dates during the winter.

Passerine interest included 2-3 singing Cetti’s warblers immediately south of the Power Stations (Fields 60/64/80) and two singing nightingales (in scrub around Field 87 and west of the sewage works) in April and May 2008.

Table 3.6 Nocturnal Field Survey Results, 2007/08[38]

Species	Location	21 Dec	26 Dec	17 Jan	24 Jan	18 Feb	21 Feb	17 Mar	19 Mar
Shelduck	Intertidal	P		2	19				4
Wigeon	Intertidal						4		
Teal	Fields	1			2		2		
Mallard	Fields		14	9				4	1
Mallard	Intertidal					1			
Oystercatcher	Intertidal	P			100		66	1	1
Ringed Plover	Fields								2
Ringed Plover	Intertidal	1		1	4				
Golden Plover	Fields	5	5	1	4	10	4	9	1
Grey Plover	Intertidal						1		
Lapwing	Fields	6	3		5				
Snipe	Fields	3	13	4	16	3	19	10	8
Curlew	Intertidal	P	P		4	1	2		2
Redshank	Intertidal				1				
Turnstone	Intertidal	P			1				
Herring Gull	Intertidal							1	
Barn Owl	Fields							1	

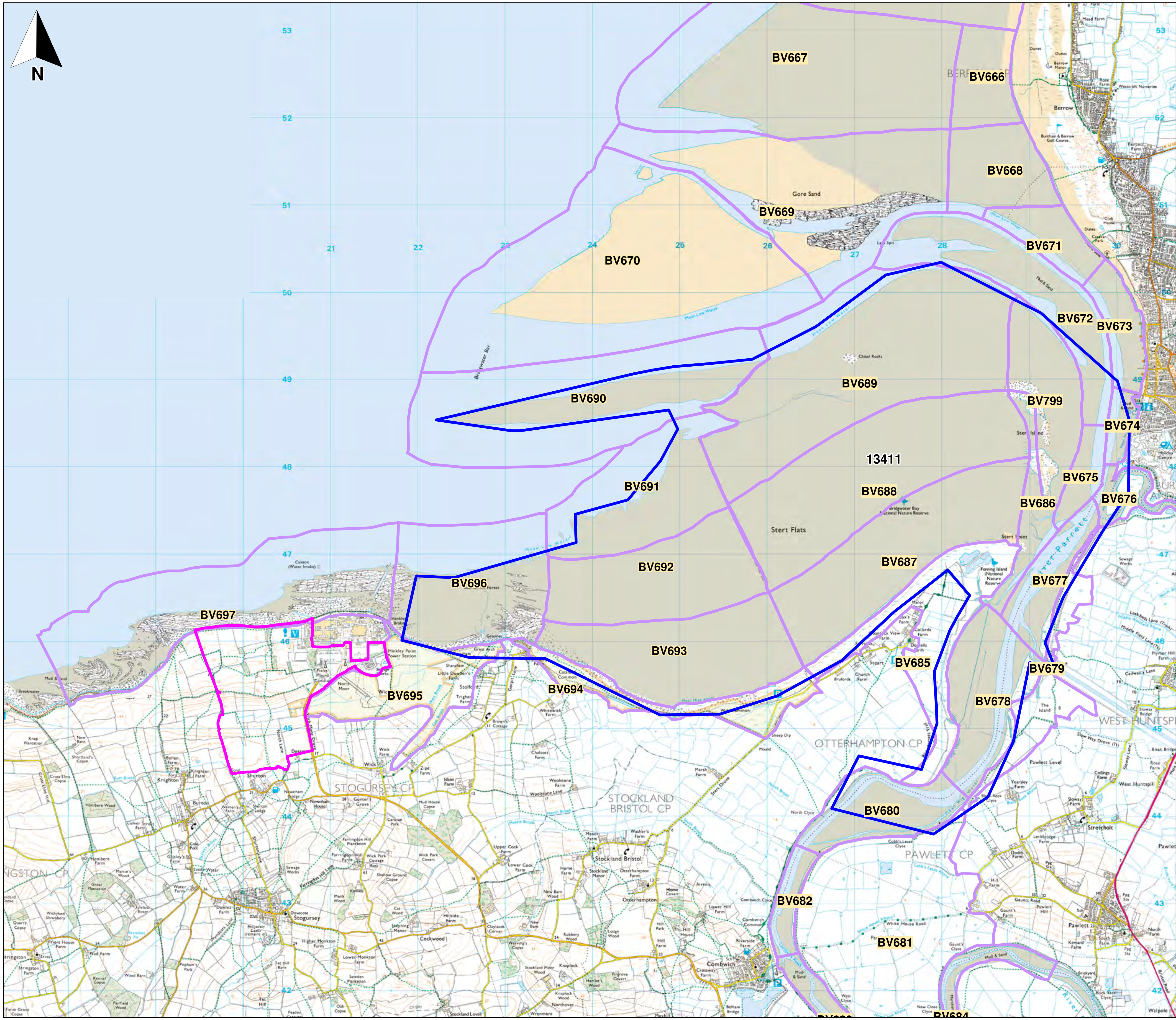
[38] The figures provided show the total number of birds recorded on each visit in fields within the survey area (as used in the daytime field surveys) and on adjacent intertidal habitat. The letter 'P' denotes that the species was present, being seen/heard during the visit, but that no accurate count could be obtained.

Table 3.7 Nocturnal Field Survey Results 2008/09[39]

Species	14 Apr	20 Apr	19 May	20 May	14 Aug	21 Aug	17 Sep	18 Sep	13 Oct	16 Oct	18 Nov	19 Nov	10 Dec	13 Dec	10 Jan	13 Jan	06 Feb	10 Feb	10 Mar	14 Mar
Mute Swan									1											
Shelduck	4					5							20	24	23	2		5	1	
Wigeon														1			3	2		
Teal														2		3			1	
Mallard				1									2	9	3				8	2
Grey Heron							1		1	1					1	1				
Coot	1																			
Oystercatcher					1	60	33	58	77	65	80	80	1	56	3	71	1	65	3	30
Ringed Plover					P	P	P	P		P					P	P	P	P	P	P
Golden Plover	4								3				37	5	13	16	4		19	2
Grey Plover															P	P	P	P	P	
Lapwing						1	1	3					3	3	55	3	1	1		
Dunlin								P							P					
Snipe							1		2	4	9	4	17	9	17	25	20	1	5	3
Woodcock															2			2	1	1

[39] The figures provided show the total number of birds recorded on each visit in fields within the survey area (as used in the daytime field surveys) and on adjacent intertidal habitat. The letter 'P' denotes that the species was present, being seen/heard during the visit, but that no accurate count could be obtained. It should be noted that even with high quality night vision equipment, it is very difficult to obtain an accurate count and therefore the figures shown should be treated as the likely minimum count of individuals present.

Species	14 Apr	20 Apr	19 May	20 May	14 Aug	21 Aug	17 Sep	18 Sep	13 Oct	16 Oct	18 Nov	19 Nov	10 Dec	13 Dec	10 Jan	13 Jan	06 Feb	10 Feb	10 Mar	14 Mar
Whimbrel	1				1															
Curlew					3	1	5	1	3		15	1	1	1	2	7	1	1	6	
Redshank					P		P	P					P		P	P		P		
Turnstone							P		P		5			P				P		
Black-headed Gull														1						
Herring Gull															200			200		150
Sandwich Tern						2														
Barn Owl						1														
Nightingale	1	1	2	2																
Cetti's Warbler	1		1	2																



Key

- SSA Boundary
- Count sectors for WeBS Low Tide Counts
- Count sectors for WeBS Core Counts

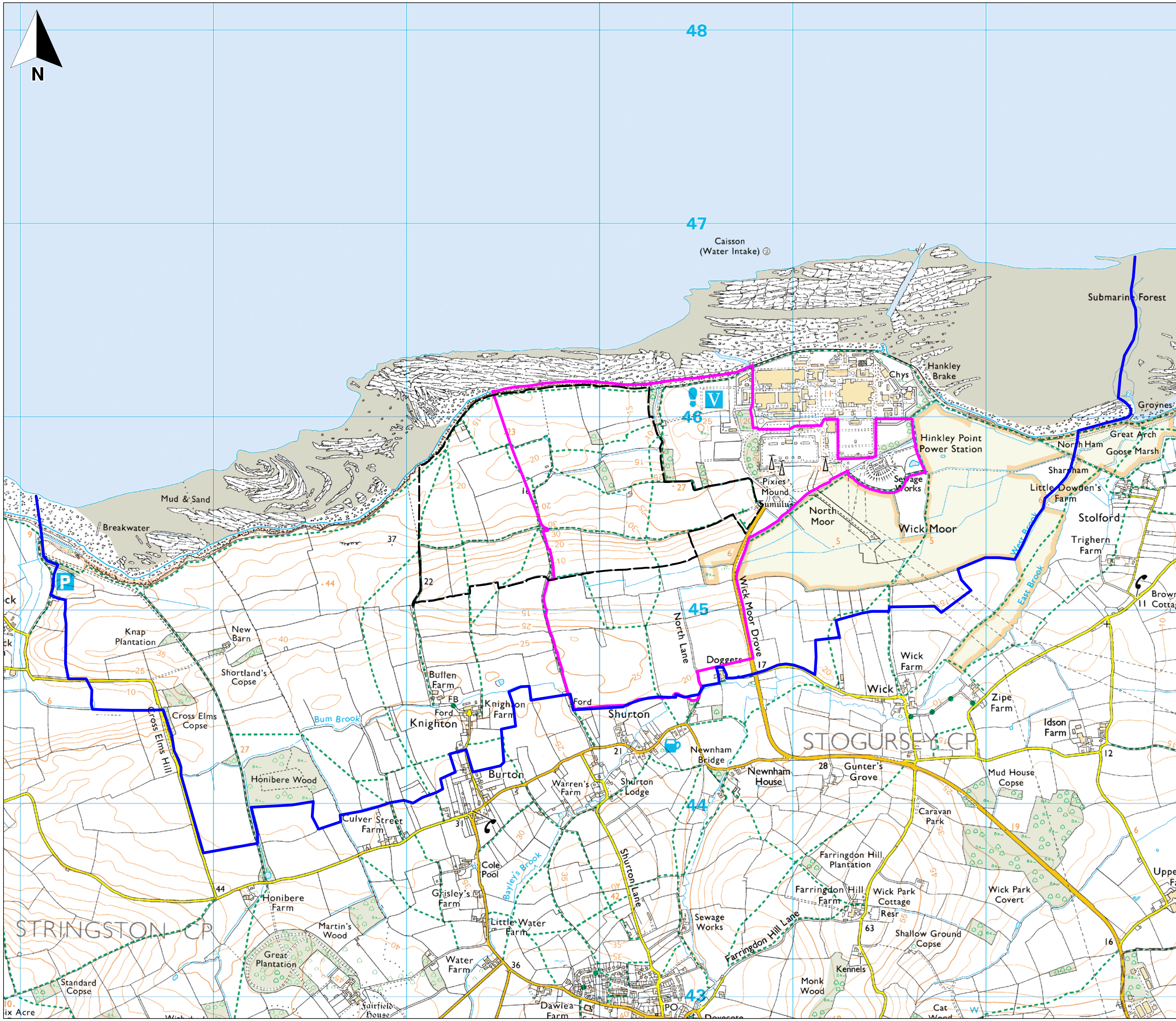
0 m 1 km

Scale 1:42,000 @ A3

Hinkley Ornithological Survey Report

Figure 3.1
WeBS Count Sectors

January 2010
19801-R608b.wor adamk



Key

- SSA Boundary
- Wind Farm Bird Study Area
- Wind Farm Application Boundary

0 m 500 m

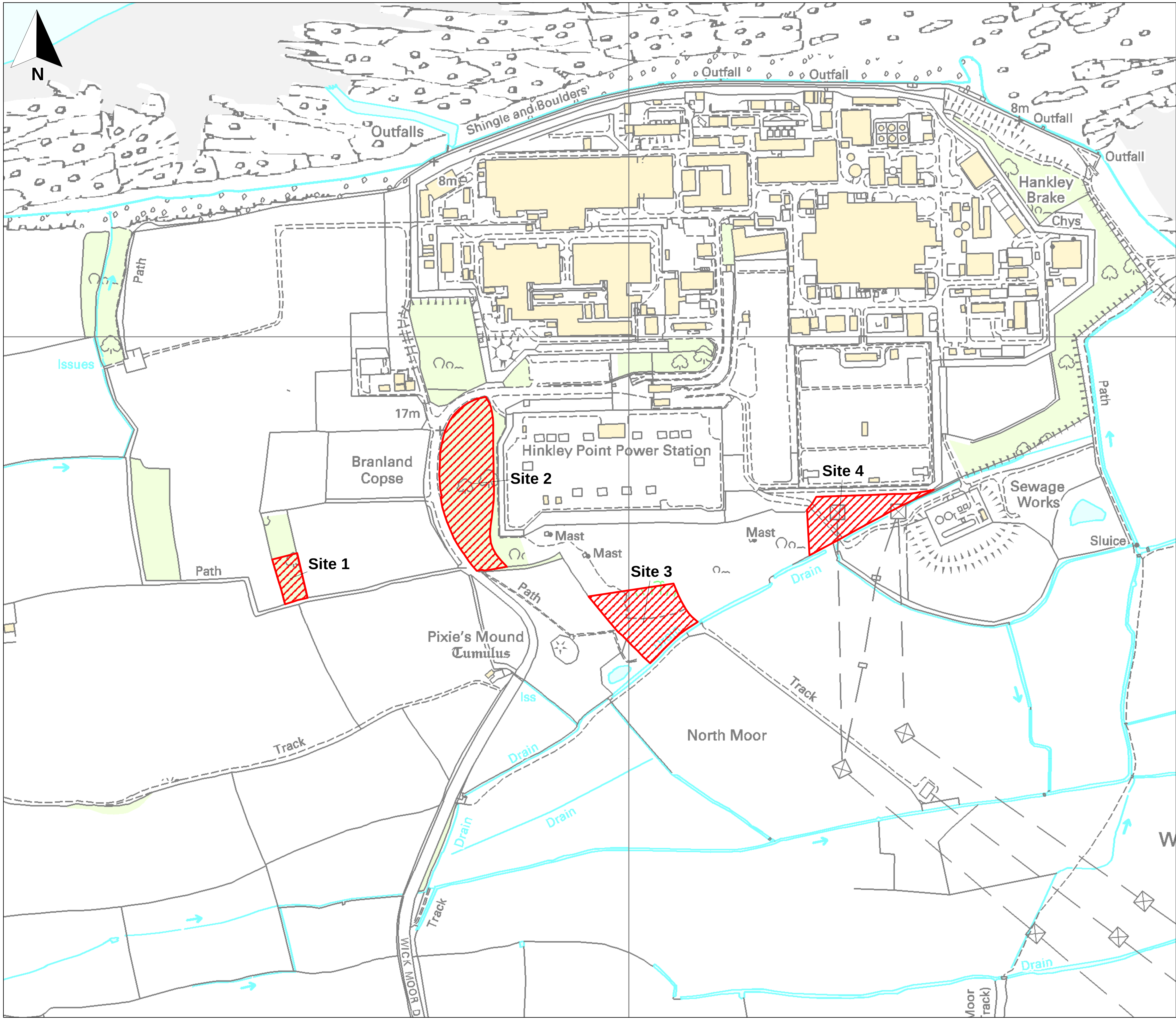
Scale 1:19,000 @ A3

Hinkley Ornithological Survey Report

Figure 3.2
West Hinkley Wind Farm
Winter Bird Study Area

December 2009
19801-R609b.wor adamk

amec



Key

Bird Survey Areas

Site 1 = Seaburton Brake
Site 2 = Branland Copse
Site 3 = Scrub near pixies pond
Site 4 = Unnamed area of scrub

0 m 250 m

Scale 1:5,000 @ A3

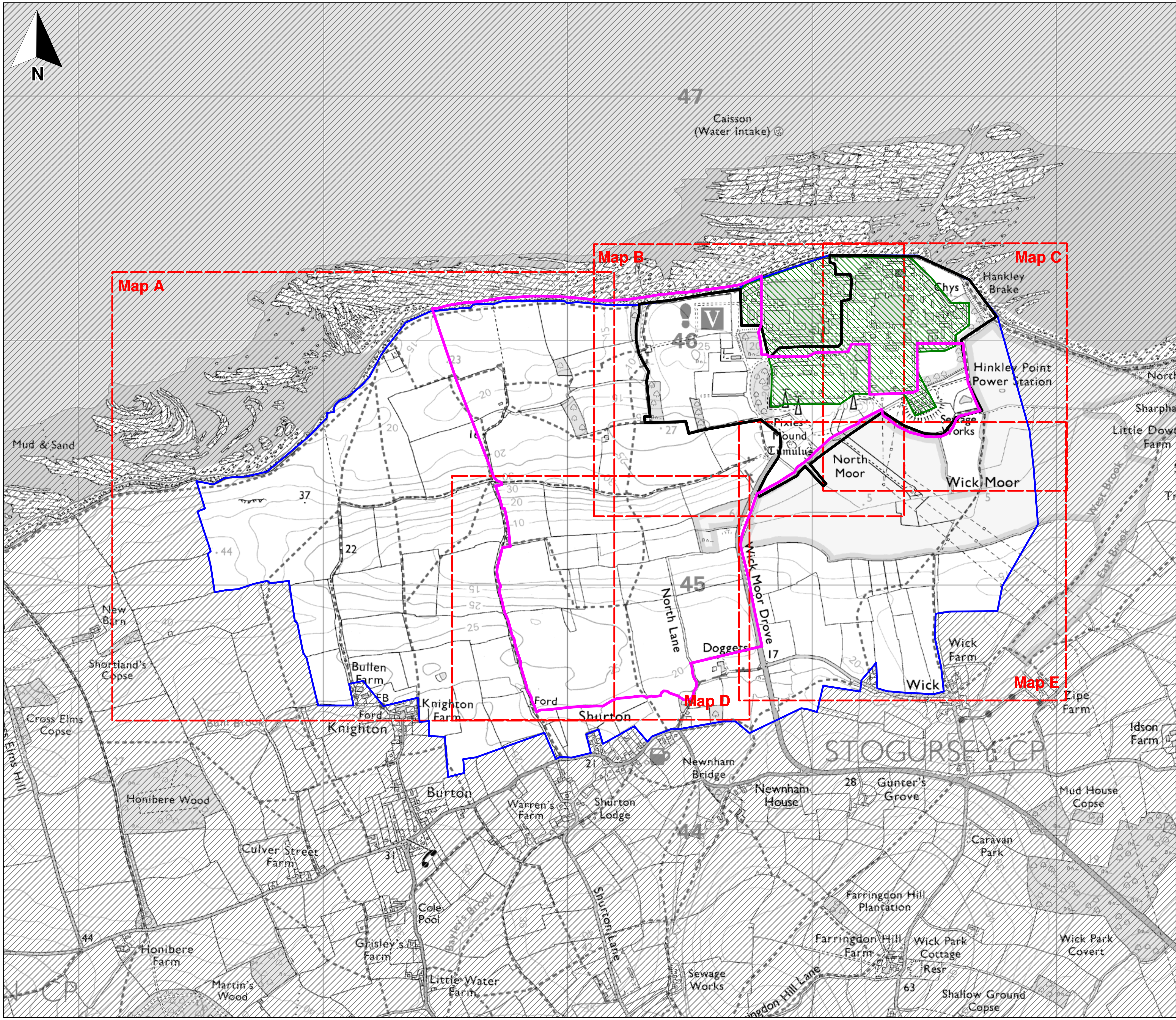
EDF

Hinkley Ornithological Survey Report

Figure 3.3
Annual BE Breeding Bird Survey Area

December 2009
19801-R610b.wor adamk

amec



Key

- Area Not Surveyed
- SSA Boundary
- British Energy Landholding
- Area Surveyed
- Area excluded from survey

0 m 750 m

Scale 1:15,000 @ A3

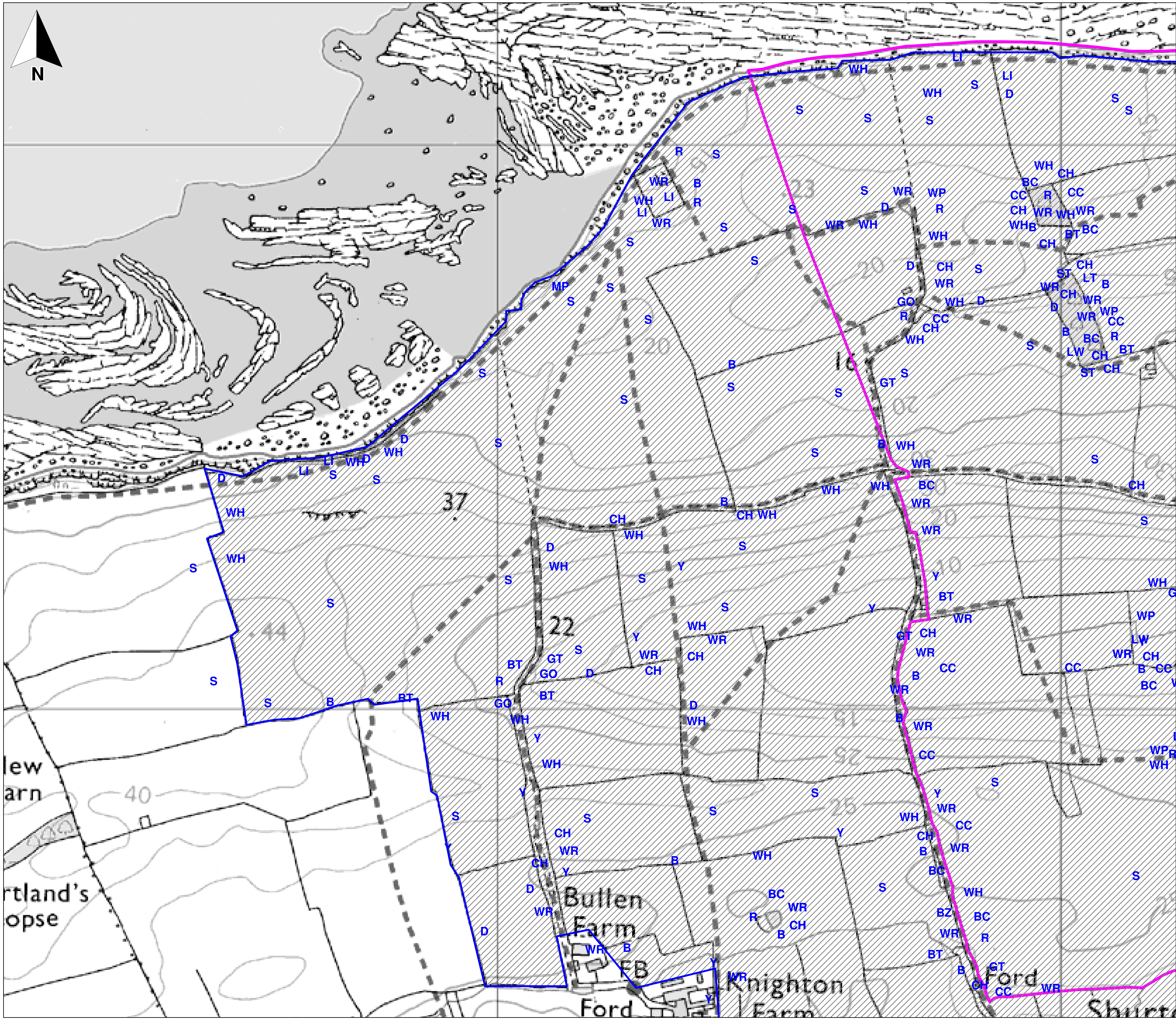
EDF

Hinkley Ornithological Survey Report

Figure 3.4
Indicative Breeding Bird Territory Locations Map Locations

January 2010
19801-R611l.wor adamk

amec



Key

- SSA Boundary
- Area Surveyed
- Area excluded from survey

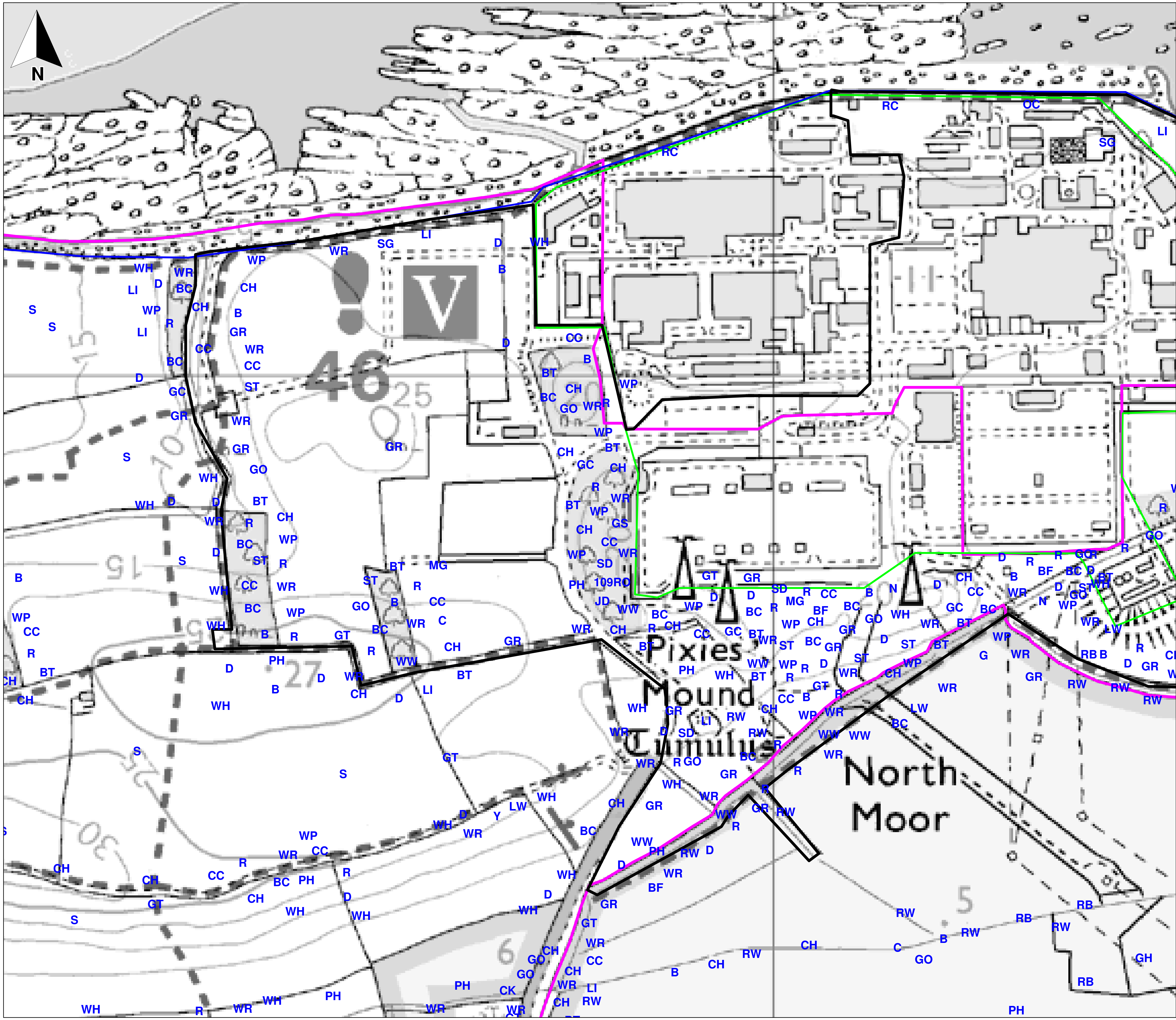
0 m 250 m

Scale 1:6500 @ A3

Hinkley Ornithological Survey Report

Figure 3.4a
Indicative Breeding Bird Territory Locations
Map A

January 2010
19801-R611m.wor adamk



Key

- Area Not Surveyed
- SSA Boundary
- British Energy Landholding
- Area Surveyed
- Area excluded from survey

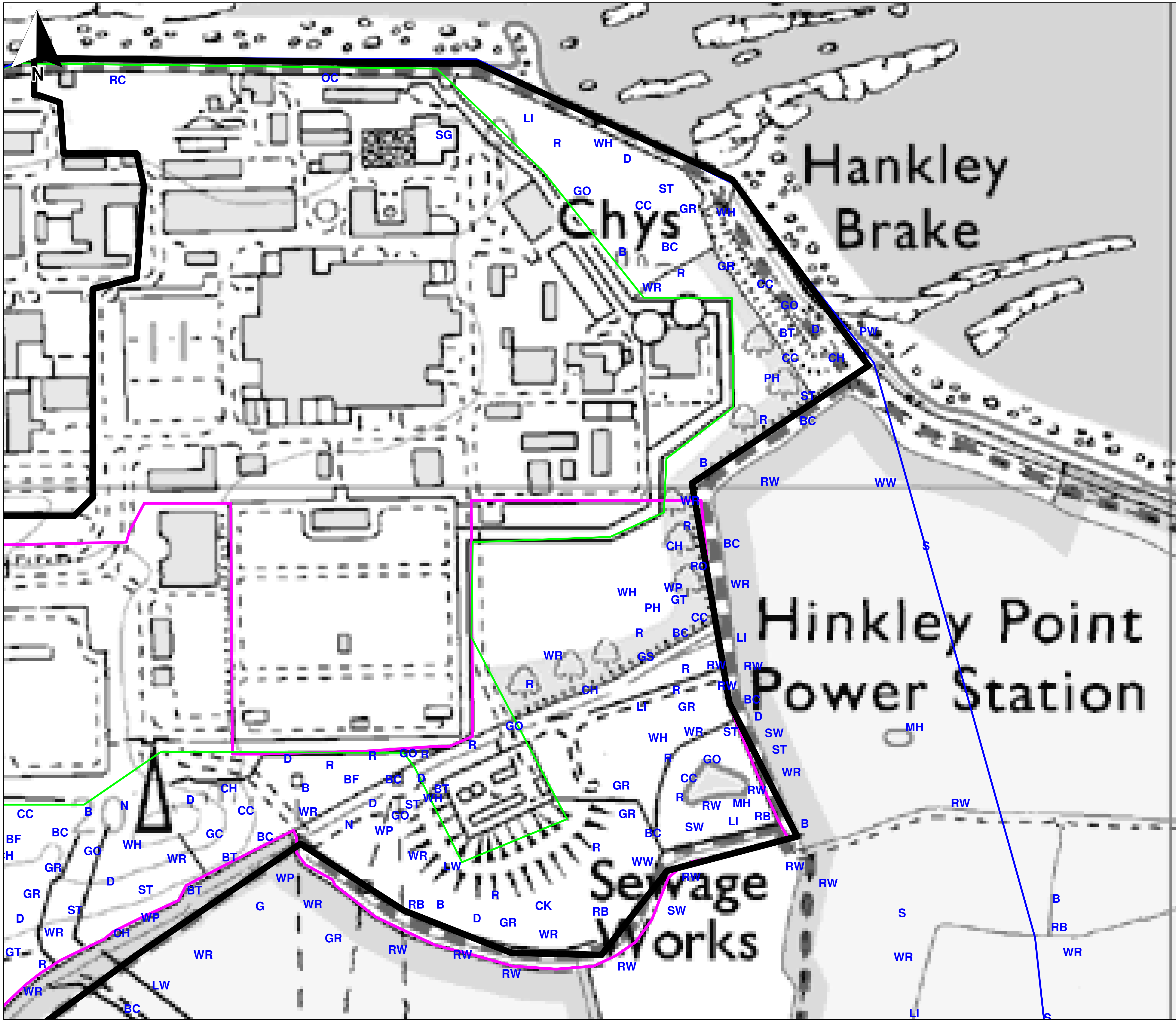
0 m 250 m

Scale 1:4500 @ A3

Hinkley Ornithological Survey Report 2011

Figure 3.4b
Indicative Breeding Bird Territory Locations Map B

January 2010
19801-R611n.wor adamk



Key

- Area Not Surveyed
- SSA Boundary
- British Energy Landholding
- Area Surveyed
- Area excluded from survey

0 m 250 m

Scale 1:3000 @ A3

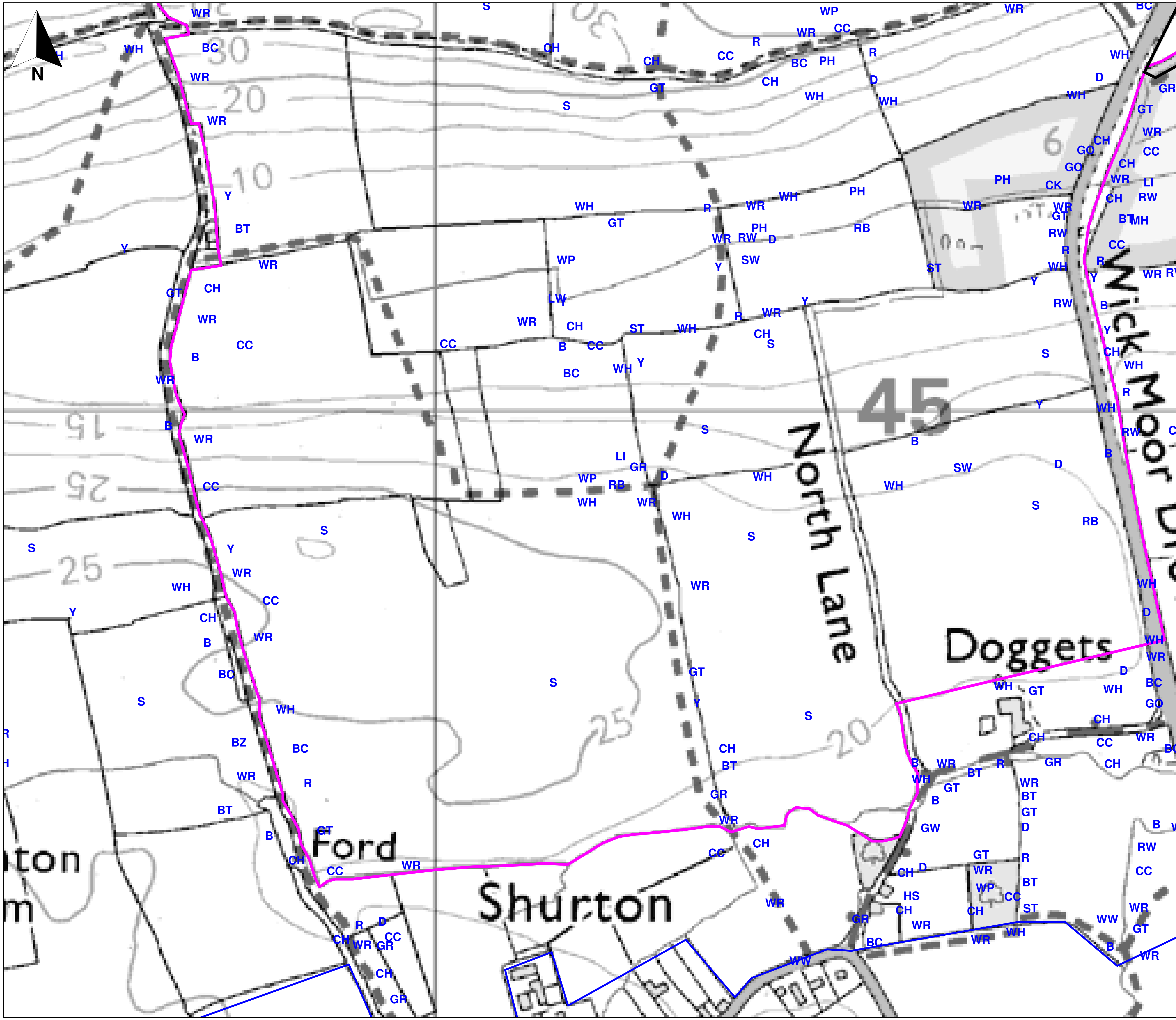
eDF

Hinkley Ornithological Survey Report

Figure 3.4c
Indicative Breeding Bird Territory Locations
Map C

January 2010
19801-R611o.wor adamk

amec



Key

- SSA Boundary
- British Energy Landholding
- Area Surveyed
- Area excluded from survey

0 m 250 m

Scale 1:4000 @ A3

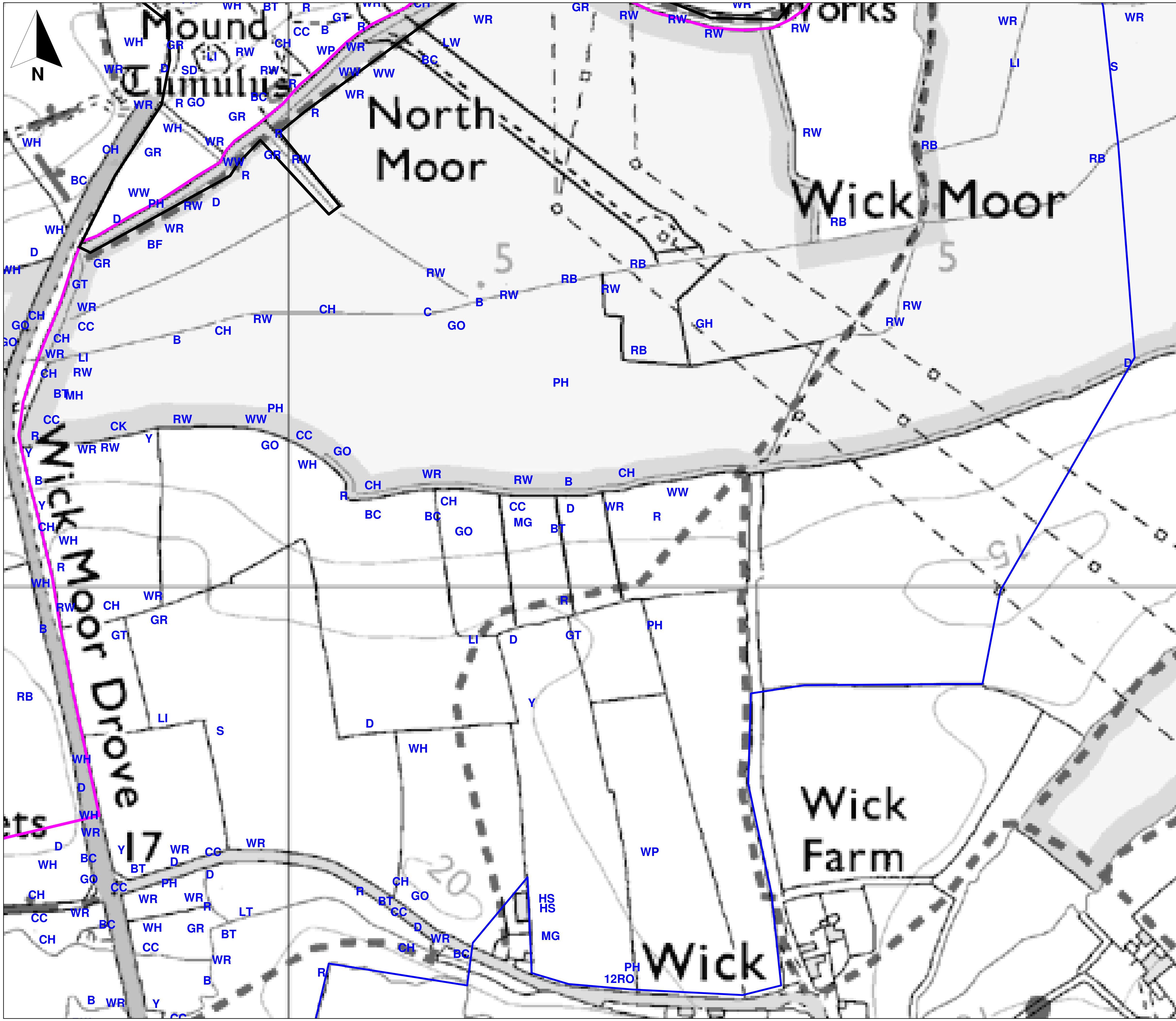
EDF

Hinkley Ornithological Survey Report

Figure 3.4d
Indicative Breeding Bird Territory Locations
Map D

January 2010
19801-R611p.wor adamk

amec



Key

SSA Boundary

British Energy Landholding

Area Surveyed

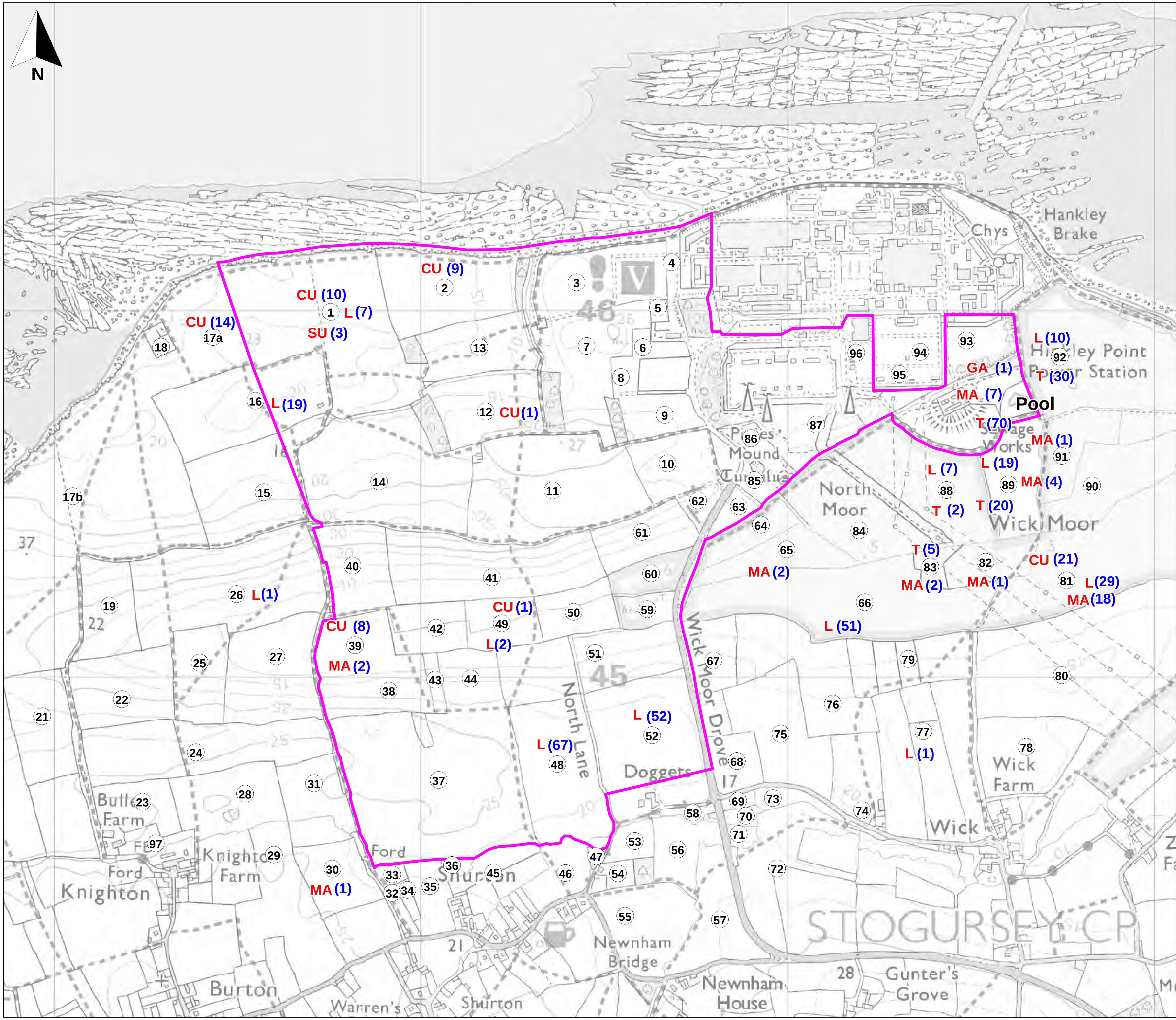
0 m 250 m

Scale 1:4000 @ A3

Hinkley Ornithological Survey Report

Figure 3.4e
Indicative Breeding Bird Territory Locations
Map E

January 2010
19801-R611q.wor adamk



Key

SSA Boundary

10 Field number

Species Names

CU = Curlew
GA = Gadwall
L = Lapwing
MA = Mallard
SU = Shelduck
T = Teal

0 m 250 m

Scale 1:10000 @ A3

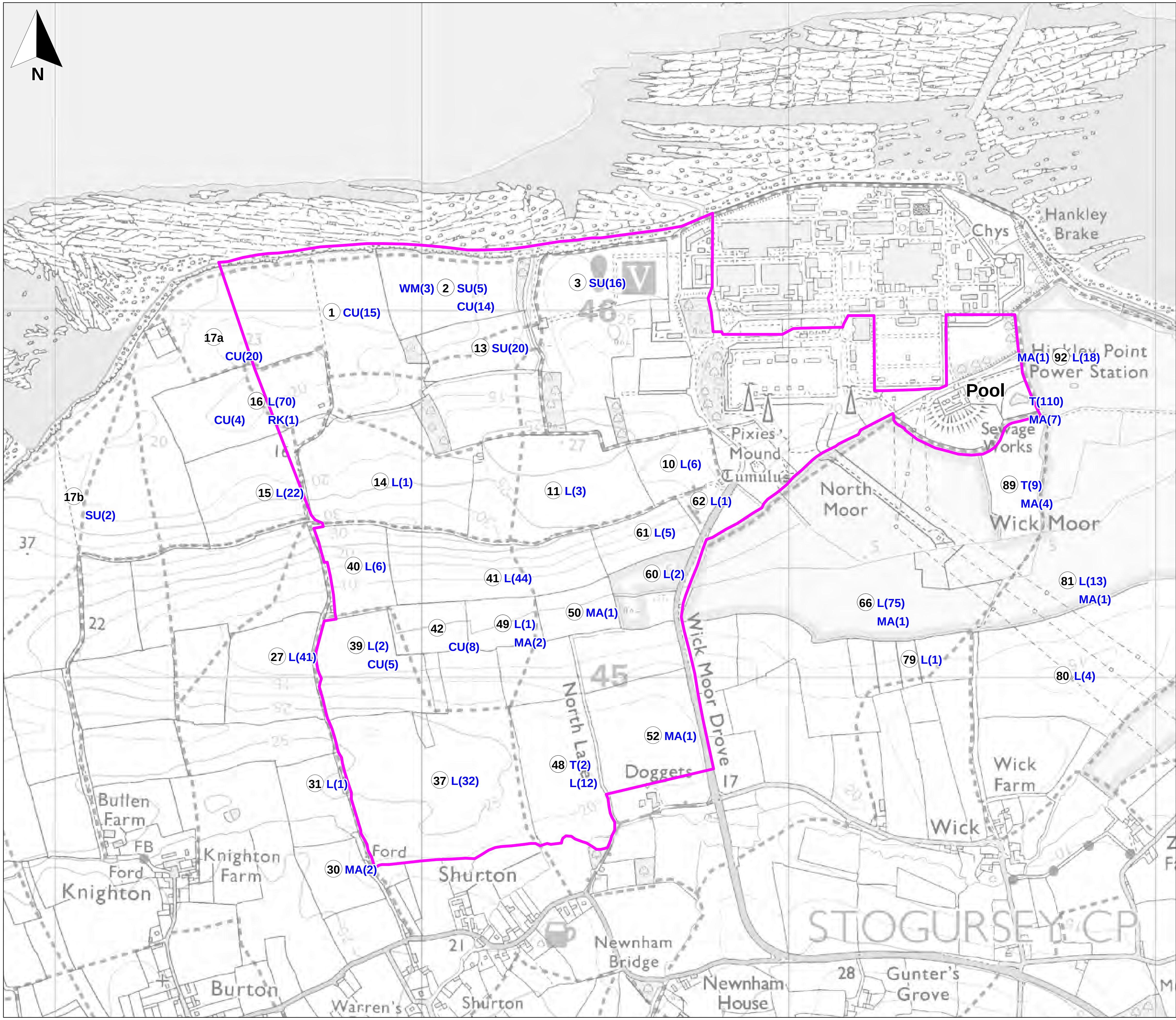
EDF

Hinkley Ornithological Survey Report

Figure 3.5a
Daytime Field Survey Results (2007/08)
Location of Cited Species

December 2009
19801-R612b.wor adamk

amec



Key

SSA Boundary

Field number

Species Names

CU = Curlew
L = Lapwing
MA = Mallard
RK = Redshank
SU = Shelduck
T = Tea
WM = Whimbrel

0 m 250 m
Scale 1:10000 @ A3

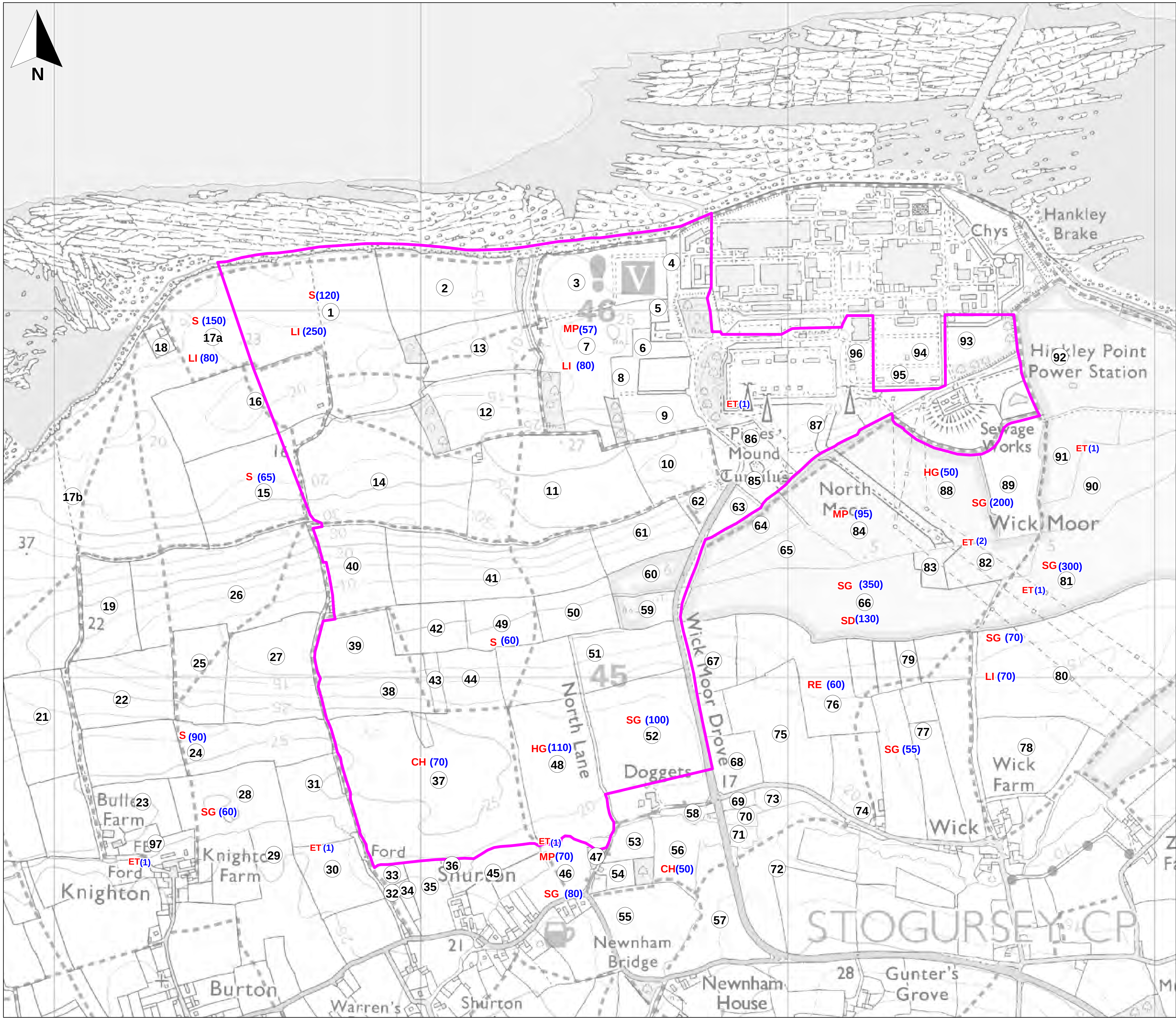
EDF

Hinkley Ornithological Survey Report

Figure 3.5b
Daytime Field Survey Results (2008/09)
Location of Cited Species

December 2009
19801-R620b.wor adamk

amec



Key

SSA Boundary

10 Field number

Species Names

CH = Chaffinch
ET = Little Egret
HG = Herring gull
LI = Linnet
MP = Meadow pipit
RE = Redwing
S = Skylark
SD = Stock dove
SG = Starling

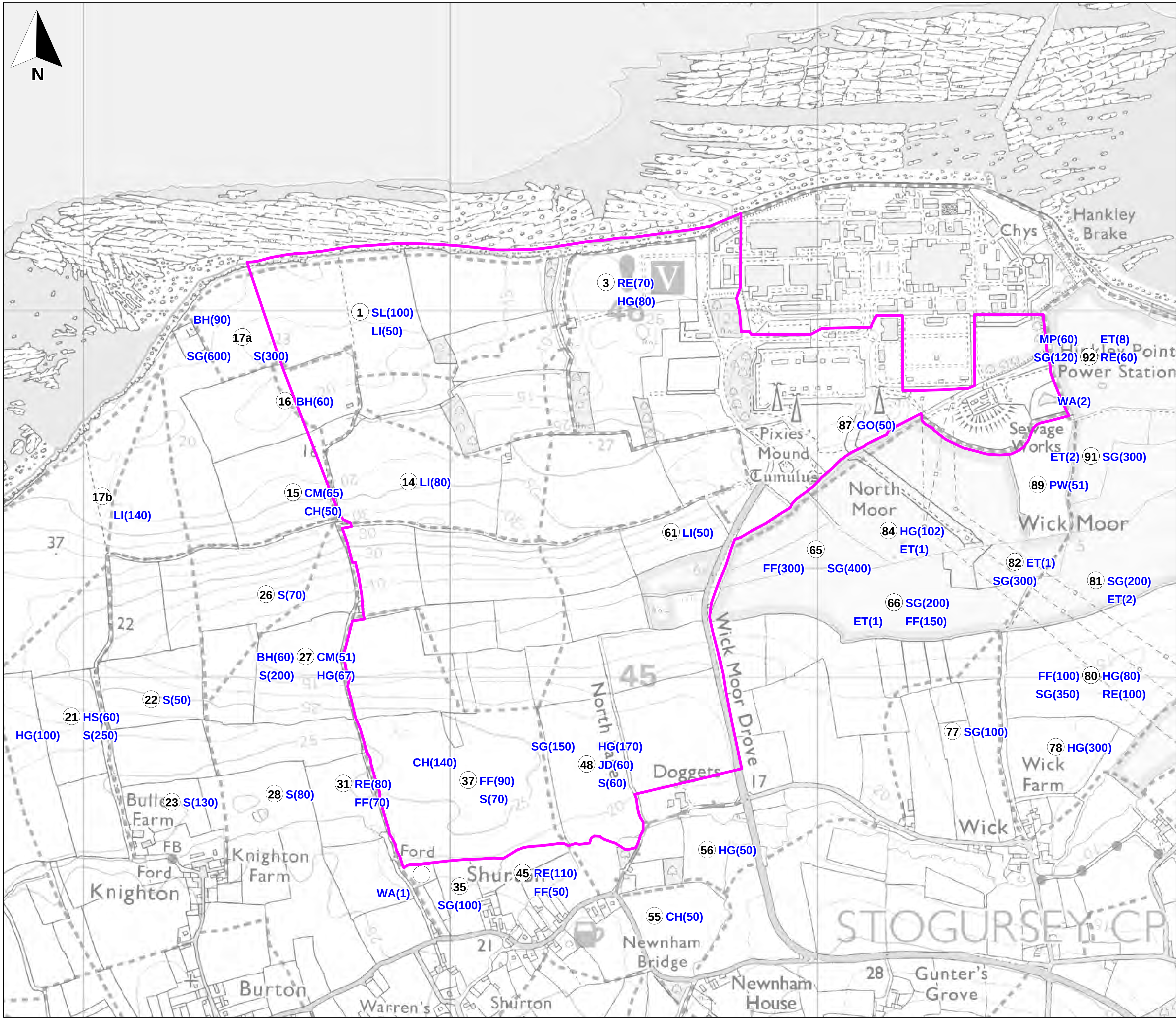
0 m 250 m

Scale 1:10000 @ A3

Hinkley Ornithological Survey Report

Figure 3.6a
Daytime Field Survey Results (2007/08)
Location of Non-Cited Species

December 2009
19801-R621b.wor adamk



Key

SSA Boundary

10 Field number

Species Names

BH = Black-headed Gull
CH = Chaffinch
CM = Common Gull
ET = Little Egret
FF = Fieldfare
GO = Goldfinch
HG = Herring Gull
HS = House Sparrow
JD = Jackdaw
LI = Linnet
PW = Pied Wagtail
RE = Redwing
S = Skylark
SG = Starling
SL = Swallow
WA = Water Rail

0 m 250 m

Scale 1:10000 @ A3

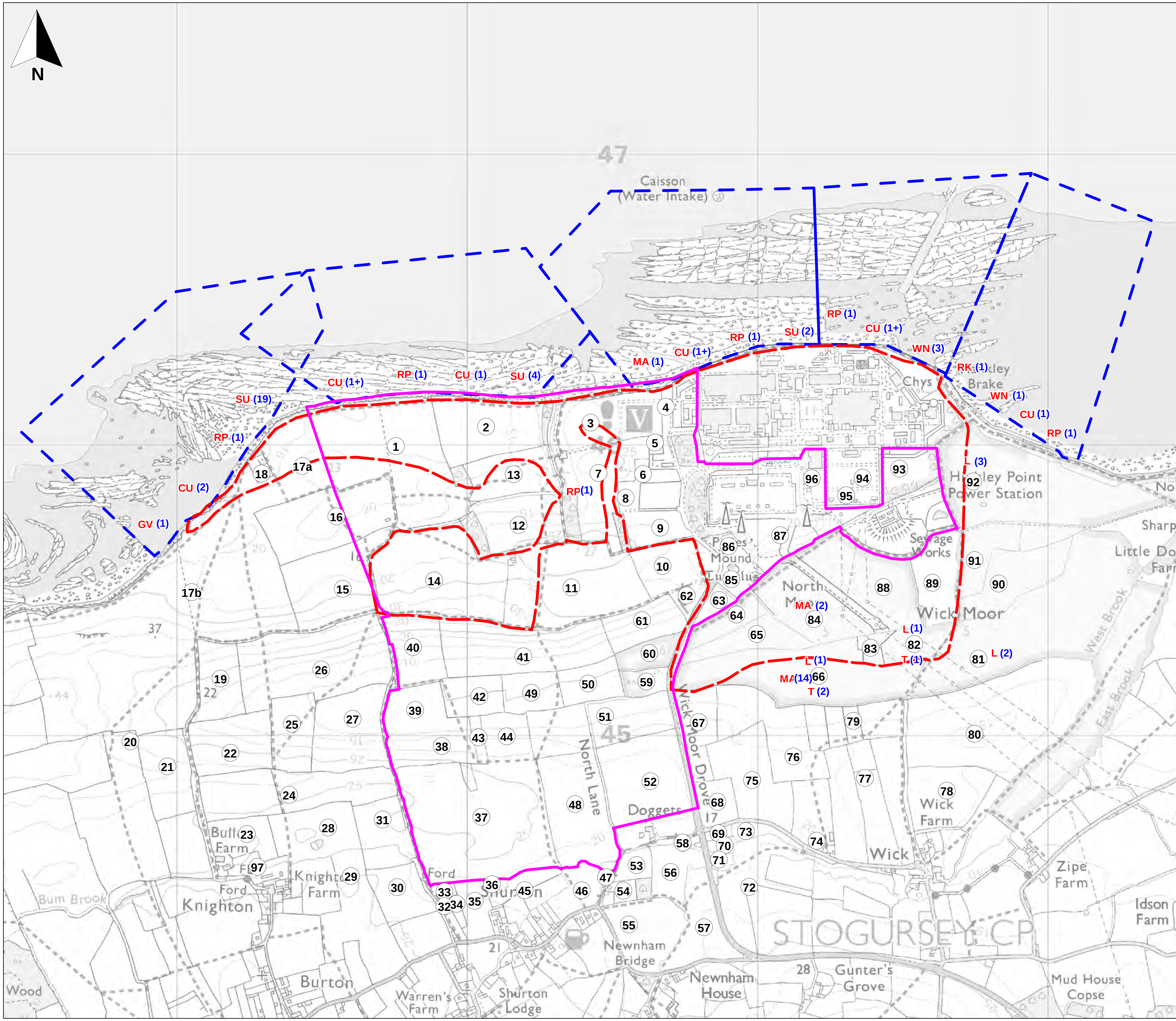
EDF

Hinkley Ornithological Survey Report

Figure 3.6b
Daytime Field Survey Results (2008/09)
Location of Non-Cited Species

December 2009
19801-R622b.wor adamk

amec



Key

SSA Boundary

Intertidal Survey Areas

Nocturnal survey route

10 Field number

Species Names

CU = Curlew
GV = Grey plover
L = Lapwing
MA = Mallard
RK = Redshank
RP = Ringed plover
SU = Shelduck
T = Teal
WN = Wigeon

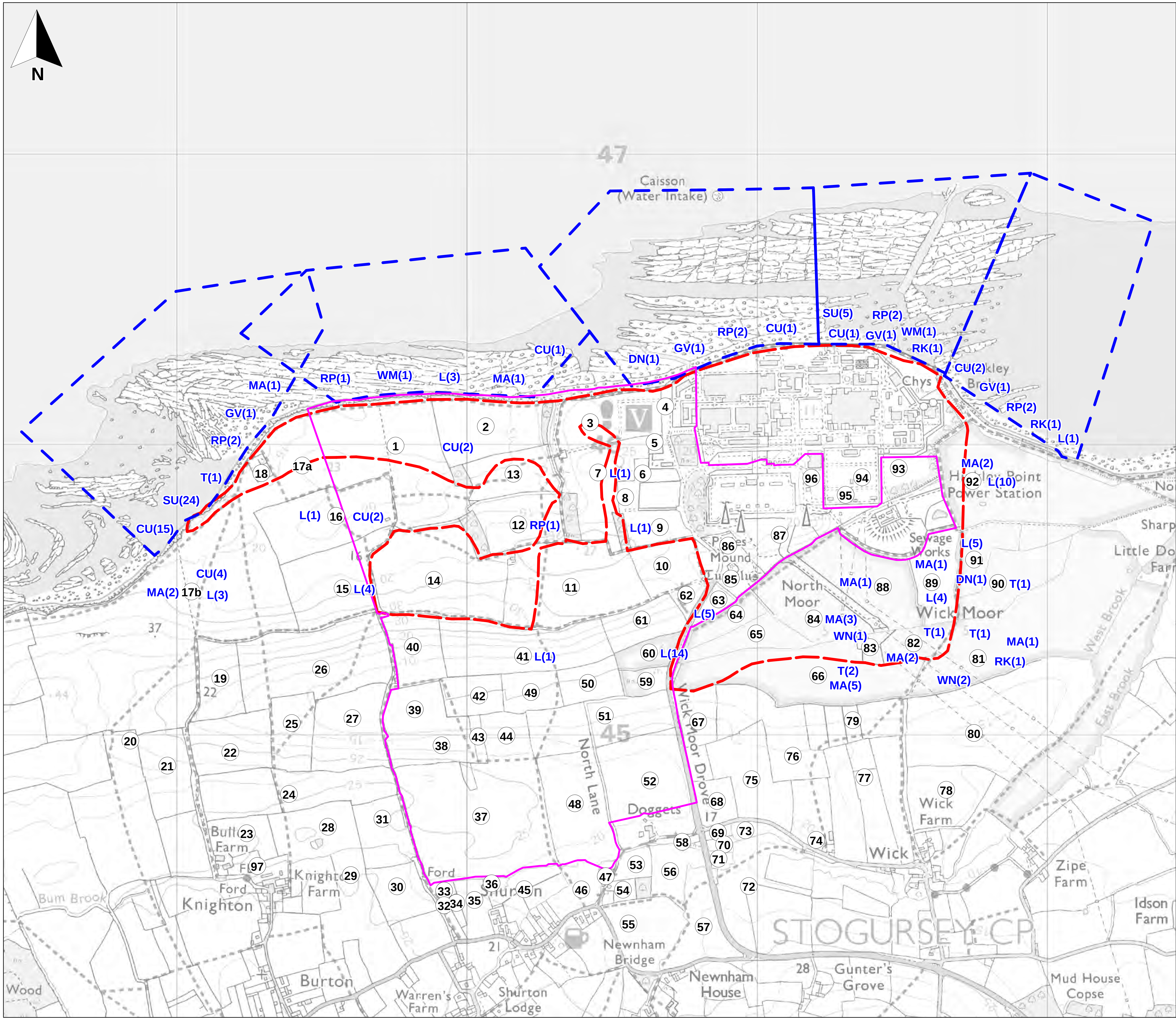
EDF

Hinkley Ornithological Survey Report

Figure 3.7a
Nocturnal Field Survey Results (2007/08)
Location of Cited Species

January 2010
19801-R623b.wor adamk

amec



Key

SSA boundary

Intertidal Survey Areas

Nocturnal survey route

10 Field number

Species Names

CU = Curlew
DN = Dunlin
GV = Grey plover
L = Lapwing
MA = Mallard
RK = Redshank
RP = Ringed plover
SU = Shelduck
T = Teal
WM = Whimbrel
WN = Wigeon

EDF

Hinkley Ornithological Survey Report

Figure 3.7b
Nocturnal Field Survey Results (2008/09)
Location of Cited Species

January 2010
19801-R624b.wor adamk

amec

4. Discussion

4.1 Breeding Bird Surveys

When considering breeding bird populations, importance is often taken as meaning that a site supports at least 1% of the population under consideration at county (Somerset), national[40] or international level[41]. This 1% of population threshold has also been used as a basis for the evaluation of likely significant effects on European and nationally designated sites of conservation importance, and as such was considered by RSPB to be an appropriate starting point for assessing potential effects of new build on the Severn SPA and Bridgwater Bay SSSI bird populations (Richard Archer, RSPB, pers comm.). The discussion of the 2007 breeding bird surveys at Hinkley takes account of the 1% threshold as well as the ecological characteristics of individual species to determine key ornithological issues and to establish the importance of the area to bird populations. To establish population estimates, thereby providing a basis for evaluation, relevant regional and national accounts (Ballance 2006, Brown & Grice 2005) have been used in conjunction with bird reports, scientific papers and information on population trends available from the BTO website (www.bto.org).

4.1.1 Highly Protected Breeding Species

The three Cetti's warbler territories within the SSA were located in scrub to the south of the built nuclear plant. Cetti's warbler particularly favour the habitat that develops where bramble and willow invades the edge of extensive reedbeds (Brown & Grice, 2005). During the breeding season birds forage on damp, bare ground at the base of scrub thickets or on wet muddy ground produced as a result of fluctuating water levels (Bibby, 1982); they also forage more extensively in reedbeds during the winter (Brown & Grice, 2005). Much of the habitat within the SSA, which predominantly consists of mixed farmland is therefore unsuitable for supporting breeding or wintering Cetti's warbler. The only suitable habitat is to the south of the built plant in the eastern arm of the SSA.

[40] For many breeding species that occur within the survey area there have been English population estimates published by Brown & Grice (2005), and these have been used as a basis to determine thresholds of national importance. These are precautionary, as from a legal perspective Wales and England combined is treated as a national unit - as the basis of protective legislation for breeding birds, the Wildlife and Countryside Act, applies to both countries. For waterfowl, however, information is generally presented by the BTO for Great Britain (GB) rather than England, and the readily available English estimates from other sources are less relevant to Hinkley (as the adjacent Severn SPA covers areas of both Welsh and English coast, and it is reasonable to assume that there is regular interchange between the two countries of some species). GB figures also form the basis on which European Sites are designated under the Habitats Regulations. Therefore, for the discussion of the intertidal data, GB figures are considered to represent 'national' totals.

[41] There is no fundamental biological reason to take 1% of a population as the threshold level for establishing the level of importance of a site. Nevertheless, this percentage is widely considered to be of value in giving an appropriate level of protection to populations, and has gained acceptance on this basis throughout the world. The criterion was, for example, adopted by parties involved in the Ramsar Convention 1971. Thereafter, the 1% level of national species totals has been taken as the basis of assessment in various countries, including Britain (Stroud, Mudge & Pienkowski, 1990).

Cetti's warbler is now considered a fairly common resident breeder in Somerset, despite the fact that breeding was first proven in the county as recently as 1982 (Ballance, 2006). During the national census in 1996 a total of 63-67 territories were found at 20 Somerset sites (Wotton *et al.*, 1998). By 2002 numbers in the Avalon Marshes alone had reached 147 territorial males (Ballance, 2006), while a total of 347 territorial males were submitted for inclusion in the 2005 Somerset Bird Report (Gibbs [Ed], 2006). At the national level the number of territorial males was considered to have more than doubled (from 300 to 622) between 1997 and 2000, and was estimated at 851-878 by 2002 (Ogilvie, 2004). Based on these figures, and assuming a constant rate of increase since this time, the current number of territorial males in England may now be between 1,423 and 1,518 individuals. It is reasonable to suggest, therefore, that the survey area therefore holds a maximum of 0.86% of the regional territorial males and between 0.19 and 0.21% of the national number. It follows that Hinkley is not therefore considered a key breeding site for Cetti's warbler at regional or national level.

4.1.2 Red-Listed Birds of Conservation Concern and UK BAP Priority Species

A total of 10 species featuring on the red-list of birds of conservation concern[42] and/or the UK BAP Priority Species List[43] were recorded breeding within the survey area in 2007. Despite considerable declines at national level, many of these species remain common or abundant at national and regional level, and this is relevant to the majority of the farmland passerines that were recorded breeding within the survey area at Hinkley. A summary of the likely importance of the survey area to each of the breeding red-listed and UK BAP species is given below.

Cuckoo, which is a UK BAP Priority Species (and features on the amber list of Birds of Conservation Concern due to a moderate decline in the breeding population over the past 25 years), was recorded holding territory in the Wick Moor area. Cuckoo is considered to have declined in intensively managed lowland farmland in Somerset (Ballance, 2006), although there have been no county population censuses and there are no long term data sets for the species that enable the scale of decline or the current county population level to be robustly assessed. The association of strong local populations of dunnock and reed warbler, which are both regular host species[44], and the mosaic of semi-natural habitats (likely to be rich in invertebrate prey) to the south of the built power stations provide suitable breeding conditions for cuckoo[45]. Two

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[42] The background to the establishment of a 'traffic light system' of conservation concern for UK birds is discussed in Gregory *et al*., (2002). 'Red-listed' species include those that are globally threatened, have suffered an historical population decline (between 1800 and 1995) or which have experienced rapid declines in their UK breeding population or contractions in their UK range of more than 50% over the past twenty-five years. Amber listed species have suffered moderate (25-49%) declines in their UK breeding population or range over the past 25 years, have an unfavourable conservation status in Europe (and are therefore of European concern), breed in very low numbers (5 year mean of 1-300 pairs), breed at 10 or fewer UK sites, or occur in relatively high numbers in the UK (exceeding 20% of the European breeding, migratory or non-breeding populations). Other species have 'green' status, as they do not fulfil these criteria. This implies that the population of a species is either stable or increasing or that too little is known about the population to allow the species to be included on the red or amber list.

[43] This is a list of species that are considered to be globally threatened and/or which are rapidly declining in the UK (by more than 50% in the past 25 years). Each has its own UK Species Action Plan (SAP) which identifies environmental measures to address the recent decline in numbers.

[44] Cuckoo is a brood parasite. A review of BTO Nest Record Cards found that dunnock, reed warbler and meadow pipit accounted for over 85% of cuckolded nests between 1939 and 1982 (Glue & Murray, 1984).

[45] Cuckoo has fairly wide ranging habitat preferences, and at national level is commonly recorded breeding in moorland, heathland, farmland, a range of wetland habitats, open woodland, farmland, parks and large suburban

territorial male cuckoos were recorded in the SSA (three in the survey area) during the breeding bird survey in 2007. The number of territorial males that are reported to the Somerset Bird Club on an annual basis (e.g. 339 in 2005) indicates that the survey area is unlikely to be of county importance to the species.

Three bullfinch territories were recorded within the survey area, all within scrub and mature hedgerow to the south of the built power stations. Although there is no census data, both Ballance (2006) and Gibbs ([Ed], 2011) consider bullfinch to be a fairly common resident species in Somerset, albeit one that is perceived to have declined in lowland farmland. It follows that three pairs are unlikely to exceed the threshold of regional importance.

Linnet is also perceived to have declined in Somerset, although there is again relatively little survey data that allows the scale of the decline and the habitats primarily affected to be assessed. The species remains a fairly common breeder in the county, and coastal farmland surveys undertaken in 2000 concluded that 154 pairs were present between the Axe Estuary and Quantoxhead, while 840 pairs were found on Exmoor in 2002 (Ballance, 2006). Of 26 territorial linnets within the survey area at Hinkley, ten were within the SSA, where they favoured coastal scrub and the edges of woodland blocks. Linnet is described as a fairly common resident and migrant breeder in Somerset, with 70-90 pairs in the Quantocks in the 1990s and 360 birds in Exmoor (including Devon) in 1992/3 (Ballance (2006). Given this, and the likely abundance of suitable habitat present in Somerset, the county population is likely to be well in excess of 1,000 pairs. In view of this, the population in the SSA is considered to be of no more than local importance.

Yellowhammer and reed bunting are both locally common breeding species in Somerset, with the former occurring in arable farmland with established hedgerows and in heathland areas such as the Quantocks and on the fringe of Exmoor, and the latter being traditionally common on the Somerset Levels and also occurring in a range of wetland habitats across the county including reedbeds, rhynes[46], and ponds. Published information indicates that 90 pairs of yellowhammer were present on the Quantocks in 2003, and 28 territorial males were present on Exmoor in 2002, but there is very limited data available for lowland farmland (Ballance, 2006). Concentrations of breeding reed bunting occur at Avalon Marshes (161 pairs in 2002), in the Catcott and Tealham/Tadham areas, where 50-70 pairs are generally present and on King’s Sedge Moor/Somerton and West Sedge Moor which both hold 100-200 pairs. There are numerous small colonies elsewhere in lowland Somerset (Ballance, 2006).

Eleven pairs of yellowhammer were recorded breeding in the SSA, with 27 territorial males across the wider area. The average density of breeding yellowhammer on lowland farmland was considered to be 11.6 pairs per km^2 in the last national breeding bird atlas (Gibbons *et al*. 1993), and (while limitations due to lack of unrestricted access during the surveys are acknowledged) the indicative density from the survey work conducted in 2007 is that 5.9 pairs per km^2 were present. This apparently low density at Hinkley is unsurprising and reflects the fact that there are a limited number of mature hedgerows with standard trees (for song posts) within the survey area, and that field boundary hedges lack associated ruderal/grassland margins throughout the SSA. Seven pairs of reed bunting were recorded within the SSA, with the 13

gardens. Caterpillars, particularly hairy species that are avoided by other birds (and are often distasteful or toxic), feature heavily in the diet (Brown & Grice, 2005).

[46] A colloquial (Somerset) word for lowland drainage channels.

pairs recorded occurring in a typical range of wetland habitats to the south and east of the built nuclear plant. Large numbers of reed bunting breed on the Somerset Levels where a total of 200-400 pairs breed on King's Sedge Moor/Somerton Moor and West Sedge Moor in most years (Ballance, 2006). Much suitable breeding habitat exists within Somerset for both species and therefore the county populations of both species are likely to be well in excess of 1,000 pairs. It is therefore concluded that the SSA is likely to of no more than local importance to both species.

Other red-listed and UK BAP Priority species recorded breeding within the survey area were skylark, dunnock, song thrush, starling and house sparrow[47]. Dunnock is included on the UK BAP Priority species list as the sub-species that breeds across much of the UK (*Prunella modularis occidentalis*) has a restricted distribution at European level (the species is also amber listed due to a moderate population decline over the past 25 years, but has shown recent signs of recovery). Dunnock is widespread and common across much of lowland England, and has relatively ubiquitous habitat preferences; hence the population in the SSA is likely to be of less than local importance. The four other red-listed species remain common or very common at county and national level, despite significant population declines. Numbers occurring in the SSA are therefore of no more than local importance.

4.1.3 Other Notable Species

Oystercatcher bred within the built power station compound. It is a scarce breeder in Somerset, but the stretch of coast between Hinkley Point and Stert is a traditional area for the species. Although there has been no county-wide survey, seven pairs were reported to the Somerset Bird Club in both 2005 and 2006, including a pair that successfully raised young at Hinkley in both years. A pair is therefore likely to be of county importance.

A total of 5-6 nightingale territories were located in scrubby woodland to the south of the built nuclear plant in 2007, all of which would be in the eastern arm of the SSA. Censuses of the county nightingale population recorded 81 territories in 26 10km squares in 1976, 169 territories across 36 10km squares in 1980 and 116 territories in 16 10km squares in 1999 (Ballance, 2006). This clearly suggests that the SSA is of county importance for the species, as 5-6 pairs is a considerable proportion of the county population. It is also apparent, that Hinkley forms one of a small network of sites that support nightingale between Watchet and the Parret Estuary, an area which is one of the county strongholds for the species. Therefore, the area of scrub adjoining the built nuclear plant at Hinkley is an important resource for the species at county level.

Lesser whitethroat is on the western edge of its range in Somerset. It favours low-lying farmland with well established dense hedgerow, and also breeds in scrubby areas. There is no contemporary estimate of the breeding lesser whitethroat population in Somerset, but in the 1980s the species was considered to breed at 76 sites within the county. Since this time it is perceived to have declined, largely due to declines in a few regularly monitored areas (Ballance, 2006). The 2007 surveys indicated that three pairs of lesser whitethroat were present in the SSA, with a further four pairs in the wider survey area. In the absence of baseline information, the population within the SSA has therefore been assumed to be of county importance.

[47] Starling and house sparrow numbers are likely to have been under recorded, as potential breeding areas such as around dwellings and farm buildings were generally excluded from the survey. Nevertheless, neither species appears particularly common in the survey area.

Rock pipit, which breeds in crevices in the coastal defences and sea wall of the built nuclear plant, is likely to be present in the survey area in numbers of county importance. Ballance (2006) suggested that approximately 50 pairs are usually present in the county, with a high concentration occurring between Hinkley Point and Watchet. Given the tendency of rock pipits to nest in the artificial habitats created by the built power station, however, it is unlikely that any negative effects on the species would result from new build.

Other breeding species are unlikely to be present in numbers of county importance. There are no recent estimates of rook abundance in Somerset, but 19,000 nests were reported from a census conducted in 1975 (Ballance, 2006), and a considerable decline since this time would have been necessary for the number of rooks breeding in the survey area to exceed 1% of the county total. The one pair of buzzard that was recorded breeding is also of local rather than regional importance as recent county bird reports state that the species is approaching carrying capacity in Somerset. In 2006 for example, 763 records involving a total of 1,932 buzzards were submitted to the Somerset Ornithological Group (Gibbs [Ed], 2007).

4.2 Intertidal and Inshore Marine Surveys

When considering bird populations outside the breeding season (i.e. the winter and passage periods), the threshold of importance (or significance) in population terms, is often taken as 1% of the (peak) number of a species known to occur within a given area. From this starting point, taking into account regularity and nature of use, it is possible to undertake a subjective analysis of the importance of an area to a bird species. The first step towards doing this for Hinkley is to define the relevant areas. In the discussion that follows, the local area has been taken as Bridgwater Bay and the immediate surrounding land, while the county is Somerset and the region is that covered in The Southwest Biodiversity Implementation Plan[48]. National refers to the United Kingdom and International to world distribution (of the bird species or race of that species concerned).

Numbers of those species (recorded in the survey area) that form part of the cited/designated interest of statutory sites within 5km of the SSA have been considered potentially significant if found to exceed 1% of the qualifying number listed in any of these site citations. To establish population estimates to provide a basis for evaluation, relevant regional and national accounts including Ballance (2006), Gibbs (Ed) 2011 and Calbrade *et al*. (2010) and the citations of designated sites have been used in conjunction with bird reports, scientific papers and information on population trends available from the BTO website (www.bto.org).

The importance of the SSA and the wider survey area to bird species has been assessed on a species specific basis using a staged process:

1. Firstly, it has been determined whether the peak number of a species present within the survey area (and each sector of it) exceeds 1% of the qualifying number of that species within the Severn Estuary SPA/Ramsar Criterion 6 or SPA Review population; if this is the case, the record, and hence the area, is of potential importance to that species at the

[48] The South-west Biodiversity Implementation Plan, which is available through the website (http://www.biodiversitysouthwest.org.uk) covers the south-west region and includes Somerset (as well as Devon, Dorset, Gloucestershire, Wiltshire, Cornwall and the Isles of Scilly). As such there is ecological data available and targets have been set for this biogeographical region. It therefore seems sensible to include this as the region for the purposes of assessment.

European level. If the species does not feature on the citations listed above or is included on the citation but does not exceed 1% of the qualifying level, then it is assessed against the criteria in 2 below;

2. Assuming the species concerned is not of significance in terms of an SPA (or SPA Review) population, the peak number of that species present within the survey area (and each sector of it) is assessed against the nationally important population SSSI citations within 5km of the SSA (often an estimate can be derived from 'potential future interest' section of the Ramsar citation if the SSSI citation is unclear). If the species features as part of the qualifying interest of a Ramsar Site (not under Criterion 6) or SSSI and numbers on site exceed 1% of the listed population estimate, the area is of potential importance at the national level. If this does not apply, the species is assessed against the criteria outlined in 3 below;

3. Assuming that the numbers of a species are not considered of importance in SPA, Ramsar or SSSI terms, the numbers present are assessed against available data on national, regional, county and local populations to determine potential importance of records and, it follows, the survey area, again using the 1% criterion.

Effects on the integrity of the statutory sites within 5km of the SSA have the potential to occur during the cited period that each of the qualifying species is present (e.g. shelduck is a qualifying species of the Severn Estuary SPA during winter, while ringed plover is a qualifying species for the SPA during passage periods). This also applies to the Bridgwater Bay SSSI, which has some common ornithological interest with the Severn Estuary SPA and Severn Estuary Ramsar site, but which support nationally important numbers of a few additional species during the passage and winter periods.

For wading birds, generally accepted definitions of the spring passage, autumn passage and winter periods have been published. In the Wetland Bird Survey annual report for 2008/09 (Calbrade *et al*., 2010), the winter period for waders is defined as November to March inclusive and that for most other water bird species (featured in the report) as being September to March inclusive. For wildfowl the seasons are less easily defined, being more species specific. As such, a variety of sources have been interrogated in order that the winter period can be reasonably defined on a species-specific basis for wildfowl in the Severn Estuary. These sources include annual Wetland Bird Survey reports published by the BTO, the Migration Atlas (Wernham *et al*., 2002), the county avifauna (Ballance, 2006) and Somerset bird reports (published by the Somerset Ornithological Society). The qualifying periods of cited interest are presented in Table 4.1.

Table 4.1 Qualifying Periods of Species[49] Included in Severn SPA (and Ramsar Site) and Bridgwater SSSI Site Descriptions[50]

Species	Severn SPA & Ramsar Site	Bridgwater Bay SSSI	Qualifying Period	Source of Information
Bewick's swan	✓	N/a	Winter (October to March)	Wernham *et al* (2002) Brown & Grice (2005)
(Russian) White-fronted goose	✓	N/a	Winter (mid September to March)	Brown & Grice (2005)
Shelduck	✓	✓	Winter (SPA & Ramsar) (September to April). Moult / early migration and dispersal period (SSSI) (June to October)	Brown & Grice (2005) Ginn & Melville (2000) Ballance (2006)
Wigeon	N/a	✓	Winter (September to March)	BTO Wetland Bird Survey Annual Reports
Gadwall	✓	N/a	Winter (September to March)	Brown & Grice (2005)
Teal	*(R)*	N/a	Winter (September to March)	BTO Wetland Bird Survey Annual Reports Brown & Grice (2005)
Pintail	✓	N/a	Winter (September to March)	Brown & Grice (2005)
Ringed plover	✓	N/a	Passage[51] (April to October)	BTO Wetland Bird Survey Annual Reports
Dunlin	✓	✓	Winter (November to March)	BTO Wetland Bird Survey Annual Reports
Black-tailed godwit	N/a	✓	Passage (April to October)	BTO Wetland Bird Survey Annual Reports
Whimbrel	N/a	✓	Passage (April to October)	BTO Wetland Bird Survey Annual Reports
Curlew	✓	N/a	Winter – SPA (November to March)	BTO Wetland Bird Survey Annual Reports
Redshank	✓	N/a	Winter (November to March)	BTO Wetland Bird Survey Annual Reports

[49] Qualifying species for the Severn Estuary SPA (including SPA Review), the Severn Estuary Ramsar site (under Criterion 6) and Bridgwater Bay SSSI.

[50] Winter assemblage species are not all included here. It is assumed that any additional wader species within the assemblage qualification are SPA species between November and March inclusive, while additional wildfowl that are included in the assemblage would be present between September to March inclusive.

[51] The BTO defines spring wader passage as occurring between the months of April and June inclusive, and autumn passage as occurring between July and October inclusive. The respective Severn Estuary SPA citation and Bridgwater Bay SSSI description include a total of three species that occur on passage: ringed plover (SPA), whimbrel and black-tailed godwit (SSSI). It has been assumed for the purposes of this report that these three species occur on passage throughout this seven month period (although peak passage periods are apparent in all from published sources) and that any effect on them during this time might result in an effect on site integrity.

With reference to the information presented in Table 4.1, of those species that were recorded during the survey work undertaken at Hinkley between April 2008 and March 2009 inclusive, the species that form part of the designated interest of the Severn Estuary SPA are as follows:

- Passage populations of European importance (ringed plover);
- Winter populations of European importance (shelduck, pintail, gadwall, dunlin, curlew and redshank); and
- Additional species included in the wildfowl assemblage listing (wigeon, teal, mallard, shoveler, lapwing, grey plover and whimbrel).

The Ramsar descriptions (species listed under Criterion 6) and SSSI citations include species that were recorded during the survey work undertaken at Hinkley during 2007-09. These were:

- Winter populations of international importance (shelduck, gadwall, dunlin and redshank);
- Passage populations of international importance (black-tailed godwit and whimbrel); and
- Winter populations of national importance (shelduck, wigeon and dunlin).

For the species that represent designated features (that were recorded during the surveys undertaken at Hinkley in 2007-09), a detailed assessment of the importance of the survey area (defined here as the area covered by the intertidal and inshore marine surveys and daytime field surveys) has been completed in this report. This has been undertaken through considering the number of each species that occur in the survey area (and the nature and regularity of their use of the five count sectors) against numbers listed as occurring in the statutory sites during the winter period, or where the species is designated for its passage numbers, also during the passage period. In addition, gadwall which was recorded during the surveys undertaken at Hinkley between April 2007 and March 2008 (2007/08) but not during 2008/09 has also been included. Gadwall was recorded during the field surveys but not the intertidal surveys. The importance of the survey area to other species, which are not features of these designated sites, has been more briefly assessed against published national population estimates, regional accounts and figures presented in county bird reports.

Where a species is designated for its passage numbers, the peak counts recorded in each intertidal survey count sector during the passage period (April to October inclusive) are compared to numbers recorded at the statutory sites during the passage period. Likewise, peak counts recorded at each count sector during the winter period are compared with numbers forming the designated interest of statutory sites during the winter period (November to March for waders, or September to March for most other species). For some assemblage and non-cited/designated species such as lapwing, golden plover and teal, peak counts recorded during the daytime and nocturnal field surveys (herein referred to generically as the field surveys) are also considered.

WeBS data for the local area around Hinkley (counts from WeBS Core Count and Low Tide count sectors within the Severn Estuary SPA, within (approximately) 2km of the SSA) are used to provide additional information about numbers that have occurred within or close to the survey area in recent years. These data have again been separated into the passage and winter periods where appropriate for that species (i.e. the species is cited/designated for its passage population).

Records of bird sightings from the Somerset Ornithological Society have also been used to provide contextual information about numbers occurring in the Hinkley area in recent years. For these data, National Ordnance Survey Grid References could not be provided, with records being selected by site name and thus only the approximate/likely location of the birds can be determined.

4.3 Cited/Designated Species

Table 4.2 provides a comparison of the peak counts recorded during the surveys undertaken at Hinkley during 2007-09 with the qualifying populations of statutory sites within 5km of the SSA. The following text provides an explanation of how the figures presented in this table have been derived.

Peak Sector Counts

The peak count for each of the five intertidal survey count sectors is shown for the periods (as defined in Table 4.2) for which the species appears as cited/designated interest in the statutory sites (e.g. winter and/or passage). Separate counts are shown for the periods covered by the first (April 2007 to March 2008 inclusive) and second year of the intertidal survey programm (April 2008 to March 2009 inclusive) as covered in detail in this report. Counts of commuting birds have been excluded. The peak count recorded during the daytime and nocturnal field surveys on a particular visit is also shown, for the first phase of field surveys (September 2007 to March 2008 inclusive for the daytime field surveys, and December 2007 to March 2008 inclusive for the nocturnal surveys) and second phase of field surveys (April 2008 to March 2009 inclusive for the daytime field surveys, and April-May 2008 and August 2008 to March 2009 inclusive for the nocturnal surveys). All peak counts have been derived from the largest single count of that species recorded within the count sector on a particular survey date.

Thresholds of Importance

Thresholds of national and international importance for each species are shown in the tables below. These have been derived from figures presented in Calbrade *et al*. (2010).

Qualifying Populations

The SPA/Ramsar site qualifying population is shown for those SPAs/Ramsar sites that the species appears as a cited/designated feature[52]. Unless otherwise stated, the qualifying population figure for the statutory site has been derived as follows:

- SPAs: figures derived from 5 year peak mean WeBS count for 1991/2 to 1995/6 as presented in the Natura 2000 Description for that site; and
- Ramsar sites: figures derived from the five-year peak mean WeBS count for 1998/99 to 2002/03 as presented in the Ramsar Information Sheet for that site.

[52] Species which it is suggested may merit future inclusion are also considered here for completeness.

Parrett Estuary Population

Qualifying populations for species that appear as cited/designated features of the Bridgwater Bay SSSI (but are not listed in the Ramsar description) are not available. Therefore, an indicative population figure for the SSSI has been derived from peak counts for the Parrett Estuary (including Berrow Flats and the Brue Estuary). This area covers much the same area as the SSSI. These figures have been obtained for the particular period (passage/winter) from the 2008 and 2009 Somerset Birds Reports (Gibbs [Ed] 2010, 2011).

Table 4.2 Peak Counts of Cited/designated Species during Surveys in Relation to Qualifying Populations

Species	Period	International Threshold	National Threshold	Qualifying Population		Parrett Estuary Population[53]	Peak Count in Each Intertidal Count Sector during Period[54]						Field Surveys Peak Count
				Severn Estuary SPA[55]	Severn Estuary Ramsar Site		Survey year(s)	CS1	CS2	CS3	CS4	CS5	
Shelduck	Moult (Jun-Oct)	3,000	782			4,375	2007/08	21	42	200	70	700	0
							2008/09	10	500	32	64	280	0
Shelduck	Winter (Sep-Apr)	3,000	782	3,330	3,223	2,700	2007/08	22	43	35	71	700	3
							2008/09	33	36	15	34	280	4
Wigeon (a)	Winter (Sep-Mar)	15,000	4,060	8,466		2,500	2007/08	5	17	45	220	170	0
							2008/09	39	4	40	150	110	2
Gadwall	Winter (Sep-Mar)	600	171	N/a	241	N/a	2007/08	0	0	0	0	0	1
							2008/09	0	0	0	0	0	0

[53] Parrett Estuary population for the specified period (passage or winter). Figures derived from the latest counts for the Parrett / Brue Estuaries and Berrow Flats taken from Somerset Bird Report 2009 (Gibbs [Ed], 2011).

[54] Peak counts derived from the largest individual count of birds in the count sector on any single survey date, excluding counts of commuting birds.

[55] Counts for winter assemblage species (a) for the Severn Estuary SPA have been derived from the figures for the Severn Estuary in Calbrade *et al.* (2010).

Species	Period	Inter-national Threshold	National Threshold	Qualifying Population		Parrett Estuary Population[53]	Peak Count in Each Intertidal Count Sector during Period[54]						Field Surveys Peak Count
				Severn Estuary SPA[55]	Severn Estuary Ramsar Site		Survey year(s)	CS1	CS2	CS3	CS4	CS5	
Teal (a)	Winter (Sep-Mar)	5,000	1,920	4,916	4,456	1,500	2007/08	0	1	0	25	3	70
							2008/09	0	0	0	0	0	110
Mallard (a)	Winter (Sep-Mar)	20,000	3,520	3,385		56	2007/08	2	2	3	15	17	18
							2008/09	0	0	0	4	5	8
Pintail	Winter (Sep-Mar)	600	279	599	756	80	2007/08	0	4	35	20	25	0
							2008/09	0	0	60	10	48	0
Shoveler (a)	Winter (Sep-Mar)	400	148	561		45	2007/08	0	0	0	0	4	0
							2008/09	0	0	4	0	1	0
Ringed plover	Passage (Apr-Oct)	730	330	655	740	490	2007/08	7	0	0	2	0	0
							2008/09	33	11	4	1	4	1
Grey plover (a)	Winter (Nov-Mar)	2,500	530	416		200	2007/08	3	1	0	0	0	0
							2008/09	0	0	0	0	0	0
Lapwing (a)	Winter (Nov-Mar)	20,000	6,200	15,693		4,611	2007/08	2	0	0	2	40	67
							2008/09	0	0	0	3	102	75

Species	Period	Inter-national Threshold	National Threshold	Qualifying Population		Parrett Estuary Population[53]	Peak Count in Each Intertidal Count Sector during Period[54]						Field Surveys Peak Count
				Severn Estuary SPA[55]	Severn Estuary Ramsar Site		Survey year(s)	CS1	CS2	CS3	CS4	CS5	
Dunlin	Winter (Nov-Mar)	13,300	5,600	44,624	25,082	11,650	2007/08	0	0	0	0	0	0
							2008/09	0	0	0	0	0	1
Black-tailed godwit	Passage (Apr-Oct)	470	150			172	2007/08	0	0	0	0	0	0
							2008/09	0	0	0	0	100	0
Whimbrel (a)	Passage (Apr-Oct)	6,800	N/a	171		160	2007/08	0	0	0	1	1	0
							2008/09	1	5	1	4	7	3
Curlew	Winter (Nov-Mar)	8,500	1,500	3,903		1,345	2007/08	14	13	8	28	18	21
							2008/09	13	21	2	8	63	20
Redshank	Winter (Nov-Mar)	2,800	1,200	2,330	2,616	1,200	2007/08	0	1	0	1	1	0
							2008/09	0	0	0	1	22	1

Shelduck [SPA and Ramsar Site Qualifying Species]

Shelduck is described in Ballance (2006) as a common summer, autumn and winter visitor and passage migrant in Somerset. Bridgwater Bay SSSI, which includes the Parrett Estuary (which in turn includes Stert Flats) is the key area for passage, moulting and foraging shelduck in Somerset (Ballance, 2006). The Severn Estuary SPA has been partly designated for its winter numbers of shelduck of European importance. Nationally important congregations of moulting birds also form part of the cited interest of the Bridgwater Bay SSSI.

Shelduck numbers in Somerset peak between June and November, with an initial wave of birds passing through the county in June, July and August and birds which use Bridgwater Bay for moulting and wintering arriving during September (Ballance, 2006). Table 4.3 shows the monthly average and peak counts from the Parrett Estuary during 1987-2002 (Ballance, 2006) and the monthly peak counts recorded in each intertidal survey Count Sector, excluding counts of commuting birds.

Table 4.3 Peak Counts of Shelduck Each Month in the Parrett Estuary and Entec Survey Area during Moulting Period (June-Oct) and Winter Period (Sep-Apr)

		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Peak and Mean Counts on the Parrett Estuary during 1987-2002												
	Mean	1,214	1,620	1,822	1,864	1,473	1,257	889	485	282	264	376
	Peak	2,000	3,057	4,000	3,000	2,800	3,100	2,000	2,000	984	700	610
Peak Counts in Each Intertidal Count Sector Each Month during 2007/08 and 2008/09[56]												
CS1	2007/08	11	21	17	14	2	4	4	20	20	9	22
	2008/09	2		6	4	10	6	16	28	33	3	9
CS2	2007/08	5	2	17	5	42	43	3	35	7	24	6
	2008/09	4	6	500			9	19	32	36	16	6
CS3	2007/08	2	200	200	35			4	2	20	10	30
	2008/09	2	32		7		2		4	15	7	8
CS4	2007/08	13	30	70	6	16	71	11	4	30	20	25
	2008/09	4	64	9	34	18	5	3	7	21	3	19

[56] The figures show the largest single count recorded in each count sector on a single intertidal survey date (excluding counts of birds commuting through the count sector)

		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
CS5	2007/08	220	106	400	700	310	250	67	52	97	76	296
	2008/09	64	234	107	280	54	46	55	109	90	55	108

The peak counts in intertidal survey Count Sectors 2, 3, 4 and 5 in 2008/09 each exceed 1% of the SPA qualifying population of 3,330 shelduck during the winter period (September to April), with that for Count Sector 5 representing 8% of the SPA population. Peak counts in Count Sectors 2, 3, 4 and 5 in 2007/08 and/or 2008/09 also exceeded 1% of the Bridgwater Bay SSSI population during the period in which groups of moulting shelduck congregate in the Bay (June to October).

However, numbers of foraging or loafing shelduck in excess of 1% of the SPA population were only recorded on a frequent basis during the winter period in Count Sector 5 (on 18 occasions in 2008/09), during both the first and second year of survey (2007/08 and 2008/09 respectively). Groups of 30-100 birds were regularly seen foraging on intertidal habitat in Count Sector 5 around low tide, with larger flocks occasionally recorded (up to 280 birds in 2008/09 and up to 700 birds in 2007/08). Groups of loafing shelduck were regularly observed loafing on the sea in all count sectors, particularly within 3 hours of high tide as birds dispersed from their feeding grounds. However, away from Count Sector 5, numbers rarely exceeded 1% of the SPA or Ramsar site populations.

As in 2007/08, numbers of foraging and loafing shelduck in Count Sectors 1-4 in 2008/09 were generally smaller. However, numbers of shelduck loafing on the sea did occasionally exceed 1% of the SPA population in Count Sectors 2 and 4 in 2008/09 and also in Count Sector 3 in 2007/08. In comparison to that in Count Sector 5, the extent of the foraging resource in Count Sectors 1-4 is limited, whereas the extent of loafing habitat is less limited.

Overall, the largest numbers of foraging shelduck that occurred in the survey area were present around low tide, feeding low on the shore on exposed mud, predominantly in Count Sector 5, on the edge of Stert Flats. These foraging birds then tended to disperse, moving offshore to form loose loafing flocks as the tide rose rather than moving into other count sectors (closer to the SSA). There is no evidence from the data collected during 2007/08 or 2008/09 that shelduck regularly roost on rocks at high water in any of the count sectors.

Results from the surveys undertaken during 2003-05 for the proposed West Hinkley Wind farm also indicate regular use by up to 400 shelduck on intertidal habitat immediately to the east of the Power Stations including in the area covered by Count Sector 5. Very few shelduck were recorded during these surveys in the area covered by Count Sectors 1-4, with no counts in excess of 1% of the SPA or SSSI populations of shelduck in these areas.

WeBS Core Count data and Somerset Ornithological Society records indicate that large concentrations of shelduck occur on Stert Flats, which includes Count Sector 5. WeBS Low Tide counts for 2008/09 recorded 185 shelduck in Count Sector 5, and 65 birds in total in Count Sectors 1-4.

The evidence from the desk study and surveys suggest that use of intertidal habitat in Count Sectors 1-4 (Sectors 1-3 include the intertidal area adjacent to the SSA) by shelduck is sporadic during the moult and winter periods, and that low numbers of birds use the intertidal zone. Count Sectors 1-4 are unlikely to support numbers of foraging or roosting shelduck that are of importance in terms of the SPA population during winter or in terms of the Bridgwater SSSI population during the moulting period. In view of this, Count Sectors 1-4 are considered to be of low importance to the SPA population of shelduck during the moulting period and winter. The large numbers of shelduck seen loafing on inshore waters within Count Sectors 1-4 during the Entec surveys were due to birds moving off the western part of the Stert Flats (including Count Sector 5) as they became inundated by the rising tide. These flocks of loafing birds were usually located more than 500m offshore (and thus outside the intertidal survey area) but would occasionally drift close inshore and into Count Sectors 1-4.

The field surveys and desk study provide no evidence to indicate that shelduck use the fields within the survey area, including those in the SSA, on a regular basis. Therefore, this area is unlikely to be of importance to the SPA population of of shelduck during the moulting period and winter.

Numbers of foraging and loafing shelduck that are important in terms of the Severn Estuary SPA population occur in Count Sector 5 on a regular basis during the winter period (September to March inclusive). The peak counts of 280 birds in 2008/09 and 700 birds in 2007/08, foraging on intertidal habitat in Count Sector 5, represents 8% and 21% of the SPA population respectively. Numbers of foraging and loafing shelduck that exceed 1% of the Bridgwater Bay SSSI population also occur in Count Sector 5 on a regular basis during the moulting period (June to October inclusive). In view of this, the intertidal habitat within Count Sector 5 is likely to provide a locally important resource to the SPA and SSSI populations of shelduck, both to foraging and loafing birds throughout much of the tidal cycle. Count Sector 5 lies on the western edge of the Stert Flats and WeBS data indicates that a considerable proportion of the SPA population of shelduck uses this area during the winter period (September to April inclusive) and the SSSI population during the moulting period (June to October inclusive).

Wigeon [SPA Assemblage and SSSI Qualifying Species]

Wigeon is described in Ballance (2006) as a common or locally abundant passage migrant and winter visitor in Somerset. The first birds arrive in the county in August, with numbers building up quickly in September and October and the bulk of birds arriving in November and December. Numbers are usually stable during January after which there is a decline, with few birds remaining in April (Ballance, 2006). The Somerset Levels SPA, which is approximately 16km to the south east of the SSA, is the most important site in the county for wigeon and the third most important area in the UK (Calbrade *et al*, 2010). The Parrett Estuary is the most important coastal site for wigeon in Somerset, with numbers tending to be at their highest during drier (and very cold) winters when birds find it hard to locate suitable flooded areas inland for roosting. Consequently, numbers vary greatly between years on the Parrett Estuary, with a peak of 5,000 birds recorded during the winter of 1996/97 compared with 1,000 birds during 2003/04. Nationally important numbers of wintering wigeon form part of the cited interest of the Bridgwater Bay SSSI of which the Parrett Estuary forms an integral part.

The peak counts for Count Sectors 4 and 5 in both 2007/08 and 2008/09 all exceed 1% of the Severn Estuary population of 8,466 birds. The peak counts for Count Sectors 4 and 5 in 2008/09 represent 1.8% and 1.3%, and those for 2007/08, 2.6% and 2.0% of the Severn Estuary population respectively.

Numbers of wigeon in excess of 1% of the Severn Estuary population (85 or more birds) were recorded feeding or loafing close to the tide line during much of the tidal cycle in Count Sectors 4 and 5 on a regular basis between November and March inclusive (on 14 and 6 occasions respectively during 2007/08 and 2008/09). In 2008/09, large counts of foraging wigeon were recorded feeding close to the waters' edge throughout much of the tidal cycle, whereas usually smaller groups of loafing birds tended to congregate close offshore two hours either side of high water. In view of this, the intertidal habitat within the survey area at Hinkley Point and immediately to the east of it is likely to provide a locally important foraging resource for the SSSI population of wigeon during winter.

The field and intertidal surveys provided no evidence for the existence of a regular roosting site for wigeon within the survey area. The survey data indicates that important numbers of wigeon forage on the intertidal habitat in Count Sectors 4 and 5 on a regular basis during the winter and that high tide roosts also occur on occasion in this area.

Somerset Ornithological Society records and surveys undertaken for the proposed West Hinkley Wind Farm indicate that numbers of wigeon in excess of 50 birds have occurred at Hinkley Point on a regular basis, including counts of 200 on 15 November 2007 and 229 on 7 February 2007. The wind farm data includes peak counts in excess of 50 wigeon on the intertidal habitat in both Count Sectors 4 and 5. WeBS Low Tide data indicates that similar-sized numbers occur on the mudflats immediately to the east of Hinkley Point (peak count of 485 wigeon in sector BV696) and the intertidal area to the west of the Power Stations and adjacent to the SSA (peak count of 185 wigeon in sector BV697).

Results from the desk study and surveys undertaken in 2007/08 and 2008/09 indicate that numbers of wigeon that are important in terms of the Severn Estuary population use the intertidal habitat in Count Sectors 4 and 5 on a regular basis for foraging (and occasionally for roosting) during the winter. The smaller expanse of suitable feeding habitat exposed at low water to the west of the Power Stations and adjacent to the SSA (Count Sectors 1, 2 and 3) is of limited (no more than local) importance to wigeon. There was also no evidence to indicate that wigeon use the fields within or close to the SSA on a regular basis or that important numbers of wigeon occur in the seasonally flooded fields to the south of the built plant within the Severn Estuary SPA.

Gadwall [SPA and Ramsar Site Qualifying Species]

Gadwall is described in Ballance (2006) as a locally fairly common, autumn and winter visitor and passage-migrant in Somerset. Currently, the Somerset Levels support the largest winter and autumn numbers of gadwall in the county, with Westhay Moor and Shapwick Heath being favoured sites. Numbers on the Parrett Estuary and surrounds are generally small and use of the area is sporadic. The Severn Estuary SPA and Ramsar site has been designated partly on the basis of its wintering gadwall population of European importance.

As there was only one gadwall recorded during the entire ornithological survey programme, and no previous desk study information indicating more historical use of the survey area, it is reasonable to conclude that the area is of low (or even negligible) importance to the SPA population.

Teal [SPA Assemblage and Possible Future Ramsar Site Qualifying Species, SSSI Qualifying Species]

Teal is described in Ballance (2006) as a scarce breeder, but a common or locally abundant winter visitor and passage migrant in Somerset. The influx of wintering birds begins in mid July, and continues through to November and December when the bulk of birds arrive. Numbers peak in January and then decline from February onwards, with few present by the end of the March (Ballance, 2006).

The Somerset Levels are currently the most important site for wintering teal in the UK (Calbrade *et al*, 2010). Good numbers also occur on the Parrett Estuary, with 1,600 birds recorded there in December 2005 (Gibbs [Ed], 2006). Internationally important numbers of wintering teal (4,456 birds) appear as a possible feature for future inclusion as part of the cited interest of the Severn Estuary Ramsar site and this species also appears in the wildfowl assemblage listing for the Severn Estuary SPA. Internationally important numbers of wintering teal that occur in the Severn Estuary also appear as cited interest for the Bridgwater Bay SSSI, which supports a substantial proportion (1,600 birds) of the entire Severn Estuary population.

Teal were not recorded using the intertidal survey area (Count Sectors 1-5) during the intertidal surveys undertaken in 2008/09. However, the peak count of 25 birds loafing on the sea in Count Sector 4 in January 2008 represents 1.6% of the Bridgwater Bay SSSI population. Numbers exceeding 1% of the SSSI population were recorded on one occasion in 2007/08. Very few foraging birds were noted.

Results from the daytime field surveys in 2007/08 and 2008/09 indicate that the network of ditches and ponds to the south of the Power Stations occasionally support numbers of teal that exceed 1% of the (potential) Ramsar site and SSSI populations. The pond to the east of the sewage works, (south of the built plant) was identified as being of particular local importance to teal. Numbers of teal that exceed 1% of the (potential) Ramsar site population were recorded foraging or loafing on this pond during winter 2008/09 on seven occasions. The field and intertidal surveys provided no evidence for the existence of a regular roosting site for teal within the survey area.

WeBS data and results from survey work undertaken for the West Hinkley Wind Farm indicate that teal use the mudflats immediately to the east of Hinkley Point in numbers that occasionally exceed 1% of the SSSI population. WeBS Core Count data indicate that much larger numbers of teal occur on the more extensive areas of intertidal habitat on the Stert Flats to the east of the survey area. During the West Hinkley Wind Farm surveys teal were also recorded flying between mudflats to the east of Hinkley Point and the pools to the south of the Power Stations.

Overall, evidence from the surveys and desk study indicate that within the survey area, the network of ditches and pools to the south of the built plant provide a locally important foraging resource to the Severn Estuary population and Bridgwater Bay SSSI population of teal during the winter period (September to March inclusive). All other areas within the survey area at Hinkley have generally low or negligible levels of use by teal and are therefore unlikely to be of importance to the SSSI population.

Mallard [SPA Assemblage Species]

Mallard is described in Ballance (2006) as a common resident breeder, winter visitor and passage migrant in Somerset. Mallards will use a wide range of habitats for foraging, including estuaries, rivers, streams and small ponds. It is therefore likely that WeBS data, which are primarily derived from counts of birds on large water bodies, underestimates the true numbers of mallard present in the Somerset. Counts of mallard from 20-30 selected sites in the county regularly total more than 1,000 birds (Gibbs [Ed] 2011). In view of the likely widespread occurrence of suitable habitat and inferred distribution of this species in Somerset, the winter population of mallard in the county is likely to be well in excess of 10,000 birds. Large numbers winter on inland reservoirs and on the Somerset Levels, with relatively small numbers present on the Parrett Estuary (Gibbs [Ed], 2011). Mallard is not a qualifying species of either the Severn Estuary SPA or the Bridgwater Bay SSSI. However, in the winter, the Severn Estuary regularly supports numbers of waterfowl that are of European importance, including mallard, which is listed in the winter assemblage qualification for the SPA.

Results from the intertidal and daytime field surveys undertaken at Hinkley during 2007/08 and 2008/09 indicate that there is a relatively low level of use by mallard of the intertidal habitat adjacent to the SSA, and the network of ditches and pools to the south of the built plant. WeBS data, Somerset Ornithological Society records and surveys undertaken for the proposed West Hinkley Wind Farm also provide no evidence to indicate that important numbers of mallard occur locally. Overall, within the survey area, the intertidal habitat, pools and network of ditches to the south of the Power Stations provide a locally important foraging resource, with much more extensive areas of suitable habitat found to the east in Bridgwater Bay and on the Somerset Levels. The survey area is therefore likely to be of low importance to the Severn Estuary population of mallard during the winter period (September to March inclusive).

Pintail [SPA Review and Possible Future Ramsar Site Qualifying Species]

Pintail is described in Ballance (2006) as a locally fairly common winter visitor and passage migrant in Somerset. Pintail arrive in the county from August to December, with many of the earlier birds only using the area on passage. Numbers peak in January and February, with flocks of birds moving between the Somerset Levels, inland reservoirs and the Parrett Estuary. During the development of the West Sedge Moor Nature Reserve on the Somerset Levels in the 1990s, numbers of pintail increased at this site whilst declining on the Parrett Estuary, although this situation has since been reversed, and there was a count of 143 on the Parrett Estuary in January 2006 (Ballance, 2006., Gibbs [Ed], 2007). Wintering numbers of pintail of European importance are a recommended addition to the qualifying interest of the Severn Estuary SPA (599 birds) in the SPA review (Stroud *et al*., 2001). Internationally important numbers of wintering pintail appear as a possible future feature for addition to the qualifying interest of the Severn Estuary Ramsar site.

The peak counts in intertidal survey Count Sectors 3, 4 and 5 in 2007/08 and 2008/09 all exceeded 1% of the SPA Review population of pintail. Important numbers of pintail in terms of the SPA Review population were recorded foraging on the tide line or loafing on the sea in Count Sectors 4 and 5 on two and nine occasions respectively in 2008/09 (six and twelve occasions respectively in 2007/08). Foraging activity was recorded primarily during low tide (three hours either side of low water) and loafing birds congregated offshore two hours either side of high tide. Use of Count Sectors 1-3 by foraging and loafing pintail was very sporadic in 2007/08 and 2008/09.

There is no evidence from the intertidal survey data collected in 2007/08 and 2008/09 of a regular high tide roost of pintail in any of the count sectors. The largest numbers of pintail occur in the survey area around low tide, feeding in intertidal habitat predominantly in Count Sectors 4 and 5, on the edge of Stert Flats. These foraging birds tend to disperse, moving offshore to form loose loafing flocks as the tide rises rather than moving into other count sectors closer to the SSA.

WeBS data, Somerset Ornithological Society records and results from the winter bird surveys undertaken for the proposed West Hinkley Wind Farm during March 2006 indicate that pintail occur in intertidal habitat to the east of Hinkley Point in the area approximately covered by Count Sector 5 (at least 1km east of the SSA), with numbers generally ranging between 30-100 birds. These data also suggest that the numbers using the Hinkley Point area represent a large proportion of the total using the Stert Flats and Bridgwater Bay. Results from the desk study and field surveys provide no evidence of pintail using the fields, ditches and other water bodies within the Entec fields survey area.

There is no evidence to suggest that intertidal habitat to the west of the built nuclear plant, and that adjacent to the proposed new build area is used by important numbers of pintail on a regular basis and therefore this area is likely to be of no more than local importance to the species during the winter period (September to March inclusive). The intertidal habitat around Hinkley Point (including that in Count Sectors 4 and 5) held numbers of pintail that are important in terms of the Severn Estuary SPA Review population on 11 and 18 occasions during the winters of 2007/08 and 2008/09 respectively. Within the survey area, the intertidal habitat to the north and north-east of the operational plant are likely to provide a locally important foraging resource for the SPA pintail population.

Shoveler [SPA Assemblage Species]

Shoveler is described in Ballance (2006) as a locally fairly common winter visitor and passage migrant in Somerset. The first winter visitors and passage migrants arrive in Somerset in August, September and October, with the bulk of birds appearing in November and December. Numbers peak in January and February, but stay at relatively high levels until the end of March when a second increase occurs as a result of an influx of passage birds en route to breeding areas. Shoveler appears in the waterfowl assemblage listed for the Severn Estuary SPA and nationally important wintering numbers (297 birds) appear as noteworthy fauna in the description for the Severn Estuary Ramsar site. Numbers on the Somerset Levels and Severn Estuary appear to have increased since designation and both currently hold internationally important numbers of shoveler; with the 5 year mean peak WeBS counts for 2004/05 to 2008/09 inclusive being 1,286 and 561 birds respectively (Calbrade *et al*, 2010). Numbers found on the Parrett Estuary (peak count of 45 birds in 2009, Gibbs [Ed] 2011) are small in comparison to those found on the Severn Estuary as a whole.

Results from the intertidal surveys undertaken at Hinkley in 2007/08 and 2008/09 indicate that small groups of 1-4 shoveler use Count Sectors 3 and 5 on an infrequent basis. Shovelers were not recorded during the field surveys in 2007/08 or 2008/09. Surveys undertaken for the proposed West Hinkley Wind Farm recorded peak counts of 11 and 22 birds in March 2006 although no shoveler were noted in the winter bird study area during the first and second phases of surveys in 2003-05.

Counts of shoveler that exceeded 1% of the Ramsar site population (297 birds) were recorded on one occasion during the Entec intertidal surveys undertaken in 2007/08 and 2008/09 and twice during the West Hinkley Wind Farm surveys. In view of the evidence from the surveys and desk study, the intertidal survey area at Hinkley is likely to be of low or negligible importance to the Ramsar site population of shoveler on a regular basis during the winter period (September to March inclusive).

Ringed Plover [SPA Review and Possible Future Ramsar Site Qualifying Species]

Ringed plover is described in Ballance (2006) as a scarce breeder and fairly common winter visitor and passage migrant in Somerset. The main sites for ringed plover in Somerset are on the Parrett Estuary and Dunster Beach where numbers of birds peak in August and September (Ballance, 2006). Passage numbers of ringed plover of European importance are a recommended addition to the qualifying interest of the Severn Estuary SPA (655 birds) in the SPA review (Stroud *et al*., 2001). Internationally important numbers of passage ringed plover appear as a possible future inclusion into the designation of the Severn Estuary Ramsar site.

During the intertidal surveys undertaken at Hinkley in 2007/08 and 2008/09, ringed plover were recorded throughout much of the passage period (April to October inclusive), and on a regular basis in Count Sector 1 (on 12 occasions between April and October 2008 inclusive). Numbers were generally small (usually involving 1-3 foraging or roosting birds), but occasional larger flocks were observed, including a notable count of 33 roosting birds on 19 September 2008.

During 2007/08, ringed plover were recorded foraging or loafing on the beach in Count Sector 1 on nine occasions during the passage period. Elsewhere within the survey area, the intertidal habitat was used more infrequently by 1-2 ringed plovers.

Counts of foraging, loafing or roosting ringed plover in excess of 1% of the Severn Estuary SPA Review population of 655 birds were recorded (during the passage period in 2008) on two occasions in Count Sector 1, and also once in Count Sector 2. The peak count of 33 roosting birds in Count Sector 1 in September 2008 represents slightly in excess of 5% of the SPA Review population. A count of ringed plover in excess of 1% of the SPA Review population was recorded on one occasion in 2007, also in Count Sector 1. Results from the daytime and nocturnal field surveys in 2007/08 and 2008/09 indicate that use of the fields and surrounding ditches and wet areas within the survey area was very limited during the passage period.

Results from the West Hinkley Wind Farm surveys included a peak count during the passage period of 12 birds in October 2004 (details of the location of the birds is unavailable) representing more than 1% of the SPA Review population. However, this count was exceptional, with no birds recorded on most visits and occurrence within the survey area was sporadic.

Somerset Ornithological Society records show that small numbers of ringed plover occur around Hinkley Point (which is likely to include all or the majority of Count Sectors 4 and 5), and that larger numbers use the Stert Flats to the east of the survey area. WeBS Core Count data also indicate that a large proportion of the Severn Estuary population occurs on the Stert Flats during the passage period, with the largest numbers seen in August (a peak count of 780 birds recorded there in August 2006), and that numbers occur at much lower levels during the winter period.

The survey data provides no evidence for the presence of a regular roosting site for ringed plover within the survey area during the passage period. It is therefore likely that small numbers of ringed plover feed on the shoreline within the survey area during low water, after which they disperse to roost sites.

During the winter period (November to March inclusive), 1-2 ringed plover were recorded regularly in the intertidal survey area. Ringed plover were noted foraging, loafing or roosting in Count Sector 1 on six and 13 occasions respectively during the 2007/08 and 2008/09 intertidal surveys, with a peak count of 12 roosting birds there on 12 February 2009. Counts in excess of two birds were observed on two and five occasions in Count Sector 1 during 2007/08 and 2008/09 respectively. Ringed plover were recorded more infrequently in the other count sectors during winter (3, 3 and 1 occasions in Count Sectors 2, 4 and 5 respectively). Results from the West Hinkley Wind Farm surveys included peak counts during the winter period of 22 birds in December 2003 and 23 birds in December 2004, although on most visits, no ringed plover were counted (details of the location of the birds is unavailable). Numbers of ringed plover in Somerset are generally much smaller in the winter than during the passage period (Ballance, 2006), and include county totals of 145 birds in January 2007, 124 birds in November 2005 and 88 birds in January 2009 (Gibbs [Ed], 2006, 2007, 2011). Even allowing for birds residing in coastal areas away from the main sites, that are not included in these county totals, the county population of ringed plover during the winter is unlikely to be much in excess of 200 birds. In view of this, the numbers of ringed plover using Count Sector 1 during the winter are occasionally of county importance. Count Sectors 2-5 are used infrequently and are therefore likely to provide a no more than locally important resource to ringed plover during the winter.

To summarise, the intertidal habitat within the survey area is likely to provide a limited resource for foraging and roosting ringed plover during the passage period, with much more extensive areas of suitable habitat being found to the east, in Bridgwater Bay. The evidence from the desk study and surveys indicates that numbers of ringed plover that are important in terms of the Severn Estuary SPA population occur occasionally in Count Sectors 1 and 2 and that there is generally low level use of the area during the passage period. In Count Sectors 3-5, SPA important numbers of ringed plover were not recorded. In view of this, the intertidal habitat within the survey area, including that adjacent to the SSA is likely to be of low importance to the SPA population of ringed plover during the passage period. During the winter, the intertidal habitat in Count Sector 1 occasionally supports numbers of foraging, roosting and loafing ringed plover that are of county importance.

Grey Plover [SPA Assemblage Species]

Grey plover is described in Ballance (2006) as a fairly common, but very local winter visitor and passage migrant in Somerset. In Somerset, most grey plover occur on the Parrett Estuary, where the mean counts for 1983-2003 for the peak months of December, January and February are 213, 214 and 204 birds respectively (Ballance, 2006). The Severn Estuary supports nationally important numbers of grey plover during winter, with Bridgwater Bay SSSI holding a considerable proportion of the total. In addition, grey plover appears in the winter assemblage qualification for the Severn Estuary SPA.

No grey plover were recorded during the intertidal surveys undertaken in 2008/09. In 2007/08 this species was recorded on two occasions, involving a maximum of three birds. However, 1-2 grey plover were heard or observed feeding in the intertidal survey area on five dates during nocturnal field surveys undertaken in January, February and March 2009.

WeBS data, Somerset Ornithological Society records and results from surveys undertaken for the proposed West Hinkley Wind Farm during 2003-06 also provide no evidence to suggest that grey plover occur on a regular basis within the survey area. WeBS data indicates that much larger numbers (150-500 birds) occur on the Stert Flats to the east of Hinkley Point. Good numbers (304 birds) were recorded duing WeBS Low Tide counts in 2008/09 on mudflats approximately 1km to the east of the survey area.

To summarise, the intertidal area within the survey area (including that around Hinkley Point and to the west, adjacent to the SSA) is used by grey plover on a very infrequent basis. In view of this low level use of the site, the survey area is likely to be of less than local importance to grey plover during the winter period (November to March inclusive).

Lapwing [SPA Assemblage Species]

Lapwing is described in Ballance (2006) as a fairly common but local breeder, and abundant winter visitor and passage migrant in Somerset. The first wintering lapwings appear in Somerset in June or July, but most arrive in October, November and December (Ballance, 2006). The largest numbers occur in the county when birds are forced south and west by prolonged cold weather. The Somerset Levels are the main site in the county for lapwing, with 69,758 birds recorded there in January 2006, compared to 7,300 birds on the Parrett Estuary in the same month (Gibbs [Ed], 2007). The Somerset Levels is now the most important site for wintering lapwing in the UK and an internationally important site for the species (Calbrade *et al.*, 2010). Lapwing is not a qualifying species of either the Severn Estuary SPA, Severn Estuary Ramsar site or the Bridgwater Bay SSSI. However, this species does appear in the winter assemblage qualification for the SPA.

Foraging, loafing and roosting lapwing were not recorded on a regular basis in the intertidal survey area during 2008/09 or 2007/08 (on 5, 1 and 2 occasions respectively between April 2008 and March 2009 inclusive). In 2007/08, almost all activity was in Count Sectors 4 and 5, and in 2008/09 no lapwing were recorded outside these count sectors.

Results from the field surveys undertaken at Hinkley indicated that the favoured areas for lapwing were arable fields in the west and south of the planning application boundary, and the pasture around Wick Moor to the south of the built plant (outside the planning application boundary). Lapwings were observed foraging in fields with the survey area on most field surveys undertaken during December 2008 to February 2009 inclusive. The largest counts were on 10-11 January and 6-7 February 2009, including a total of 117 birds within the planning application boundary on 7 February. The largest counts outside the planning application boundary were primarily in fields at Wick Moor, and included a total of 147 birds on 16 November 2007 and 130 birds on 10 January 2009. Table 4.4 shows the total number of lapwing counted during the field surveys on each date, within and outside the planning application boundary.

Table 4.4 Total Number of Lapwing Recorded on Each Date during Entec Field Surveys at Hinkley[57]

Date	With SSA	Outside SSA	Total
16/11/2007		147	147
17/12/2007	60	2	62
21/12/2007	17	7	24
22/12/2007	1	52	53
14/02/2008	29		29
18/02/2008	44		44
07/08/2008	3		3
14/08/2008	2		2
22/10/2008	4		4
11/12/2008		10	10
17/12/2008	18	8	26
10/01/2009	5	130	135
11/01/2009		46	46
15/01/2009	13		13
29/01/2009		30	30
06/02/2009	88		88
07/02/2009	117	44	161
24/03/2009	3		3

[57] Counts of commuting birds have been excluded.

Small numbers of lapwings were recorded in fields within the SSA and those to the south of the built plant during the nocturnal surveys undertaken in 2008/09. However, the surveys undertaken in 2007/08 and 2008/09 provide no evidence to suggest that large numbers of lapwing were roosting in these areas.

Accurate information on the likely size of the lapwing population in the local area and within the county of Somerset as a whole during the winter is not available. WeBS counts are predominantly undertaken on estuaries and at the larger wetland sites and not on farmland where important numbers of lapwing occur during winter. In most winters the county population is likely to be in excess of 50,000 to 100,000 birds, as lapwing will occur on farmland out with the Somerset Levels. Results from the surveys undertaken at Hinkley during 2007/08 and 2008/09 indicate that numbers of lapwing of county importance (i.e. more than 1% of the likely population in Somerset) occur irregularly during the winter. Evidence from the desk study and surveys indicates that the fields and intertidal habitat within the survey area are likely to provide a limited foraging and roosting resource to lapwing. In view of this, the survey area (including the fields within the planning application boundary) is likely to be of no more than local importance to lapwing during the winter period (November to March inclusive).

Dunlin [SPA, Ramsar Site and SSSI Qualifying Species]

Dunlin is described in Ballance (2006) as an abundant winter visitor and common passage migrant in Somerset. The main area for passage and winter dunlin is Bridgwater Bay (Ballance, 2006) of which the Parrett Estuary often holds more than 10,000 birds during November to February. The Severn Estuary SPA is designated partly on the basis of dunlin numbers of European importance during the winter (44,624 birds). Internationally important numbers of dunlin during winter (25,082 birds) are a cited/designated feature of the Severn Estuary Ramsar site. Nationally important winter numbers (11,650 birds) appear in the citation for the Bridgwater Bay SSSI.

Dunlin were not recorded using the intertidal habitat at Hinkley for foraging, loafing or roosting during the intertidal surveys undertaken during the winters of 2007/08 or 2008/09 (November to March inclusive). Low level use of the intertidal area was recorded irregularly during the spring and autumn passage period (April to October inclusive). Results from winter bird surveys undertaken for the proposed West Hinkley Wind Farm also indicate a low level of use of intertidal habitat adjacent to the Power Stations and SSA. WeBS data suggest that much larger numbers (sometimes in excess of 10,000 birds) occur on the Stert Flats, 2-5km east of the survey area.

The evidence indicates that the intertidal habitat around Hinkley Point and that adjacent to the SSA is used by small numbers of dunlin on a relatively infrequent basis. The survey area is likely to be of low or negligible importance to the Severn Estuary SPA/Ramsar site populations and Bridgwater Bay SSSI population of dunlin during the winter period (November to March inclusive).

Black-Tailed Godwit [SSSI Qualifying Species]

Black-tailed godwit is described in Ballance (2006) as a locally common winter visitor and passage migrant in Somerset. Internationally important numbers of passage black-tailed godwit form part of the cited interest of the Bridgwater Bay SSSI. Peak numbers of black-tailed godwit occur on the Parrett Estuary during summer and early autumn (Ballance, 2006), with 172 and 110 birds counted respectively August and September 2009 (Gibbs [Ed] 2011).

During the 2008/09 intertidal surveys, black-tailed godwits were recorded on two occasions, both during the passage period, including a large flock of 100 birds foraging on intertidal habitat in Count Sector 5 in August 2008, which is likely to represent at least 30% of the Bridgwater Bay population. Black-tailed godwits were recorded on one occasion during intertidal surveys undertaken in 2007/08 (involving six birds in December and therefore outside the passage period for which this species appears as a cited feature).

Single black-tailed godwits were recorded in the survey area on two occasions during surveys undertaken for the proposed West Hinkley Wind Farm during 2003-06 (the activity of these birds is not known). WeBS data indicates that large numbers of black-tailed godwits occur to the east on the Stert Flats, where e.g. 148 birds were noted in September 2008.

The evidence indicates that the intertidal habitat around Hinkley Point and that adjacent to the SSA is used by black-tailed godwit on a very infrequent basis during the passage period. Numbers that are important in terms of the Bridgwater Bay population occur very occasionally, with more extensive areas of suitable foraging habitat lying to the east of Hinkley. The surveys provide no evidence of roosting black-tailed godwits at Hinkley.

In view of this low level of use, it is likely that the survey area is of low importance to the SSSI population of black-tailed godwit during the passage period (April to October inclusive).

Whimbrel [SPA Assemblage and SSSI Qualifying Species]

Whimbrel is described in Ballance (2006) as a passage migrant that is more common in the spring than autumn in Somerset, and the species appears in the waterfowl assemblage qualification for the Severn Estuary SPA. The Bridgwater Bay SSSI was originally notified partly on the basis of its important numbers of passage whimbrel (160 birds, Gibbs [ed] 2011), and nationally important passage numbers appear as noteworthy fauna in the description for the Severn Estuary Ramsar site (333 birds).

Whimbrel were recorded on a regular basis in the spring passage period (April and May) during the intertidal surveys undertaken at Hinkley in 2007 and 2008 (on a total of 29 occasions). Smaller numbers were seen irregularly during the return autumn passage period of July to October (on a total of nine occasions). Foraging or loafing birds were observed in all count sectors, but were irregular (seen on one occasion) in Count Sector 1 and most commonly recorded in Count Sectors 4 and 5. Results from the field surveys provide no evidence to suggest that whimbrel were using fields within the survey area for foraging or roosting on a regular basis. Table 4.5 shows the peak count of whimbrel recorded during the Hinkley intertidal surveys in each count sector during each month of the passage period in 2007 and 2008.

Table 4.5 Peak Count of Whimbrel Recorded in Each Intertidal Count Sector during Entec Intertidal Surveys in 2007 and 2008[58]

Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct
1	2007							
1	2008		1					
2	2007	3	2					
2	2008	3	5			2		
3	2007		1					
3	2008	1	1					
4	2007	3	4			1		
4	2008	2	4	2	1	1		
5	2007	8	15		2	1		
5	2008	7	3					

Whimbrel was not recorded on any of the bird surveys undertaken for the proposed West Hinkley Wind Farm during 2003-06 (some of these surveys were conducted during late August and September in 2004 (i.e. part of the usual autumn passage period for whimbrel) although none were carried out during the spring passage period. WeBS data and records from the Somerset Ornithological Society indicate that larger numbers of whimbrel occur around Hinkley Point and to the east of the survey area on Stert Flats during spring passage. The peak (WeBS Core Count) numbers of whimbrel recorded on the Stert Flats during 2004/05 to 2008/09 were 14, 7, 3, 28 and 6 birds respectively. A total of 101 whimbrel were counted on the Severn Estuary in May 2006 (Musgrove *et al*., 2007) and there were peak counts of 160 and 81 whimbrel on the Parrett Estuary (including the Berrow Flats) in April and May 2009 (Gibbs [Ed], 2011). Numbers appear to peak on the Parrett Estuary in April and May, with much smaller numbers passing through the area during autumn, mainly in August and September when counts rarely exceed five birds.

The evidence suggests that the survey area is used by numbers of whimbrel that are important in terms of the Bridgewater Bay SSSI population during spring passage (April and May). The intertidal habitat in Count Sectors 4 and 5 was particularly favoured. Whimbrel were recorded using Count Sector 4 on five and seven occasions respectively during the 2007 and 2008 passage periods, including counts of four birds on one date in each year. In Count Sector 5, whimbrel were recorded on 12 and three occasions respectively in 2007 and 2008, including counts in excess of 1% of the SSSI site population on seven and three occasions respectively in 2007 and 2008.

Count Sector 2 is likely to provide a locally important foraging resource to whimbrel during the passage period (whimbrel were recorded using the intertidal habitat on two and five occasions respectively during the 2007 and 2008 passage periods). Whimbrel were recorded less

[58] Counts of commuting birds have been excluded.

frequently in Count Sectors 1 and 3 being observed using the intertidal habitat on a total of one and four occasions respectively during the 2007 and 2008 passage periods. It is therefore concluded that these sectors are likely to be of less than local importance to the species. Smaller numbers of whimbrel occur more irregularly during the autumn passage period (July to October inclusive), primarily commuting through the area, but occasionally stopping off to feed in intertidal habitat.

Curlew [SPA Review Qualifying Species, Potential Future Ramsar Qualifying Species]

Curlew is described in Ballance (2006) as an uncommon breeder, common winter visitor and passage migrant in Somerset. Wintering numbers of curlew of European importance are a recommended addition to the qualifying interest of the Severn Estuary SPA (3,903 birds) in the SPA Review (Stroud *et al.*, 2001). Nationally important numbers of passage curlew (2,021 birds) appear as noteworthy fauna in the description for the Severn Estuary Ramsar site. Curlew arrive in the county between June and October (on autumn passage), with smaller but still substantial numbers remaining through the winter until late March (Ballance, 2006). The Parrett Estuary is currently the most important site in Somerset for passage and wintering curlew.

Table 4.6 shows the (mean) peak counts on the Parrett Estuary during 1981-2003 (Ballance, 2006); maximum counts of curlew on the Parrett Estuary in each month between April 2008 and March 2009 inclusive (Gibbs [Ed] 2010, 2011) and the peak counts (excluding commuting birds) recorded in the five intertidal count sectors between April 2007 and March 2008 inclusive (2007/08) and April 2008 and March 2009 inclusive (2008/09). The peak count each month during the field surveys are also shown (derived from summing the counts in each field on any one date).

Table 4.6 Peak Counts of Curlew by Month in the Parrett Estuary and the Entec Survey Area

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mean Peak Counts on the Parrett Estuary During 1981-2003													
		351	78	137	697	964	1,019	858	631	705	690	583	569
Peak Counts on the Parrett Estuary During 2008/09													
2008/09		1,000	90	85	535	74	265	960	1,385	1,005	766	1,345	953
Peak Counts in Each Intertidal Count Sector Each Month During 2007/08 and 2008/09													
CS1	2007/08	5	2	0	0	5	2	3	13	7	14	10	6
CS1	2008/09	0	2	4	2	2	3	2	2	8	1	6	13
CS2	2007/08	5	2	0	0	16	21	24	13	12	5	6	7
CS2	2008/09	1	0	3	7	17	17	1	1	21	1	0	14
CS3	2007/08	2	2	0	3	25	4	21	2	2	8	3	3
CS3	2008/09	0	0	0	11	2	5	16	2	1	2	1	2
CS4	2007/08	3	15	5	4	21	29	7	28	21	3	20	4
CS4	2008/09	9	3	2	20	7	13	15	8	4	8	2	2
CS5	2007/08	15	5	11	13	21	7	10	11	7	12	18	16
CS5	2008/09	10	2	6	15	6	14	4	1	34	13	63	31
Fields	2007/08	No count	No count	No count	No count	No count	0	0	10	21	10	14	3

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Fields	2008/09	0	0	0	0	0	2	3	12	19	20	14	8

NB: Field surveys were not undertaken in April to August 2007 inclusive and only single visits were made in September and October 2007. Therefore, the absence of curlew in fields during these months does not necessarily indicate that little egret do not use this area at this time of year (although this can be inferred from the data for 2008/09).

Foraging, roosting and loafing curlew were consistently recorded during the 2007/08 and 2008/09 survey periods. Numbers using the intertidal habitat were higher between July and the following March inclusive (covering the entire autumn passage and winter periods) and at their lowest during April, May and June (the spring passage period).

During the 2008/09 intertidal surveys, one count (of 63 birds foraging in Count Sector 5) exceeded 1% of the SPA Review population during the winter period, and none during the 2007/08 surveys. During the passage period, no counts in 2008/09 exceeded 1% of the (potential) Ramsar site population, although in 2007/08, numbers of importance to the (potential) Ramsar site, were recorded on seven occasions (of which five were of roosting birds). These counts were all during August, September and October, with two counts each in Count Sectors 2, 3 and 4 and one in Count Sector 5. Groups of 20-29 roosting birds were noted on seven occasions within two hours of high tide in Count Sector 4, both during the passage and winter periods in 2007/08. In 2008/09, numbers were smaller, although 10-20 curlew were recorded roosting in Count Sector 4 on five occasions.

Curlew (usually 1-10 birds) were seen foraging in fields around Hinkley during the field surveys undertaken in 2007/08 and 2008/09, predominantly between November and February, with none seen during April to August inclusive[59]. The most favoured area for feeding curlew were the fields within or adjacent to the western end of the SSA. None of the total (summed) counts in all fields within the survey area, on any one date, exceeded 1% of either the SPA or Ramsar populations during the winter and passage periods respectively.

Curlews were recorded regularly in intertidal habitat adjacent to the SSA and built nuclear plant during surveys undertaken for the proposed West Hinkley Wind Farm in 2003-06. Numbers that exceeded 1% of the SPA Review population were recorded during six of seven survey visits conducted in March 2006 although no details were provided as to where these birds were recorded within the survey area. Numbers that exceeded 1% of the Ramsar site population were recorded on one occasion during the wind farm surveys during the passage period, in October 2004. Curlew were occasionally recorded in fields close to the shoreline during 2003-06, although the report stated that there was no evidence of regular use of fields to the west of the nuclear facility (Dulas, 2006). WeBS Core Count data indicate that much larger numbers of curlew occur to the east of the survey area on the Stert Flats (of which Count Sector 5 forms a small part), with counts in excess of 1,000 birds recorded during the passage and winter periods. WeBS Low Tide counts for 2008/09 recorded peak counts of 98 birds in Count Sector 5 and a total of 28 birds in Count Sectors 1-4 during the winter. Somerset Ornithological Society records for the passage and winter periods respectively, from Hinkley Point (which is likely to include part or all of Count Sectors 4 and 5), include peak counts of 80 birds in September 2001 and 30 birds in March 1997. These records include several counts of curlew at Hinkley Point that are in excess of 1% of the Ramsar population during the passage period but none of importance to the SPA Review population during winter.

Evidence from the surveys and desk study indicate that intertidal habitat within the survey area is used by numbers of foraging curlew that are of importance in terms of the Severn Estuary SPA Review population on a sporadic basis during the winter period (numbers in excess of 1% of the SPA population were not recorded in 2007/08 and on one occasion during 2008/09). In

[59] Field surveys were not undertaken in April to August 2007 inclusive and only single visits were made in September and October 2007. Therefore, the absence of curlew in fields during these months does not necessarily indicate that they did not use this area during these months (although the likelihood can be inferred from the data for 2008/9).

view of this, the intertidal habitat in Count Sectors 1-5 is likely to be of low importance to the SPA population of curlew during the winter period (November to March inclusive).

Numbers of foraging or roosting curlew that are of importance in terms of the Ramsar site population are likely to occur on intertidal habitat within Count Sectors 2-5 inclusive on a regular basis during the passage period in some years (i.e. none in 2008 and on seven occasions during 2007 of which five records were of roosting birds). In view of this, it is concluded that the intertidal habitat within Count Sectors 2-5 provide an important foraging resource and roosting area for the Severn Estuary Ramsar population of curlew during the passage period (April to October inclusive) and particularly during autumn passage (August, September and October).

Redshank [SPA and Ramsar Site Qualifying Species]

Redshank is described in Ballance (2006) as an uncommon breeder, fairly common winter visitor and passage migrant in Somerset. The two main sites in the county for redshank are the Parrett and Axe Estuaries (Ballance, 2006). Average monthly counts on the Parrett Estuary during 2000 to 2003 for August to March inclusive range between 340 birds (February) and 897 birds (September) (Ballance, 2006). Redshank is a winter qualifying feature of the Severn Estuary SPA, which is listed as supporting 2,330 birds and of the Severn Estuary Ramsar site (2616 birds).

Redshank (mostly 1-2 birds) were recorded using intertidal habitat within the survey area at Hinkley on 12 and seven occasions respectively during 2007/08 and 2008/09, predominantly during the autumn and winter (September to March inclusive). The only count of note was of 22 birds foraging in Count Sector 5 in December 2008 and no counts exceeded 1% of the SPA population. Results from the field surveys provide no evidence of redshank using the network of ditches and pasture to the south of the built plant within the survey area on a regular basis (recorded on one and two occasions respectively during 2007/08 and 2008/09).

Very few redshank were recorded within the survey area during work undertaken for the proposed West Hinkley Wind Farm between 2003 and 2006. Records from the Somerset Ornithological Society also indicate that intertidal habitat around Hinkley Point is not used by large numbers of redshank. WeBS data, however, indicates that much larger numbers of redshank occur on the Stert Flats to the east of the survey area with 400-1,000 frequently recorded.

The evidence suggests that use of the intertidal habitat and fields within the survey area by redshank is very low and of negligible importance to the SPA/Ramsar site populations during the winter.

Other Cited/designated Species

Of the remaining species that appear as cited/designated features (including waterfowl assemblage species) of statutory sites within 5km of the SSA during passage and winter, Bewick’s swan, white-fronted goose tufted duck and pochard were not recorded during the surveys undertaken at Hinkley during 2007/08 or 2008/09. Results from the desk study provided no evidence to suggest that any of these species use the survey area on a regular basis during the passage and winter periods. In view of this low level of use, the survey area is likely to be of less than local importance to these species during the autumn and winter.

4.4 Non-Cited/Designated Species

4.4.1 Wildfowl and Other Water Birds

A further ten species of waterfowl and other water birds that do not appear as cited/designated features of statutory sites within 5km of the SSA were recorded during the surveys undertaken at Hinkley during 2008/09. Of these, mute swan, brent goose, scaup, ruddy duck, shag, grey heron and water rail were either recorded irregularly or in relatively small numbers in 2008/09. Ruddy duck, brent goose, water rail and scaup were not recorded in 2007/08, and mute swan, shag and grey heron irregularly or in very small numbers. Results from the desk study (including WeBS data and Somerset Ornithological Society records) also provide no evidence to suggest that the survey area was being used by important numbers of these species. In view of this and the low level of use of the site by these species in 2007/08 and 2008/09, the intertidal habitat and fields within the survey area are likely to be of no more than local importance to these species.

Common scoter was regularly recorded in flocks of up to 25 birds on the sea during 2007/08, but few were seen in 2008/09 (1-8 birds on six occasions). At no time during either the 2007/08 or 2008/09 surveys did the numbers of common scoter represent an important proportion (i.e. more than 1%) of the internationally important Carmarthen Bay population (mean peak count of 17,656 birds from 2004/05 to 2008/09, Calbrade *et al*., 2010), which is located approximately 100km to the northwest of Hinkley. In view of this, it is likely that the inshore waters at Hinkley provide no more than a locally important feeding resource to common scoter, in some winters. Of the remaining species, the importance of the survey area to cormorant and little egret, which was recorded regularly during the surveys, is discussed in more detail below:

Cormorant

Cormorant is described in Ballance (2006) as a fairly common winter visitor, passage-migrant and non-breeding summer visitor in Somerset. The peak counts of cormorant in Somerset in 2005 and 2006 were 235 (January) and 287 (October) respectively. Counts on the Parrett Estuary in the same years peaked at 24 (January) and 35 (September) birds respectively (Gibbs [Ed] 2006, 2007). Results from the intertidal surveys undertaken at Hinkley during 2007/08 and 2008/09 indicate that cormorant (usually 1-5 birds) use the intertidal habitat within the survey area for loafing and to a less extent foraging. Although it is recognised that many cormorants using inland open freshwater bodies and inland waterways are unlikely to be accounted for in these figures, it is likely that the numbers of cormorant using the survey area are of county importance.

Little Egret

Numbers of little egret occurring in the UK have increased substantially since 1990, when the species was on the British Birds Rarities Committee list[60], although in recent years the expansion in terms of both range and numbers may have started to slow (Collier *et al*, 2005, Calbrade *et al*., 2010). BTO monthly indices illustrate a strong post-breeding peak in September, and a low point from April to July when birds probably either return to French breeding colonies or (increasingly) become more secretive around British ones. Whilst there is

[60] The authenticity of all records required consideration by a panel of experts following the submission of a written description.

still no official 1% national threshold value for this species, Calbrade *et al*. (2010) indicates that sites with mean counts of at least 50 individuals might be nationally important.

Nationally important numbers of little egret feature as noteworth fauna in the Severn Estuary Ramsar site description (17 birds), although the peak counts for the Severn Estuary during 2007/08 and 2008/09 (based on the WeBS recorded year of July to the following June) were 105 and 103 birds respectively (Calbrade *et al*., 2010). This indicates that the national population increase in little egret has been mirrored in the Severn Estuary and Somerset populations. Roost counts of 40-60 birds have been recorded from at least two Somerset locations, and the species is now widespread throughout lowland areas of the county. It follows that the WeBS may not, therefore, provide accurate data on overall numbers or the rate of population increase in Somerset, and the Severn Ramsar Information Sheet is clearly out of date (the figure is derived from the 5 year mean peak count for 1998/99 to 2002/03 inclusive). A total of 123 birds were counted from nine sites in Somerset in July 2007 (Gibbs [Ed], 2008) indicating that the present county population is likely to be well in excess of 100 birds during the late Summer and early Autumn.

More locally, peak counts from the Stert Flats include at least 48 birds in October 2006 (Somerset Ornithological Society records) and 42 birds in September 2005 (WeBS Core Count data). WeBS data for 2002-06 indicate that little egret numbers are at their highest on the Stert Flats in September and October. **Table 4.7** shows the maximum counts of little egret on the Parrett Estuary in each month between April 2008 and March 2009 inclusive (Gibbs [Ed], 2010, 2011) and the peak counts (excluding commuting birds) recorded in the five intertidal count sectors between April 2007 and March 2008 inclusive. The peak count each month during the field surveys are also shown (derived from summing the counts in each field on any one date).

Table 4.7 Peak Counts of Little Egret by Month in the Parrett Estuary and the Entec Survey Area

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Peak Counts on the Parrett Estuary (including the Huntspill River)													
2008/09		12	28	31	27	26	26	32	8	3	15	3	8
Peak Counts in each Intertidal Count Sector Each Month during 2007/08 and 2008/09													
CS1	2007/08	1	1	2	1	2	2	2	1	1	1	2	1
CS1	2008/09	1	1	2	1	1	1	5	1	0	1	0	0
CS2	2007/08	1	1	1	2	2	1	2	1	1	0	1	1
CS2	2008/09	1	2	2	2	2	2	2	1	1	0	0	1
CS3	2007/08	1	2	2	3	3	2	3	1	2	1	1	1
CS3	2008/09	1	1	1	1	2	1	2	2	0	1	1	0
CS4	2007/08	2	4	3	3	4	3	4	2	2	2	1	2
CS4	2008/09	1	1	2	1	2	4	2	1	1	1	1	0
CS5	2007/08	3	5	2	5	5	4	3	2	1	1	2	1
CS5	2008/09	2	1	1	2	2	2	5	2	0	2	1	1
Fields	2007/08	No count	No count	No count	No count	No count	0	0	2	2	3	1	1
Fields	2008/09	1	3	1	0	1	2	8	0	5	1	2	1

NB: field surveys were not undertaken in April to August 2007 inclusive and only single visits were made in September and October 2007. Therefore, the absence of little egret in fields during these months does not necessarily indicate that little egret do not use this area at this time of year.

Against this background of sustained increase, it is difficult to assess the value of the survey area to little egret. Foraging and loafing birds were seen on a regular basis at low water throughout much of 2007/08 and 2008/09 in all count sectors, with 1-2 birds generally present in each count sector in 2008/09, with slightly larger numbers in Count Sectors 3, 4 and 5 in 2007/08 (1-3 birds in Count Sector 3, 1-4 birds in Count Sector 4 and up to five birds in Count Sector 5).

One to three birds were regularly counted in ditches surrounding fields to the south of the built plant within the survey area with occasionally larger numbers present (two counts of five birds and one count of eight birds in 2008/09). There is some evidence in 2008/09 to suggest that little egret were moving between fields and ditches south of the built plant and intertidal habitat to the north, with birds observed flying north from the fields around Wick Moor. Birds were also seen flying east and west along the shoreline through the intertidal survey area.

Currently the best available data suggests that numbers in each of the count sectors are still likely to exceed 1% of the current population for the Severn Estuary Ramsar site on a regular basis. In 2008/09, counts of three or more birds were recorded on eight occasions during the passage period (August to November inclusive), with too few records to indicate any preference for a particular count sector. In 2007/08, three or more birds were recorded on 24 occasions during the passage period of which all but six records related to foraging birds in Count Sectors 4 and 5.

However, in view of the relatively low level of use in Count Sectors 1-3 (generally 1-2 birds), this suggests that if the county and Severn Estuary populations continues to rise and a constant level of use within the survey area is assumed, these sectors will become of no more than local importance to little egret in the short to medium term.

To summarise, numbers of foraging and loafing little egret that exceed 1% of the published Severn Estuary Ramsar site population occur in Count Sectors 4 and 5, and are likely to occur in fields immediately south of the Power Stations on a regular basis during the passage period (August to November inclusive). These areas are therefore likely to provide a locally important foraging resource to the Severn Ramsar population.

4.4.2 Waders

In addition to those species of wader that have already received detailed assessment in this report, a further seven species were recorded during the intertidal and field surveys undertaken at Hinkley between April 2008 and March 2009 inclusive. Of these, common sandpiper and knot were recorded irregularly during 2007/08 and 2008/09 and in view of this transient use of the survey area, the area is considered to represent a less than locally important foraging resource to them. Of the remaining species, oystercatcher, golden plover, purple sandpiper, snipe and turnstone were recorded on a more regular basis. The value of the survey area to these species is discussed below. Table 4.8 shows the peak counts for these species for the Parrett Estuary and sites counted in Somerset during 2008 and 2009 (Gibbs [Ed], 2010, 2011), and the peak counts recorded during the intertidal and field surveys during 2007/08 and 2008/09 (excluding counts of commuting birds).

Table 4.8 Peak Counts of Waders in Somerset, the Parrett Estuary and Survey Area

Species	Somerset[61]		Parrett Estuary[62]		Intertidal Count Sectors, Peak Counts during 2008/09 and 2007/08 (in parenthesis)				
	2008	2009	2008	2009	CS1	CS2	CS3	CS4	CS5
Oystercatcher	511	514	328	289	20 (89)	100 (57)	79 (95)	60 (55)	13 (26)
Golden plover	22,233	20,370	3,480	2,300	37 (27) - daytime (daytime) field surveys				
Purple sandpiper	19	13	16	13	0 (2)	7 (0)	9 (15)	0 (1)	0 (0)
Turnstone	349	499	243	358	21 (20)	13 (9)	5 (8)	3 (8)	13 (1)
Snipe	2,145	1,582	n/a	n/a	20 (19) - daytime (nocturnal) field surveys				

NB: peak counts for oystercatcher, purple sandpiper and turnstone are taken from the intertidal surveys and those for golden plover and snipe are the peak count in any one field during the field surveys.

Oystercatcher

Oystercatcher is described in Ballance (2006) as a fairly common winter visitor, passage-migrant and non-breeding summer visitor in Somerset. It is the only wader species that can regularly be found along the entire Somerset coast (Ballance, 2006) and therefore WeBS and Somerset Ornithological Society data, which are concentrated at key estuarine sites are likely to under-represent the true size of the wintering population in Somerset. However, Ballance (2006) stated that oystercatchers mainly occur at three key sites in the county: the Axe and Parrett Estuaries and Dunster Beach.

Foraging and roosting oystercatchers were found in all count sectors throughout much of the year during the intertidal surveys undertaken at Hinkley in 2007/08 and 2008/09, with numbers at their lowest in May and June and relatively constant through the remainder of the year. Up to 20 oystercatchers were recorded on a regular basis foraging on intertidal habitat in all count sectors and groups of 10-50 roosting birds were seen in all but Count Sector 5 and most regularly in Count Sectors 3 and 4 in 2008/09. Similar levels of use of the site were recorded in 2007/08.

WeBS data for oystercatcher and results from surveys undertaken for the proposed West Hinkley Wind Farm during 2003-06 are consistent with those obtained from the intertidal surveys during 2007/08 and 2008/09. On the basis of the county totals presented in Table 4.8, the numbers of foraging and roosting oystercatcher using the survey area are likely to be of county importance on a regular basis during the autumn and winter. The intertidal habitat within the survey area is likely to provide an important foraging resource and roosting sites for oystercatcher within the county. The results of the surveys and desk study also indicate that the

[61] Figures for Somerset are the peak monthly count from the main sites counted (i.e. the sum of counts from the main sites counted that month).

[62] Includes Stert Point/Flats, Stert to Knighton beach.

fields within the survey area are used very irregularly, and are likely to be of less than local importance to oystercatcher throughout the year.

Golden Plover

Golden plover is described in Ballance (2006) as a common winter visitor and passage migrant in Somerset. The main sites for this species during winter and autumn are Exmoor and the Somerset Levels (Ballance, 2006). The numbers of wintering golden plover in Somerset vary considerably between years. Large influxes of golden plover to Somerset occur when there is hard weather to the east and/or north and, conversely, birds leave the county during freezing conditions. The first passage golden plover arrive in August, with larger numbers of wintering birds appearing from late September through to November and peak numbers generally occurring during January and February. The Somerset Levels and Severn Estuary currently hold internationally and nationally important numbers of golden plover during the winter respectively (5 year peak mean counts during 2004/05 - 2008/09 of 11,219 and 4,745 birds respectively, Calbrade *et al*., 2010). However, large numbers of golden plover winter on arable farmland on sites that are not included in WeBS counts and therefore WeBS data are likely to under-represent the true county total. Even allowing for considerable annual variation in numbers, the county population is likely to be well in excess of 10,000 birds in most winters.

Golden plover were recorded during the field surveys undertaken at Hinkley during 2007/08 and 2008/09, primarily in the period December to March inclusive. The most favoured areas in 2008/09 were outside the SSA, in fields immediately to the west and south of it. Numbers varied considerably between visit dates, with the largest total number of golden plover in all fields on any single date 127 birds (all outside the SSA) on 7 February 2009. Within the SSA, golden plover were recorded on one date during 2008/09 (a total of seven birds on 10 January). In 2007/08, the vast majority of records of golden plover were from fields within, or adjacent to the planning application, with the largest total count in all fields within the SSA being eight birds on 18 February 2008.

During surveys undertaken for the proposed West Hinkley Wind Farm, counts of 189 and 332 golden plover were recorded in the winter bird study area in February 2005 and March 2006 respectively, the latter count coinciding with cold weather in eastern Britain. These numbers (and the peak count of 127 birds from the Entec surveys) are likely to be of county importance although overall, golden plover were recorded on few occasions during the entire West Hinkley Wind Farm survey period (2003-06) and therefore it is likely that these numbers are unusual if not exceptional.

The evidence from the desk study and surveys suggest that numbers of golden plover using the survey area during the winter are unlikely to be of county importance on a regular basis (and reach this threshold on isolated occasions). In general, the arable fields within the survey area are limited in size (providing a limited foraging and roost site resource) and would therefore not be expected to support large flocks of plovers on a regular basis during winter. Much more extensive areas of more suitable foraging habitat exist outside the survey area within the county, particularly on the Somerset Levels. In view of this, the survey area is likely to be of no more than local importance to golden plover.

Purple Sandpiper

Purple Sandpiper is described in Ballance (2006) as a scarce and very local winter visitor and rare passage migrant in Somerset. There is no regular autumn passage of purple sandpiper in Somerset and wintering birds usually do not arrive until November (Ballance, 2006). Numbers of purple sandpiper peak in December and January, after which there is a decline, with a few lingering into April or even May. The main wintering site for the species in Somerset is now along the rocky beach from Hinkley Point west to Watchet, with up to eight birds present in most years (Ballance, 2006). In 2008 and 2009, Hinkley Point held nearly all of the county population with peak counts during the winter of 16 and 13 birds respectively (Gibbs [Ed], 2010, 2011)..

During the intertidal surveys undertaken at Hinkley, counts of 2-5 (and occasionally up to nine) purple sandpiper were regularly recorded loafing on the intake tower in Count Sector 3 during April and May 2008 and between November 2008 and March 2009. Similar numbers were recorded between November 2007 and March 2008.

These birds are likely to represent a substantial proportion of the county total. Results from the desk study indicate that the numbers recorded during winters 2007/08 and 2008/09 might be exceptional. This species was recorded on one occasion during the West Hinkley Wind Farm surveys undertaken during 2003-06 involving one record of 25 birds in 2003. Somerset Ornithological Society records indicate that although purple sandpipers were recorded regularly along the Hinkley coast during 1999-2006, no more than two birds were recorded at any one time. More recent counts, in 2008 and 2009, indicate that larger numbers do occur in the Hinkley to Watchet area (Gibbs [Ed], 2010, 2011). Purple sandpipers were not recorded during the WeBS counts at Hinkley.

However, purple sandpipers are relatively unobtrusive in rocky habitat and these habitats support few species and are therefore likely to be under-watched, leading to this species being under-recorded. This leads to the view that the numbers of purple sandpiper found in Somerset are likely to be larger than baseline data suggests. It follows that the numbers recorded at Hinkley during the intensive programme of Entec surveys undertaken in 2007/08 and 2008/09 may be typical of the area in most years. Notwithstanding this, the county population is unlikely to be in excess of 500 birds and the conclusion is that the survey area is of county importance to purple sandpiper during the winter.

Snipe

Snipe is described in Ballance (2006) as a common winter visitor and passage migrant and an uncommon resident or migrant breeder in Somerset. WeBS and Somerset Ornithological Society data, which are concentrated at key wetland sites, are likely to under-represent the true size of the wintering population of snipe in Somerset. Large numbers of snipe winter on the Somerset Levels and this species is likely to be widespread in small numbers across much of the county, wherever flooded fields, wet meadows and ditches occur. The peak count for Somerset in 2009 was 2,145 birds in January (Gibbs [Ed], 2011), and this total is likely to represent a relatively small proportion of the actual county total. The peak count of 20 birds recorded during the field surveys in 2008/09 (and 19 birds in 2007/08) are likely to represent a small proportion (less than 1%) of the county total during winter. The most favoured areas were the damp fields and ditches to the south of the built plant, around Wick Moor. This area is likely to provide a limited foraging recourse and roosting site for snipe, with much more extensive areas of suitable habitat to be found in the Somerset Levels. In view of this, the survey area is likely to be of no more than local importance to snipe during the autumn and winter.

Turnstone

Turnstone is described in Ballance (2006) as a locally common winter visitor and passage-migrant in Somerset. Turnstones occur along much of the Somerset coastline and therefore

WeBS and Somerset Ornithological Society data, which are concentrated at key estuarine sites are likely to under-represent the true size of the wintering population in the county. The main wintering and passage areas for turnstone in Somerset are on the Parrett Estuary and Dunster Beach (Ballance, 2006). Turnstones are recorded regularly in Somerset throughout the year, although peak numbers generally occur in August, September and October.

Foraging, loafing and roosting turnstone were recorded on a regular basis during the winter, spring and autumn passage periods during the intertidal surveys undertaken at Hinkley in 2007/08 and 2008/09. Even allowing for birds not included in the county totals presented in Table 4.8, (i.e. those that occur along rocky stretches of the coastline away from the main sites), the intertidal habitat within the survey area is likely to support numbers of turnstone that regularly exceed 1% of the county total during the winter and passage periods. Within the survey area, the rocky intertidal habitat to the west of Hinkley Point covered by Count Sectors 1-4 is likely to provide an important foraging and roost site resource to the county population.

4.4.3 Gulls, Terns and Skuas

Ten species of gulls and terns were recorded during the surveys undertaken at Hinkley between April 2008 and March 2009. None of these species appear as cited/designated interest for statutory sites within 5km of the SSA during the winter and passage periods. Nationally important breeding numbers of herring gull (1,540 pairs) appear as noteworthy fauna in the description for the Severn Estuary Ramsar site, and internationally important breeding numbers of lesser black-backed gull appear as a possible future inclusion for the designation of the Severn Estuary Ramsar site. Of the species recorded during the surveys, Mediterranean gull, kittiwake and Sandwich tern were seen irregularly in very small numbers (two, one and one occasions respectively). In view of their transient use of the site, the survey area is likely to be of less than local importance to them.

Arctic tern and common tern were recorded in potentially notable numbers (in terms of county or regional populations) during the intertidal surveys undertaken at Hinkley in 2007/08. However, in 2008/09, Arctic tern was seen on one occasion (involving 5 birds off Count Sector 4 in August 2008), and 2-10 common terns were observed foraging in Count Sectors 2, 3 and 4 on three dates (two in May and one in September 2008). Both species are considered by Ballance (2006) to be fairly common passage migrants in Somerset. In most years, low numbers pass along the Somerset coast, with larger numbers blown inshore during strong westerly winds. The numbers recorded in 2007 at Hinkley were considered to be of county importance, with the outfall off Count Sector 3 providing a locally important foraging resource to these species. However, in light of the low numbers and irregular occurrence of both species at Hinkley in 2008, it is clear that use of the area is sporadic and prone to substantial fluctuation between years. As birds recorded cannot be ecologically linked to local populations, it is not possible to ascribe a geographical context in terms of valuation of the resource. All that can be concluded is that the resource appears of no more than local importance.

Of the remaining species, five species of gull (black-headed, herring, lesser black-backed, great black-backed and common) were recorded in potentially notable numbers on a regular basis during the intertidal surveys. The value of the survey area to these species is discussed below.

Common gull and great black-headed gull were recorded in relatively small numbers at Hinkley in 2007/08 and 2008/09.

- Most records of common gull were of 1-2 foraging or loafing birds, recorded on 13 of 50 dates between April 2008 and March 2009 inclusive. Common gulls were not recorded in the survey area between April and August;

- Great black-backed gulls were seen consistently throughout much of the year during the survey periods (2007/08 and 2008/09), with most records involving 1-2 loafing or foraging birds on intertidal habitat or the sea.

Numbers and population trends in gulls outside the breeding season are very difficult to reliably estimate for Somerset. There are a number of reasons for this; noting gull numbers during WeBS counts is optional; juvenile and immature gulls provide difficulties in identification for many observers, hence records are not submitted to bird clubs or conservation bodies and; areas which attract large numbers of gulls, such as landfill sites, pasture and newly ploughed fields are not necessarily attractive to recreational birdwatchers. Table 4.9 gives an idea of monthly fluctuations in gull numbers at regularly counted Somerset sites, as well as peak counts for each count sector during the survey period.

Table 4.9 Thresholds of Importance and Counts of Gulls in Somerset

Species	International Threshold of Importance (individuals) Calbrade *et al*. 2010	National Threshold of Importance (individuals) Calbrade *et al*. 2010	Sum of Monthly Maxima at Regularly Counted Somerset Sites in 2006 (Gibbs [Ed], 2007)[63] and 2007 (Gibbs [Ed], 2008)[64]									Peak Intertidal Sector Counts of Gulls in 2008/09 and (2007/08)[65]				
			Year	Jan	Feb	Mar	Aug	Sep	Oct	Nov	Dec	CS1	CS2	CS3	CS4	CS5
BH Gull	20,000	19,000	2007	6,370	4,130	902	717	5,161	1,810	3,225	8,300	100	32	100	120	105
			2006	12209	3789	2678	425	2496	3025	6030	6636	(70)	(16)	(100)	(106)	(1,000)
Common gull*	20,000	9,000	2007	2,818	541	8	2	9	4	11	1,151	13	1	4	2	2
			2006	2633	331	328	51	52	563	822	1291	(16)	(4)	(2)	(4)	(1)
LBB gull	5,500	500	2007	850	355	768	2,150	7,058	7,480	4,002	206	4	17	17	35	4
			2006	388	4094	528	1819	4092	5128	2566	1535	(15)	(14)	(50)	(30)	(10)
Herring gull	5,900	4,500	2007	1,955	1,181	864	1,291	720	426	660	2,216	120	121	276	174	111

[63] In 2007, data was presented for black-headed gull and common gull for 5 sites, lesser black-backed gull for 7 sites, herring gull for 8 sites and great black-backed gull for 4 sites.

[64] In 2006, data was presented for black-headed gull for 8 sites, common gull for 5 sites, lesser black-backed gull for 7 sites, herring gull for 8 sites and great black-backed gull for 5 sites.

[65] The periods covered by the intertidal surveys are April 2007 to March 2008 inclusive (2007/08) and April 2008 to March 2009 inclusive (2008/09).

Species	International Threshold of Importance (individuals) Calbrade *et al*. 2010	National Threshold of Importance (individuals) Calbrade *et al*. 2010	Sum of Monthly Maxima at Regularly Counted Somerset Sites in 2006 (Gibbs [Ed], 2007)[63] and 2007 (Gibbs [Ed], 2008)[64]									Peak Intertidal Sector Counts of Gulls in 2008/09 and (2007/08)[65]				
			Year	Jan	Feb	Mar	Aug	Sep	Oct	Nov	Dec	CS1	CS2	CS3	CS4	CS5
			2006	7015	460	530	294	321	221	440	1084	(170)	(187)	(350)	(280)	(150)
GBB gull*	4,400	400	2007	12	19	8	2	38	22	3	6	4	2	3	2	3
			2006	8	9	9	8	7	14	4	13	(3)	(2)	(12)	(2)	(2)

* Great black-backed gulls and common gulls are likely to be very widely distributed in small numbers along much of the Somerset coastline during autumn and winter and therefore under-represented in the figures given for the county in Table 4.9. The counts provided in Table 4.9 are therefore likely to represent a small proportion of the actual county total.

As is apparent from the data, none of the peak sector counts of any of the five regularly recorded gull species approaches the threshold of national importance. It is also apparent that the sum of peak monthly maxima at regularly counted sites (from Gibbs [Ed], 2007, 2006) can fluctuate considerably between years for individual species, and many areas that are attractive to gulls will be irregularly or never counted. These counts are therefore possibly most useful in illustrating relative gull abundance within the county over the survey period rather than as indicative county population estimates.

The intertidal habitat within the survey area, and in particular, the outfall and built nuclear plant, are likely to provide a locally important resource for foraging and loafing common and great black-backed gulls throughout much of the year. Much larger expanses of suitable foraging habitat are located inland, and in the Parrett Estuary to the east of the survey area, and therefore, it is unlikely that numbers of great black-backed gull or common gull using the survey area are of county importance.

Black-headed Gull

Black-headed gull is described by Ballance (2006) as an abundant winter visitor and passage migrant in Somerset. Black-headed gulls do not breed regularly in Somerset but are present in the county throughout the year. Black-headed gulls arrive in large numbers in the county from July onwards, with the bulk of the population departing in late February and March. Data on the size of the population in the county is patchy and likely to be very incomplete but counts have included 25,000 birds on Cheddar Reservoir in January 1984 and 40,000 birds on the Parrett Estuary in October 1989. On the basis of the readily available information it is not possible to accurately estimate the number of black-headed gulls that occur in the county. However, in view of the large counts mentioned above and the data presented in Table 4.9, the county population is likely to be well in excess of 50,000 birds during the autumn and winter in most years. In common with other gull species in the county, the pattern of use of roosting sites has varied with the changing location of landfill sites and decrease in winter flooding inland (Ballance, 2006).

Overall, results from the surveys undertaken at Hinkley during 2007/08 and 2008/09 indicate that the intertidal area is used by black-headed gulls on a regular basis, with birds foraging and loafing on intertidal habitat and inshore waters in all count sectors. Numbers were similar during the two survey periods (2007/08 and 2008/09) and although recorded throughout the year, lower counts were generally made between April and June. Counts in excess of 100 birds were rarely recorded. In relation to the county total, the peak count of 1,000 birds recorded in Count Sector 5 during the 2007/08 intertidal surveys was exceptional and may be of county importance. Somerset Ornithological Society records, WeBS data and results from the surveys undertaken during 2003-06 for the proposed West Hinkley Wind Farm also support this conclusion.

Groups of foraging and loafing black-headed gulls were also frequently recorded in fields to the west and south of the built plant during the field surveys undertaken at Hinkley in 2007/08 and 2008/09. Counts of 50-100 birds were recorded in fields on four occasions in 2008/09, all in autumn and winter. Results from the intertidal, daytime or nocturnal field surveys, provide no evidence to indicate that large numbers of black-headed gulls (in excess of 50 birds) were roosting on a regular basis on the intertidal habitat, built plant or surrounding fields. In view of the evidence provided by the surveys and desk study, the survey area is (generally) likely to be of no more than local importance to black-headed gull.

Lesser Black-Backed Gull

Internationally important numbers of breeding lesser black-backed gulls (4,617 pairs, Seabird 2000 Census) are listed for possible future consideration for addition to the cited/designated interest of the Severn Estuary Ramsar site. No counts in excess of 1% of this figure were recorded during the intertidal surveys undertaken at Hinkley during the breeding season (April to July inclusive) in 2007 and 2008. Counts of ten or more birds were recorded on seven occasions between April 2008 and March 2009 inclusive. Few foraging or roosting lesser black-backed gulls were seen, and most records related to individuals or small groups of birds loafing on the sea and intertidal habitat. In view of the low level of use by lesser black-backed gull, the intertidal habitat at Hinkley is unlikely to be of importance to the potential Ramsar site population and is of no more than local importance to this species throughout the year.

Herring Gull

Herring gull is described in Ballance (2006) as a fairly common resident breeder, winter visitor and passage migrant in Somerset. Nationally important breeding numbers (1,540 pairs, Seabird 2000 Census) of herring gull appear as cited/designated interest of the Severn Estuary Ramsar site. Large numbers of herring gulls were recorded on a frequent basis in the intertidal survey area during the 2008 breeding season period (April to July inclusive), with counts of 30 or more loafing and foraging birds noted on 11 occasions (43 in 2007).

Results from the intertidal surveys undertaken at Hinkley between April and July 2008 inclusive, indicate that Count Sector 3 was again the most favoured area for herring gulls, with counts of 30 or more (usually loafing) birds recorded on eight occasions (27 occasions in 2007). Large counts of herring gull were more infrequent in the other count sectors. The built plant at Hinkley and the intertidal habitat and inshore waters in Count Sector 3 are therefore considered to provide an important resource to nesting, foraging and loafing herring gulls during the breeding season, many of which are likely to originate from the Ramsar site population.

Data on the size of the population outside the breeding season in the county is patchy and likely to be very incomplete but recent counts include 6,000 birds on Wimbleball Lake in January 2006 and 3,000 birds on the Parrett Estuary in March 2005. In view of this, the county population is likely to peak at well in excess of 10,000 birds during most winters.

Overall, results from the surveys undertaken at Hinkley during 2007/08 and 2008/09 indicate that the intertidal area is used by relatively large numbers of herring gulls on a regular basis, with birds foraging and loafing on intertidal habitat and inshore waters in all count sectors. Counts of 100 or more birds were recorded on 39 and 20 occasions in 2007/08 and 2008/09 respectively, with a large proportion being of loafing birds in Count Sector 3. The largest numbers were consistently recorded in and around the built nuclear plant in Count Sector 3, with counts above 100 birds recorded infrequently outside this area. The maximum count of 350 birds recorded in Count Sector 3 in March 2008 may exceed 1% of the county total. Somerset Ornithological Society records and results from the surveys undertaken during 2003-06 for the proposed West Hinkley Wind Farm also indicate that numbers of herring gull of county importance may occasionally occur in the survey area, although are unlikely to do so on a regular basis.

Groups of foraging and loafing herring gulls were also recorded frequently in fields to the west and south of the built plant during the daytime field surveys undertaken at Hinkley in 2007/08 and 2008/09. Numbers of 100 or more birds were recorded on five occasions in fields during 2008/09, all in autumn and winter. Results from the intertidal, daytime or nocturnal field surveys, provided no evidence to indicate that large numbers of herring gull (in excess of 100 birds) were roosting on a regular basis on the intertidal habitat, built plant or surrounding fields.

To summarise, evidence from the surveys and desk study indicate that the built nuclear plant and adjacent rock platforms may occasionally hold county important numbers of herring gull outside the breeding season. Outside of this area, the intertidal habitat and adjacent fields within the survey area are likely to be of no more than local importance to this species.

4.4.4 Birds of Prey

A total of seven species of bird of prey were recorded in the survey area between April 2008 and March 2009. Results from the surveys and desk study indicate regular use of the survey area by hunting and commuting kestrel, sparrowhawk, buzzard and peregrine and occasional or low level use by merlin, red kite, marsh harrier and barn owl.

Kestrel, buzzard and sparrowhawk are common species in Somerset (Ballance, 2006) and although use of the site by these species was regular, given the habitat present and the relatively small size of the survey area in relation to the county as a whole, it is likely to provide a foraging resource that is of no more than local value to them. For red kite, merlin, marsh harrier and barn owl, the level of use of the survey area during the two survey periods (2007/08 and 2008/09) was low, with red kite was not recorded in 2008/09, and marsh harrier not recorded in 2007/08. In view of this, the survey area is likely to be of less than local importance as a foraging resource for these species.

Peregrine

One or two peregrines were recorded hunting or loafing in the survey area on 16 occasions (throughout much of the year) during the field surveys undertaken at Hinkley between April 2008 and March 2009. In 2007/08, 1-3 peregrines were recorded regularly during the field and intertidal surveys. Results from surveys undertaken for the proposed West Hinkley Wind Farm during 2003-06 also indicate that peregrines occur on a regular basis within the survey area during autumn and winter. This species is described in Ballance (2006) as an uncommon resident breeder and fairly common winter visitor and passage migrant. A total of 26 pairs were present in Somerset during the breeding season in 2002 (Ballance, 2006) although it is not known whether the birds recorded at Hinkley are derived from the local breeding population or from migrant birds. Peregrines are not thought to have bred on the built plant at Hinkley in recent years (Dick Best, British Energy Site Warden, pers comm.). Peregrines were reported from 93 sites throughout the year in Somerset in 2009 (Gibbs [Ed], 2011) indicating that this species is now widespread in the county.

The evidence from the surveys and desk study indicate that at least 1-3 peregrines use the fields and intertidal habitat around Hinkley for hunting and commuting on a regular basis. A much larger expanse of mudflats and other intertidal habitat is located immediately to the east of the survey area, which is likely to provide this species with much more important hunting areas than those found around Hinkley. In view of this, the survey area is likely to provide a no more than locally important foraging resource to peregrine.

4.4.5 Other Species

Results from the surveys undertaken at Hinkley between April 2008 and March 2009, indicate that a wide range of other species occur in or use the survey area, including (occasionally) large flocks of wintering passerines such as skylark[66] (600-700 birds in February 2009), linnet (140 birds in November 2008) and fieldfare (300 birds in November 2008). There is little data to provide any indication of the likely size of the wintering populations of widespread farmland passerines in Somerset but given the amount of suitable farmland habitat available in the county they are likely to be substantial. The peak number of skylarks recorded in fields at Hinkley may be of county importance. However, numbers of none of the farmland passerine species recorded using the survey area, are likely to be of county importance on a regular basis.

The nocturnal field surveys undertaken by Entec in 2008 located at least two territories each of nightingale and Cetti's warbler, both located immediately to the south of the built plant. Recent breeding bird surveys of the Hinkley Nature Reserve by ADAS in 2008 identified two pairs of nightingale in this area, as well as two pairs of lesser whitethroat (within the planning application boundary). The results for these species, from the 2008 Entec nocturnal field surveys and the 2008 ADAS surveys, do not differ markedly from those found during the 2007 Entec surveys undertaken in the same area. An assessment of the importance of the Hinkley populations of these species is provided in the first Interim Hinkley Bird Report. Overall, the SSA is likely to support county important populations of Cetti's warbler, nightingale and lesser whitethroat.

[66] Peak numbers in parenthesis.

5. Conclusions

The SSA, surrounding farmland and adjacent intertidal habitat and inshore waters to the east and west of the proposed Hinkley C were subject to intensive ornithological survey between April 2007 and March 2009 inclusive. The novel data collected, and the extensive contextual information resulting from various sources, including previous power station applications, the BTO's Wetland Bird Surveys and the West Hinkley Wind Farm application, mean that the ornithological interest of the area is very well understood.

The principal interest of the intertidal area is the large number of shelduck that regularly occur on intertidal mud at the western end of Stert Flats. This area is relatively remote from the terrestrial footprint of the plant, and could potentially be subject to greater effects during operation than construction (thermal regime change and chemical discharge have the potential to influence the biomass of prey and the structure of the community in this area). Up to 21% of the Severn SPA shelduck population have been recorded using this discrete area, and flocks of birds exceeding 1% of the interest of the SPA and SSSI are recorded regularly during the moult (mid summer to autumn) and winter periods. Elsewhere within the study area numbers are typically small and use irregular, although occasional flocks of loafing birds drift west on the tide (following feeding on Stert Flats) and can enter the inshore waters adjacent to the SSA. During the moult period some of these flocks will contain numerous flightless birds, potentially sensitive to disturbance. Use of fields within and adjacent to the SSA by shelduck was very limited, and there was no evidence to suggest local roosting or from the nocturnal surveys.

Other SPA species that showed relatively regular use of the area were pintail and curlew. Pintail was present in winter only, with birds almost exclusively recorded from the intertidal rock platforms to the north and the intertidal mud to the north-east of the operational plant. Flocks exceeded 1% of the SPA Review population on 29 occasions over the two years of survey, indicating that use is relatively sporadic, but regular. Curlew numbers were lower in SPA (Review) terms, with only one flock (also on Stert Flats) exceeding 1% of the cited/designated population during the survey period, but very consistent use of the area by foraging birds. More historical data from the West Hinkley Wind Farm application suggests that larger numbers have occurred on the western end of the Flats in previous years.

Ringed plover was irregularly recorded during the surveys, mostly during the autumn passage period. The western end of the intertidal survey area was favoured. Here, the combination of rock platforms and mobile sand provide foraging and roosting opportunities. Although numbers present occasionally exceeded 1%[67] of the SPA (Review) population during the survey work, it is unlikely that the area is of particular importance to the population, based on the considerable amount of similar habitat to the west (over 9km of similar coast) and the irregularity of use.

Other SPA and Ramsar species were recorded on such an infrequent basis during survey work as to suggest the area was of limited importance to them. SSSI species that were recorded using the area, particularly the flats and adjacent rock platforms to the north and north-east of the operational plant on a regular basis were whimbrel (during spring passage) and wigeon (winter).

[67] The largest flock recorded in the area accounted for approximately 5% of the SPA Review population.

The walkover surveys (nocturnal, 'field by field' and breeding bird work) established that the farmland habitat that dominates the SSA is relatively representative of the wider area. The arm of flat, open land that extends inland across Wick Moor, and which is subject to SPA, Ramsar and SSSI designation does not currently hold wildfowl during winter (with very few birds noted over the two years of work), probably due to the fact that it is rather dry. Lapwing and golden plover use farmland throughout the area, occasionally in numbers that are likely to be of importance at the county level, while large flocks of wintering passerines such as skylark and linnet also occur on an irregular basis.

The breeding bird community across much of the SSA and the surrounding area is reflective of intensively farmed habitats, with relatively low numbers of farmland birds present among a community dominated by common species with ubiquitous habitat preferences. The exception to this, is the species rich area in the mosaic of habitats to the south of the built plant. This area supports the only Schedule 1 species recorded breeding within the survey area, Cetti's warbler, as well as populations of nightingale and lesser whitethroat, which have a restricted regional range. The high incidence of peregrine sightings throughout the year suggests breeding may soon occur on the operational plant, while barn owl does not breed in the survey area (and has not been recorded doing so for well over 20 years) probably predominantly due to an absence of nesting opportunities.

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Appendix A
WeBS Count Data

8 Pages

Table A.1 Peak Counts in WeBS Core Count Sector 13411

Species	Scientific Name	2004/05	2005/06	2006/07	2007/08	2008/09	5-yr Peak Mean
Mute Swan	*Cygnus olor*	0	13	2	29	26	14
Bewick's Swan	*Cygnus columbianus*	0	0	0	0	11	2
Whooper Swan	*Cygnus cygnus*	0	0	0	0	3	1
Canada Goose	*Branta canadensis*	42	175	45	73	41	75
Brent Goose (dark-bellied)	*Branta bernicla bernicla*	0	1	4	0	0	1
Brent Goose (pale-bellied)	*Branta bernicla hrota*	9	5	2	11	0	5
Shelduck	*Tadorna tadorna*	1,850	2,900	2,480	2,180	2,355	2,353
Wigeon	*Anas penelope*	500	950	820	940	600	762
Teal	*Anas crecca*	1,800	1,350	350	1,350	940	1,158
Mallard	*Anas platyrhynchos*	70	12	21	9	12	25
Pintail	*Anas acuta*	44	17	25	42	17	29
Shoveler	*Anas clypeata*	2	21	0	20	9	10
Common Scoter	*Melanitta nigra*	0	0	2	4	0	1
Little Grebe	*Tachybaptus ruficollis*	10	4	2	7	2	5
Cormorant	*Phalacrocorax carbo*	8	5	19	6	9	9
Little Egret	*Egretta garzetta*	7	42	26	31	32	28
Grey Heron	*Ardea cinerea*	5	2	2	3	3	3
Spoonbill	*Platalea leucorodia*	0	0	0	0	1	0

Species	*Scientific Name*	2004/05	2005/06	2006/07	2007/08	2008/09	5-yr Peak Mean
Water Rail	*Rallus aquaticus*	1	0	2	2	1	1
Moorhen	*Gallinula chloropus*	6	3	3	3	2	3
Coot	*Fulica atra*	0	0	0	1	0	0
Oystercatcher	*Haematopus ostralegus*	150	30	38	200	85	101
Avocet	*Recurvirostra avosetta*	26	26	26	68	18	33
Little Ringed Plover	*Charadrius dubius*	0	1	0	0	0	0
Ringed Plover	*Charadrius hiaticula*	200	320	780	160	66	305
Golden Plover	*Pluvialis apricaria*	142	1,950	285	310	240	585
Grey Plover	*Pluvialis squatarola*	190	520	140	190	220	252
Lapwing	*Vanellus vanellus*	420	8,400	1,950	165	1,250	2,437
Knot	*Calidris canutus*	1,050	840	420	1,650	780	948
Sanderling	*Calidris alba*	2	20	140	17	108	57
Little Stint	*Calidris minuta*	1	1	1	2	8	3
Curlew Sandpiper	*Calidris ferruginea*	6	1	4	3	15	6
Purple Sandpiper	*Calidris maritima*	0	0	0	0	1	0
Dunlin	*Calidris alpina*	8,300	10,500	11,000	3,800	9,800	8,680
Ruff	*Philomachus pugnax*	1	0	1	0	0	0
Jack Snipe	*Lymnocryptes minimus*	0	1	1	1	1	1
Snipe	*Gallinago gallinago*	1	13	32	7	7	12
Black-tailed Godwit	*Limosa limosa*	137	3	7	31	148	65
Bar-tailed Godwit	*Limosa lapponica*	43	10	2	21	8	17

Species	*Scientific Name*	2004/05	2005/06	2006/07	2007/08	2008/09	5-yr Peak Mean
Whimbrel	*Numenius phaeopus*	14	7	3	28	6	12
Curlew	*Numenius arquata*	1,380	1,550	1,480	1,450	675	1,307
Common Sandpiper	*Actitis hypoleucos*	0	4	0	0	6	2
Green Sandpiper	*Tringa ochropus*	0	0	1	0	0	0
Spotted Redshank	*Tringa erythropus*	12	7	2	1	5	5
Greenshank	*Tringa nebularia*	1	5	0	5	2	3
Redshank	*Tringa totanus*	950	580	430	680	560	640
Turnstone	*Arenaria interpres*	35	120	65	165	115	100
Kittiwake	*Rissa tridactyla*	1	0	0	2	0	1
Black-headed Gull	*Chroicocephalus ridibundus*	200	550	2,600	2,746	950	1,409
Mediterranean Gull	*Larus melanocephalus*	0	0	1	2	1	1
Common Gull	*Larus canus*	3	9	20	3	25	12
Lesser Black-backed Gull	*Larus fuscus*	19	19	5	25	15	17
Herring Gull	*Larus argentatus*	30	70	35	55	56	49
Great Black-backed Gull	*Larus marinus*	20	14	6	9	16	13
Common Tern	*Sterna hirundo*	1	0	0	0	0	0
Arctic Tern	*Sterna paradisaea*	0	0	1	0	0	0

Table A.2 Peak and Mean Counts in WeBS Low Tide Count Sectors

Species	Data	BV691	BV692	BV693	BV694	BV695	BV696	BV697
Mute Swan	Peak Count				19			
Mute Swan	Mean Count				7			
Bewick's Swan	Peak Count				11			
Bewick's Swan	Mean Count				3			
Dark-bellied Brent Goose	Peak Count		13	12			13	
Dark-bellied Brent Goose	Mean Count		3	3			5	
Light-bellied Brent Goose	Peak Count		1	1			13	
Light-bellied Brent Goose	Mean Count		0	0			9	
Shelduck	Peak Count		41	101	2		185	65
Shelduck	Mean Count		15	55	1		87	28
Wigeon	Peak Count		40	17			485	185
Wigeon	Mean Count		10	4			223	70
Teal	Peak Count		7	5	15	1	73	20
Teal	Mean Count		2	1	4	0	40	5
Mallard	Peak Count		40	30	6	4	15	3
Mallard	Mean Count		12	10	2	2	11	1
Pintail	Peak Count		32	7			57	35
Pintail	Mean Count		16	2			36	11
Shoveler	Peak Count			4				
Shoveler	Mean Count			1				

Species	Data	BV691	BV692	BV693	BV694	BV695	BV696	BV697
Scaup	Peak Count						4	4
Scaup	Mean Count						2	1
Common Scoter	Peak Count							8
Common Scoter	Mean Count							2
Little Grebe	Peak Count				3			
Little Grebe	Mean Count				1			
Cormorant	Peak Count							2
Cormorant	Mean Count							1
Little Egret	Peak Count			6	8	1	3	6
Little Egret	Mean Count			2	2	0	2	2
Grey Heron	Peak Count					1	3	1
Grey Heron	Mean Count					1	2	0
Water Rail	Peak Count				1			
Water Rail	Mean Count				0			
Moorhen	Peak Count				2	1		
Moorhen	Mean Count				1	0		
Coot	Peak Count				2	1		
Coot	Mean Count				1	0		
Oystercatcher	Peak Count	40	51	26			4	40
Oystercatcher	Mean Count	22	13	10			2	29
Ringed Plover	Peak Count		8	15				35

Species	Data	BV691	BV692	BV693	BV694	BV695	BV696	BV697
Ringed Plover	Mean Count		2	4				24
Golden Plover	Peak Count		10	7				
Golden Plover	Mean Count		3	2				
Grey Plover	Peak Count		250	54			9	6
Grey Plover	Mean Count		63	16			5	2
Lapwing	Peak Count		20	11	75	6	43	
Lapwing	Mean Count		6	3	19	2	17	
Knot	Peak Count		300	2			82	
Knot	Mean Count		75	1			32	
Purple Sandpiper	Peak Count						3	12
Purple Sandpiper	Mean Count						1	9
Dunlin	Peak Count	1000	1500	1500			230	2
Dunlin	Mean Count	467	528	794			124	1
Snipe	Peak Count		5		3			
Snipe	Mean Count		1		3			
Black-tailed Godwit	Peak Count		2					
Black-tailed Godwit	Mean Count		1					
Curlew	Peak Count	25	95	48	35	26	98	28
Curlew	Mean Count	15	48	34	9	8	44	12
Redshank	Peak Count	5	42	73	7		36	6
Redshank	Mean Count	2	11	27	2		17	3

Species	Data	BV691	BV692	BV693	BV694	BV695	BV696	BV697
Turnstone	Peak Count		21	80			16	26
Turnstone	Mean Count		5	22			8	22

Appendix B
Somerset Ornithological Society Data

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Table B.1 Cited/Designated Species[68]

Species	Location[69]	Peak Counts of Individuals each Year[70]										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bewick's Swan	Hinkley Point											4
Shelduck	Hinkley Point	30			46	150		20				24
Shelduck	Knighton				2			4	4	2		
Shelduck	Lilstock							2				
Shelduck	Stolford	600		274	152	2	94	13	150	700	147	111
Wigeon	Hinkley Point	20	35	10	41	60	74	53	4		180	229
Wigeon	Lilstock									40		
Wigeon	Stolford	16	32	59	84				70	120	100	150
Gadwall	Hinkley Point				2							
Gadwall	Stolford			5								
Teal	Hinkley Point	4		11	29	80						2
Teal	Stolford	12	20	62		1					10	6

[68] Species that appear as featured interest for at least one of the statutory sites within 5km of the SSA (including possible future designation under Ramsar Criterion 6) and species which appear as noteworthy fauna in the information sheet for the Severn Estuary Ramsar site.

[69] Locations identified as being within or less than 1km from the intertidal survey area and/or the survey area used for the daytime field surveys.

[70] Peak count of individuals recorded for that location that year. Blank fields do not necessarily indicate that no birds were present, but could relate to birds not being counted at that location that year.

Species	Location[69]	Peak Counts of Individuals each Year[70]										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Mallard	Hinkley Point	33	60		62	71	31	10				35
Mallard	Knighton							9				
Mallard	Lilstock									4		
Mallard	Stolford	162		69	76	15	20	56		6	2	27
Pintail	Hinkley Point	60	40	16	14	90	32	40	35		28	109
Pintail	Lilstock				19							
Pintail	Stolford	149	88	72	32	66	29	60	110	80	143	106
Shoveler	Hinkley Point	4								5		2
Shoveler	Stolford			11						2	12	4
Pochard	Stolford	8	8				5					
Tufted Duck	Hinkley Point						1					
Tufted Duck	Stolford						1					
Little Egret	Hinkley Point				1	2	1	2	4	7	1	8
Little Egret	Knighton							1			2	2
Little Egret	Stolford		1		1	10	13	8	20	21	48	8
Water Rail	Hinkley Point	1										
Ringed Plover	Hinkley Point				6							1
Ringed Plover	Lilstock				8	5	6					
Ringed Plover	Stolford	65	1	8	4		30	1		37	28	50
Grey Plover	Lilstock											5

Species	Location[69]	Peak Counts of Individuals each Year[70]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Grey Plover	Stolford	55	41	52	5	17	30	1	48		2	6
Lapwing	Hinkley Point		2			40						
Lapwing	Knighton							85				
Lapwing	Stolford		2,500	90	4,000					1	140	
Dunlin	Hinkley Point					25						2
Dunlin	Lilstock						10					
Dunlin	Stolford	100	15	1,500	60	30	2,000		2,500	200	1,700	3,000
Black-tailed Godwit	Stolford			2			2		24	27		
Whimbrel	Hinkley Point			3	2	1	13			7	11	10
Whimbrel	Knighton					53						
Whimbrel	Stolford	11	9	2	7	1	4	44	5	18	10	3
Curlew	Hinkley Point	35		2	62	80	35	10	26		2	40
Curlew	Knighton					1			9	1	6	
Curlew	Lilstock					4				20		
Curlew	Stolford	40	400	38	114	70	20	21	1,400	12	80	6
Spotted Redshank	Hinkley Point					1						
Spotted Redshank	Stolford											1
Greenshank	Knighton											1
Greenshank	Stolford		3	1		1	2					2
Redshank	Hinkley Point				4	15					1	

Species	Location[69]	Peak Counts of Individuals each Year[70]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Redshank	Stolford	62		25	81	40	32	20			7	22

Table B.2 Non-cited/Designated Species[71]

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mute Swan	Hinkley Point							3				
Mute Swan	Lilstock	3										
Mute Swan	Stolford		5	2	7	6	5	5			2	
Brent Goose	Hinkley Point	2					11					3
Brent Goose	Lilstock											
Brent Goose	Stolford	3	2		4	2	11		21	6	5	11
Brent Goose	Hinkley Point									5		2
Brent Goose	Stolford									6	6	10
Scaup	Hinkley Point	5				1					1	1
Scaup	Stolford	15	5				5			2	2	2
Eider	Stolford									5		
Long-tailed Duck	Hinkley Point						1					

[71] Species that do not appear as a featured interest for at least one of the statutory sites within 5km of the PWA or as noteworthy fauna for the Severn Estuary Ramsar site.

[72] Locations identified as being within or less than 1km from the intertidal survey area and/or the survey area used for the daytime field surveys.

[73] Peak count of individuals recorded for that location that year during the months of January, February, March, August, September, October, November and December (i.e. those covered by the surveys undertaken at Hinkley in 2007/08). Blank fields do not necessarily indicate that no birds were present, but could relate to birds not being counted at that location that year.

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Long-tailed Duck	Lilstock						1					
Long-tailed Duck	Stolford						1				1	
Common Scoter	Hinkley Point	14			3		13	20	14	7		25
Common Scoter	Lilstock		5				12					
Common Scoter	Stolford	1	1			1	12		4	3	3	8
Smew	Stolford	1										
Red-breasted Merganser	Stolford						1			1		
Goosander	Stolford					1						
Red-legged Partridge	Lilstock	1	7				4			2		
Grey Partridge	Knighton							7				
Grey Partridge	Stolford						1					
Pheasant	Hinkley Point							1				
Red-throated Diver	Hinkley Point				1							1
Great Northern Diver	Stolford	1								1	1	
Little Grebe	Stolford		11	8	3	7					2	2
Great Crested Grebe	Hinkley Point	1										1
Great Crested Grebe	Stolford		1			1						
Slavonian Grebe	Stolford											1
Manx Shearwater	Hinkley Point		5						1			
Manx Shearwater	Stolford		2			1						

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Leach's Petrel	Stolford		1							5		
Gannet	Hinkley Point		4									
Gannet	Stolford						1		9			
Cormorant	Hinkley Point						2	1	4	2		22
Cormorant	Stolford			1					2	1	1	
Shag	Hinkley Point		1									
Grey Heron	Hinkley Point			9		4		2	5			1
Grey Heron	Knighton							2				
Grey Heron	Lilstock											3
Grey Heron	Stolford	1	9	8	7	12	7	6	7	4		2
Honey Buzzard	Hinkley Point				1							
Hen Harrier	Lilstock									1		
Goshawk	Hinkley Point											1
Sparrowhawk	Lilstock										1	
Sparrowhawk	Hinkley Point	1		2		1		2	2			2
Sparrowhawk	Knighton					1		2	2	2		2
Sparrowhawk	Lilstock				1	1		1		1		
Sparrowhawk	Stolford	1	1		1				1	1	1	
Buzzard	Hinkley Point	3	1	2	1	2	1	4	1	4		
Buzzard	Knighton	1					6	8	18	4		8

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Buzzard	Lilstock	1	1		3	1		1		7		
Buzzard	Stolford	1	2	2					1	4	1	1
Osprey	Hinkley Point		1									
Kestrel	Hinkley Point	1	1	1	1		1		2	1	2	
Kestrel	Knighton	1	1					2			2	
Kestrel	Lilstock		1				2	1	1		1	
Kestrel	Stolford		1	1			1		1	1		
Merlin	Hinkley Point	1	1			1	1	1	1	1		
Merlin	Knighton		1	1	1		1			1		
Merlin	Lilstock		1									1
Merlin	Stolford	1		1	1	1				1	2	
Hobby	Knighton	2				2		2		2		2
Hobby	Lilstock	1										
Peregrine	Hinkley Point	1		1	1		2	3	4	2	3	2
Peregrine	Knighton	1						1	2	2	1	2
Peregrine	Lilstock	2							1	1		
Peregrine	Stolford	2	1		2		3		2			1
Moorhen	Knighton							4	8			
Moorhen	Stolford			1					3			1
Oystercatcher	Hinkley Point	25			23	50	22	30	41		36	135

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Oystercatcher	Knighton								26			
Oystercatcher	Lilstock		13			2						
Oystercatcher	Stolford	52	65	69	123	130	50	12	50	40	31	100
Golden Plover	Knighton							450			210	
Golden Plover	Lilstock				1							
Golden Plover	Stolford		1						105			
Knot	Hinkley Point			120	15							45
Knot	Stolford	100		70	1670				70	1		
Sanderling	Stolford								10			8
Little Stint	Hinkley Point			1								
Little Stint	Stolford										1	
Curlew Sandpiper	Hinkley Point											5
Purple Sandpiper	Hinkley Point				2	1			1			13
Purple Sandpiper	Stolford			2						2	1	
Jack Snipe	Stolford			1						1	1	
Snipe	Lilstock								2			
Snipe	Stolford									1	1	
Woodcock	Hinkley Point				2		1			1		1
Bar-tailed Godwit	Hinkley Point											3
Bar-tailed Godwit	Stolford	10							4			

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Common Sandpiper	Hinkley Point			1	2				2			
Common Sandpiper	Stolford					1						
Green Sandpiper	Stolford	2					1					
Turnstone	Hinkley Point	10		12	15	23						15
Turnstone	Lilstock				1							
Turnstone	Stolford	96	30	20	80	65	22	25	30	200	90	124
Grey Phalarope	Lilstock				1				1			
Pomarine Skua	Hinkley Point				1							
Pomarine Skua	Stolford						1					1
Arctic Skua	Hinkley Point				1							
Great Skua	Hinkley Point											1
Great Skua	Stolford			3								2
Kittiwake	Hinkley Point	1			5	1		80				
Kittiwake	Lilstock				40							
Kittiwake	Stolford	5					2				17	
Black-headed Gull	Lilstock										250	
Black-headed Gull	Hinkley Point	150	3000		50	150						47
Black-headed Gull	Stolford		11	3		2200			600	70		181
Little Gull	Hinkley Point	1	1	1	2	3						
Little Gull	Stolford					1						1

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mediterranean Gull	Hinkley Point	1						1				
Mediterranean Gull	Lilstock										1	
Mediterranean Gull	Stolford	1	1				1			1	1	
Common Gull	Lilstock										30	
Common Gull	Hinkley Point	2		41	5	15				5	5	5
Lesser Black-backed Gull	Hinkley Point	2			20	2		40	40	24		60
Lesser Black-backed Gull	Stolford											2
Herring Gull	Hinkley Point	205	17		60	50		270	200	70		250
Herring Gull	Lilstock				237							
Herring Gull	Stolford	250							400			50
Yellow-legged Gull	Hinkley Point	1										
Yellow-legged Gull	Stolford											
Iceland Gull	Hinkley Point	1										
Great Black-backed Gull	Hinkley Point	45		41	2	5		2		2		5
Great Black-backed Gull	Stolford	1	1	2	7				4		4	4
Bonaparte's Gull	Hinkley Point					1						
Laughing Gull	Stolford									1		
Sabine's Gull	Hinkley Point	1										1

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Black Tern	Hinkley Point	6	8	4	3		1		1			
Sandwich Tern	Hinkley Point	5										
Sandwich Tern	Stolford					2						
Common Tern	Hinkley Point	3	60	10	5	1	1		5	2		5
Common Tern	Stolford	2									2	
Arctic Tern	Hinkley Point	5	6	30	1	1	1		4	3		25
Guillemot	Hinkley Point		1									1
Guillemot	Stolford										1	
Stock Dove	Hinkley Point		7									9
Stock Dove	Knighton		5					12		12		22
Stock Dove	Lilstock				8			1				
Stock Dove	Stolford								2			
Wood Pigeon	Hinkley Point											300
Wood Pigeon	Lilstock				200							
Collared Dove	Hinkley Point							3				
Collared Dove	Knighton											4
Collared Dove	Stolford					20						
Ring-necked Parakeet	Lilstock		1									
Barn Owl	Hinkley Point										1	
Barn Owl	Knighton									1	2	

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Barn Owl	Stolford	1									1	
Little Owl	Hinkley Point		1									
Little Owl	Knighton						2	1	1	2	2	2
Little Owl	Lilstock	1					2					
Little Owl	Stolford		1									
Tawny Owl	Hinkley Point							1				
Tawny Owl	Knighton	2	2			2	2	4	2		1	
Tawny Owl	Lilstock							2				
Short-eared Owl	Hinkley Point				1							
Short-eared Owl	Lilstock				1							
Short-eared Owl	Stolford											1
Swift	Hinkley Point										1	
Swift	Knighton	1	50					4	2	30		35
Swift	Lilstock	1										
Kingfisher	Hinkley Point	1	1									
Kingfisher	Knighton									1		
Kingfisher	Stolford	1	1	1			1		1	1	1	
Hoopoe	Knighton											1
Green Woodpecker	Lilstock						1	2		1	1	
Green Woodpecker	Hinkley Point	1	1	1	1	1	1		2	2		2

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Green Woodpecker	Knighton					1	1		2	2		
Green Woodpecker	Stolford		1				1					1
Great Spotted Woodpecker	Hinkley Point											2
Great Spotted Woodpecker	Knighton	1		1			1	2	2	2		2
Great Spotted Woodpecker	Lilstock					1		1				
Great Spotted Woodpecker	Stolford					1						
Lesser Spotted Woodpecker	Knighton					1						
Woodlark	Knighton									2		
Skylark	Hinkley Point											2
Skylark	Knighton		71						30	530	45	10
Skylark	Lilstock	25	14	75	14		2	30	120	350		
Skylark	Stolford		4							7		4
Sand Martin	Hinkley Point								4			
Sand Martin	Knighton					1						
Swallow	Hinkley Point	10				4	4	1				
Swallow	Knighton								22		250	28
Swallow	Lilstock	4	1	3	3200			20		600	34	1000

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Swallow	Stolford		1		4			2		7	1	
House Martin	Hinkley Point	1										
House Martin	Knighton					2			12	500		
House Martin	Lilstock				2					1000		3000
House Martin	Stolford								50	2	35	
Tree Pipit	Lilstock								1			1
Meadow Pipit	Hinkley Point											5
Meadow Pipit	Knighton										2	
Meadow Pipit	Lilstock	35						200		60	60	40
Meadow Pipit	Stolford	80	24	1		45				100		9
Rock Pipit	Hinkley Point	12		12	5	9	8		12	11		10
Rock Pipit	Lilstock				6					1		
Rock Pipit	Stolford	3		4	6				5	4	3	1
Richard's Pipit	Hinkley Point	1										
Yellow Wagtail	Hinkley Point	1										
Yellow Wagtail	Lilstock						3			1		
Grey Wagtail	Hinkley Point							1			1	
Grey Wagtail	Knighton						1					
Grey Wagtail	Lilstock	1			2			1				2
Grey Wagtail	Stolford	1								1		

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Pied Wagtail	Hinkley Point	400	500	70		900	500	500				7
Pied Wagtail	Knighton									20		
Pied Wagtail	Lilstock							120	8		1	
Pied Wagtail	Stolford		8		60	15	35	30		30		50
White Wagtail	Knighton											49
White Wagtail	Lilstock									1		
White Wagtail	Stolford											4
Waxwing	Hinkley Point							2				
Waxwing	Knighton								2			
Wren	Hinkley Point						2					
Wren	Knighton						5	4				2
Wren	Stolford											2
Dunnock	Hinkley Point							1				
Dunnock	Knighton							2				6
Dunnock	Stolford									2		1
Robin	Hinkley Point						1	1		2		3
Robin	Knighton						4	4				4
Robin	Lilstock						16					
Robin	Stolford									3		2
Black Redstart	Hinkley Point	2	1	2	5	1	1	1		1	1	3

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Black Redstart	Knighton			1			1					1
Black Redstart	Lilstock										1	
Black Redstart	Stolford	1	3	3	1	1				2	1	1
Redstart	Hinkley Point					3						
Redstart	Lilstock											1
Whinchat	Hinkley Point	1			1		2					
Whinchat	Lilstock						3					1
Whinchat	Stolford									2		
Stonechat	Hinkley Point				4	5	2	2		2		4
Stonechat	Knighton			1	2				1		3	
Stonechat	Lilstock	2		2		4		1	2	2	17	2
Stonechat	Stolford		2	2	3	2		2	1	1	1	3
Wheatear	Hinkley Point	3	5	6	3	55	4	3	5	16	4	5
Wheatear	Knighton		3	1	4						2	
Wheatear	Lilstock	1		1	1	1	1	7	1	4		12
Wheatear	Stolford	13	10	7	7	4	3		6	12	22	5
Ring Ouzel	Knighton						1					
Blackbird	Hinkley Point						5					
Blackbird	Knighton						6	4				
Blackbird	Lilstock		12						40			

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Blackbird	Stolford											2
Fieldfare	Hinkley Point						12	60				
Fieldfare	Knighton	20		40		3	26		55	125	450	
Fieldfare	Lilstock	20	2500					2	300			
Fieldfare	Stolford	70				500		6				1800
Song Thrush	Hinkley Point	70	15		1			8				1
Song Thrush	Knighton		10					2	2			6
Song Thrush	Lilstock		1	10			20		60	100		
Song Thrush	Stolford											3
Redwing	Hinkley Point	15	240		20			1				
Redwing	Knighton			40		150	9		400	40	150	
Redwing	Lilstock		1500					62	2850	100		
Redwing	Stolford		3									500
Mistle Thrush	Lilstock										7	
Mistle Thrush	Hinkley Point			4				2		3		
Mistle Thrush	Knighton				2					9		2
Mistle Thrush	Stolford			2								
Sedge Warbler	Hinkley Point	2										
Cetti's Warbler	Hinkley Point					1				2		1
Reed Warbler	Hinkley Point	2										

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Reed Warbler	Lilstock							1				
Blackcap	Hinkley Point	2										
Blackcap	Knighton	2	1							2		
Blackcap	Lilstock	1		3						1	2	
Garden Warbler	Knighton	1										
Garden Warbler	Lilstock		1		1							
Lesser Whitethroat	Lilstock				1							
Whitethroat	Lilstock		2		1				1			
Whitethroat	Stolford								1			
Dartford Warbler	Hinkley Point				2							
Dartford Warbler	Stolford	1	1									
Chiffchaff	Hinkley Point	3			1	5	7			1		
Chiffchaff	Knighton				1	2	3	1	10	4	2	2
Chiffchaff	Lilstock	3			2		1	2	2	7	3	
Chiffchaff	Stolford	2									6	
Willow Warbler	Lilstock		4		2				1	1		
Willow Warbler	Stolford										1	
Yellow-browed Warbler	Hinkley Point	1										
Yellow-browed Warbler	Stolford		1									
Goldcrest	Hinkley Point											4

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Goldcrest	Knighton	30										
Goldcrest	Lilstock	11			6		10	4	3	15		
Firecrest	Hinkley Point				1							
Firecrest	Knighton			1								
Firecrest	Lilstock			1	1					1		1
Spotted Flycatcher	Knighton							1				
Red-breasted Flycatcher	Lilstock				1							
Long-tailed Tit	Hinkley Point				30	2						40
Long-tailed Tit	Knighton						15	6				
Long-tailed Tit	Lilstock	30		2				50		2	15	
Long-tailed Tit	Stolford									15		
Blue Tit	Hinkley Point									1		
Blue Tit	Knighton						10		6			
Blue Tit	Stolford											4
Great Tit	Knighton							4	4	4		
Great Tit	Stolford											1
Coal Tit	Hinkley Point							10				
Coal Tit	Knighton					4						
Coal Tit	Lilstock							3				
Coal Tit	Stolford					2						

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Marsh Tit	Hinkley Point						2					
Marsh Tit	Lilstock			2	2							2
Treecreeper	Stolford					1						
Great Grey Shrike	Stolford		1							1		
Jay	Knighton									1		
Jay	Lilstock									1		
Magpie	Hinkley Point					2						3
Magpie	Stolford											1
Jackdaw	Knighton											
Rook	Stolford									20		20
Carrion Crow	Hinkley Point					50				8		20
Carrion Crow	Knighton						1					
Carrion Crow	Stolford				82		56					73
Raven	Hinkley Point				2		3			3	1	2
Raven	Lilstock			3	1			1	2	2	4	
Raven	Stolford	1	3	5			2			2		2
Starling	Knighton						35			100		
Starling	Stolford						200					30
House Sparrow	Knighton						14	40				
House Sparrow	Lilstock				30						30	

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
House Sparrow	Stolford								2			10
Chaffinch	Hinkley Point							4				
Chaffinch	Knighton						9					
Chaffinch	Lilstock	20					25	600	700	150		
Chaffinch	Stolford									400		1
Brambling	Hinkley Point				1		1	1				
Brambling	Knighton									1		
Brambling	Lilstock							6		2		
Brambling	Stolford									2		
Greenfinch	Hinkley Point			200			35					
Greenfinch	Knighton						150					
Greenfinch	Lilstock							50		100		
Greenfinch	Stolford					20						
Goldfinch	Hinkley Point	40			35	8		10	40	5		
Goldfinch	Knighton							5	4	10		4
Goldfinch	Lilstock		4		12		16	30		30		
Goldfinch	Stolford	20	14		25	15		7	25	3		6
Siskin	Hinkley Point			3								
Siskin	Knighton					2	6	3	2		2	50
Siskin	Lilstock	1						17	80			

Species	Location[72]	Peak Counts of Individuals each Year[73]										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Siskin	Stolford	25						1				400
Linnet	Hinkley Point			200				4		300		300
Linnet	Knighton							35		150	120	
Linnet	Lilstock			125				250		100	100	150
Linnet	Stolford		8				67		60			
Bullfinch	Hinkley Point						2	12		5		4
Bullfinch	Knighton						1	1		2	2	
Bullfinch	Lilstock							3		3		
Bullfinch	Stolford					2				2		2
Lapland Bunting	Stolford											1
Snow Bunting	Hinkley Point											2
Snow Bunting	Stolford			3	1					1		4
Yellowhammer	Hinkley Point				1		4					8
Yellowhammer	Knighton				4	35	25	12	16	16	1	16
Yellowhammer	Lilstock	60		16				1	12	2	1	
Yellowhammer	Stolford			1			15	3		1	4	
Reed Bunting	Hinkley Point		2		1				2			4
Reed Bunting	Stolford									2	3	

Appendix C
Intertidal Survey, Peak Monthly Counts[74]

13 Pages

[74] The figures show the peak count of birds on any single survey date within the month. The peak counts have been derived from the sum of all counts of birds within the count sector on any single survey date (excluding counts of birds commuting through the area).

Table C.1 Cited/Designated Species

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Shelduck	1	2007/08	22	8	11	21	17	14	2	4	4	20	20	9
Shelduck	1	2008/09	9	14	2		6	4	10	6	16	28	33	3
Shelduck	2	2007/08	6		5	2	17	5	42	43	3	35	7	24
Shelduck	2	2008/09	6	13	4	6	500			9	19	32	36	16
Shelduck	3	2007/08	30	6	2	200	200	35			4	2	20	10
Shelduck	3	2008/09	8	3	2	32		7		2		4	15	7
Shelduck	4	2007/08	25	14	13	30	70	6	16	71	11	4	30	20
Shelduck	4	2008/09	19	7	4	64	9	34	18	5	3	7	21	3
Shelduck	5	2007/08	296	340	220	106	400	700	310	250	67	52	97	76
Shelduck	5	2008/09	108	158	64	234	107	280	54	46	55	109	90	55
Wigeon	1	2007/08								4	5	4		
Wigeon	1	2008/09									1	4	5	39
Wigeon	2	2007/08	3							17	8		3	2
Wigeon	2	2008/09								1	4			2
Wigeon	3	2007/08	3						8	45	41	67	30	5
Wigeon	3	2008/09								10		15	40	4
Wigeon	4	2007/08	2					8	8	124	159	220	142	70
Wigeon	4	2008/09							21	62	98	150	121	59
Wigeon	5	2007/08	3					70	100	204	187	100	80	120
Wigeon	5	2008/09							25	47	55	100	110	75
Teal	2	2007/08											1	

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Teal	4	2007/08										25		6
Teal	5	2007/08			14									3
Mallard	1	2007/08			1	3						2	2	
Mallard	1	2008/09		2										
Mallard	2	2007/08		2								2	2	2
Mallard	2	2008/09				2						4	2	
Mallard	3	2007/08	2							3		2		
Mallard	3	2008/09										2		
Mallard	4	2007/08	2		10	30					5	15	6	5
Mallard	4	2008/09				32				4		3		
Mallard	5	2007/08		2	27	14	7	2		10	2	7	20	3
Mallard	5	2008/09			51	30	1	1		4	5	30	2	2
Pintail	2	2007/08	2							4				
Pintail	3	2007/08	4						35		4			
Pintail	3	2008/09										60		
Pintail	4	2007/08	7							1	8	20	7	
Pintail	4	2008/09								5		10	4	6
Pintail	5	2007/08	10					7	25	16	37	20	8	10
Pintail	5	2008/09						48	30	24	37	15	30	6
Shoveler	3	2008/09									4			
Shoveler	5	2007/08											4	
Shoveler	5	2008/09												1

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ringed Plover	1	2007/08	2	1			7		3	1	6	1	2	3
Ringed Plover	1	2008/09		8	1	2	3	33	2		4	2	12	
Ringed Plover	2	2007/08				1						2		2
Ringed Plover	2	2008/09				2		11			16			2
Ringed Plover	3	2008/09	4											
Ringed Plover	4	2007/08	2	1				10	1		2			
Ringed Plover	4	2008/09		1					1				1	1
Ringed Plover	5	2008/09								4				
Grey Plover	1	2007/08											3	
Grey Plover	2	2007/08									1			
Lapwing	1	2007/08									2			
Lapwing	3	2007/08						35						
Lapwing	4	2007/08									2			
Lapwing	4	2008/09				3								3
Lapwing	5	2007/08							6	40	10	37		2
Lapwing	5	2008/09				3				5	36	45	102	
Dunlin	1	2007/08				7	1							
Dunlin	1	2008/09			1			5	1					
Dunlin	2	2007/08				13								
Dunlin	2	2008/09						3						
Dunlin	5	2008/09						9						
Black-tailed Godwit	5	2008/09			15		100							

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Whimbrel	1	2007/08	1	1										
Whimbrel	1	2008/09		1										
Whimbrel	2	2007/08	3	2										
Whimbrel	2	2008/09	3	5			2							
Whimbrel	3	2007/08		1										
Whimbrel	3	2008/09	1	1										
Whimbrel	4	2007/08	3	4			1							
Whimbrel	4	2008/09	2	4	2	1	1							
Whimbrel	5	2007/08	8	16		2	1							
Whimbrel	5	2008/09	7	3		1								
Curlew	1	2007/08	10	2			5	2	3	16	10	14	10	6
Curlew	1	2008/09		2	4	2	2	3	2	2	8	1	6	13
Curlew	2	2007/08	5	2			16	21	24	13	12	5	6	7
Curlew	2	2008/09	1		3	7	17	17	1	1	21	1		14
Curlew	3	2007/08	3	2		3	25	4	21	2	2	8	3	3
Curlew	3	2008/09				11	2	5	16	2	1	2	1	3
Curlew	4	2007/08	3	17	5	22	21	41	10	28	21	3	20	4
Curlew	4	2008/09	9	3	2	20	7	15	15	8	4	8	2	2
Curlew	5	2007/08	15	7	15	13	21	7	10	11	7	12	18	16
Curlew	5	2008/09	10	2	6	15	6	20	4	1	34	13	63	31
Redshank	1	2007/08				1	1							
Redshank	1	2008/09						1						

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Redshank	2	2007/08					1							1
Redshank	3	2007/08				1								
Redshank	4	2007/08							1		1		1	
Redshank	4	2008/09					1		1				1	
Redshank	5	2007/08			1	1				1				
Redshank	5	2008/09									22		1	

Table C.2 Non-cited/Designated Species

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mute Swan	1	2007/08										3		
Mute Swan	1	2008/09			3									
Mute Swan	5	2007/08											1	
Whooper Swan	1	2007/08												4
Whooper Swan	2	2007/08												4
Canada Goose	5	2007/08											1	
Brent Goose	5	2007/08	12	14	9									
Brent Goose	5	2008/09	14		8						1			20
Scaup	1	2008/09		4										
Scaup	2	2008/09		4										4
Common Scoter	1	2007/08	9											
Common Scoter	1	2008/09									1			
Common Scoter	2	2007/08	1		1				1					7
Common Scoter	3	2007/08				4								
Common Scoter	3	2008/09							4					
Common Scoter	4	2007/08			4	4							21	6
Common Scoter	4	2008/09			2	4							4	
Common Scoter	5	2007/08	5	6	4				1				25	13
Common Scoter	5	2008/09												8
Red-breasted Merganser	5	2007/08				2								
Great Crested Grebe	4	2007/08												1

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Gannet	5	2007/08				20								
Cormorant	1	2008/09						1						
Cormorant	2	2007/08		5									2	
Cormorant	3	2007/08	6	7	7	2	2	4	7	10	14	15	14	12
Cormorant	3	2008/09	4	4	3	2	3	2	6	5	4	11	6	12
Cormorant	4	2007/08	2	2	1	1	1	2	2	6	6	3	5	1
Cormorant	4	2008/09		1	1	4	1	1	1	2	1	1	2	
Cormorant	5	2007/08					1	2	1	5	6	2	5	3
Cormorant	5	2008/09								1	5			
Shag	2	2008/09								4				
Shag	3	2008/09					1							
Little Egret	1	2007/08	1	3	1	1		2	2	2	2	2	2	1
Little Egret	1	2008/09	1			1	1	1	1	1	1	1	1	
Little Egret	2	2007/08		1	1	1	1	1	2	2	2	2	1	1
Little Egret	2	2008/09						2	1	2	6	2	1	1
Little Egret	3	2007/08	1	1	1	1	2	2	3	3	2	3	1	2
Little Egret	3	2008/09	1			1	1	2	1	1	3	1	1	
Little Egret	4	2007/08	2	1	2	2	4	4	1	5	3	4	2	2
Little Egret	4	2008/09		1		1	3	1	1	3	6	3	1	1
Little Egret	5	2007/08	1	2	1	3	5	3	6	5	4	3	2	1
Little Egret	5	2008/09			1	2	3	1	4	2	3	5	2	
Grey Heron	1	2007/08										1		

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Grey Heron	1	2008/09									2			
Grey Heron	2	2007/08	1									1		
Grey Heron	2	2008/09									1			
Grey Heron	3	2007/08				1					1	1		
Grey Heron	3	2008/09									1			
Grey Heron	4	2007/08									1		1	
Grey Heron	4	2008/09									1			
Grey Heron	5	2007/08	1							1	2	2	1	
Grey Heron	5	2008/09								1				
Red Kite	4	2007/08									1			
Red Kite	5	2007/08									1			
Merlin	2	2008/09	1											
Peregrine	1	2007/08									1	1		
Peregrine	1	2008/09		1										
Peregrine	2	2007/08									1			
Peregrine	3	2007/08									1	1		
Peregrine	4	2007/08										1		1
Peregrine	5	2007/08										1		1
Oystercatcher	1	2007/08	27	23	14	29	4	7	5	12	89	6	61	27
Oystercatcher	1	2008/09	6	6	9	12	4	2	3	4	4	3	4	20
Oystercatcher	2	2007/08	50	10	26	26	12	4	4	14	45	37	21	14
Oystercatcher	2	2008/09	7	5	10	16	2		13	18	30	5	2	100

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Oystercatcher	3	2007/08	78	35	40	28	16	4	11	54	29	95	71	35
Oystercatcher	3	2008/09	50	35	43	21	22		12	4	25	79	7	6
Oystercatcher	4	2007/08	17	48	14	18	4	2	4	23	39	55	41	38
Oystercatcher	4	2008/09	13	21	7	4	3	2	4	54	27	60	22	32
Oystercatcher	5	2007/08	14	12	7	5	1	1	7	15	5	8	7	16
Oystercatcher	5	2008/09	8	13	2	5	1			1	8	7		3
Golden Plover	1	2007/08								1				
Knot	1	2007/08									1			
Knot	1	2008/09									2			
Knot	4	2007/08									100		1	
Knot	5	2007/08									1			
Knot	5	2008/09		1										
Sanderling	1	2007/08				40								
Sanderling	2	2007/08							6					
Sanderling	4	2007/08				104								
Purple Sandpiper	1	2007/08											2	
Purple Sandpiper	2	2008/09												1
Purple Sandpiper	3	2007/08	15	7	7									7
Purple Sandpiper	3	2008/09	6	9	5	3	3						2	
Purple Sandpiper	4	2007/08											1	
Snipe	1	2008/09												1
Common Sandpiper	4	2007/08								2				

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Common Sandpiper	4	2008/09								1				
Common Sandpiper	5	2007/08							1					
Turnstone	1	2007/08	6	15	20						7	2	11	
Turnstone	1	2008/09		15	20		4	4			21	4		
Turnstone	2	2007/08	4	7	8						4	2	4	3
Turnstone	2	2008/09	4	6	13	7			2	2	8	4		9
Turnstone	3	2007/08			2	8						2		
Turnstone	3	2008/09		5		4	3						1	
Turnstone	4	2007/08			2	2	2				6		3	3
Turnstone	4	2008/09		1	1					2		3		1
Kittiwake	5	2007/08									1			
Black-headed Gull	1	2007/08	14	10	1				5	20	50	25	32	24
Black-headed Gull	1	2008/09	19	2	2			1	22	100	93	12	40	2
Black-headed Gull	2	2007/08	3	2	7				1	7	6	10	3	3
Black-headed Gull	2	2008/09	1	1						6	32	1	4	20
Black-headed Gull	3	2007/08	25	11	2				27	50	70	61	110	35
Black-headed Gull	3	2008/09	15	14					103	13	78	6	20	22
Black-headed Gull	4	2007/08	28	18	5			23	67	127	121	60	27	26
Black-headed Gull	4	2008/09	20	10					70	150	48	110	5	150
Black-headed Gull	5	2007/08	40	18	11	1		27	114	300	1000	130	66	55
Black-headed Gull	5	2008/09	85	24					90	84	125	105	5	21
Mediterranean Gull	2	2008/09												1

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mediterranean Gull	5	2008/09									1			
Common Gull	1	2007/08												5
Common Gull	1	2008/09		2	9						13	2		
Common Gull	3	2008/09		2										
Common Gull	4	2007/08	2		1						2			3
Common Gull	4	2008/09	2	1										
Common Gull	5	2008/09									2			
Herring Gull	1	2007/08	11	22	16	20	56	7	134	101	28	130	9	25
Herring Gull	1	2008/09	40	10	66	18	5	5	7	120	16	40	124	15
Herring Gull	2	2007/08	46	24	77	17	10	3	8	90	46	25	14	2
Herring Gull	2	2008/09	41	26	16	6	2	22	4	121	4	36	4	12
Herring Gull	3	2007/08	170	30	380	310	120	129	216	420	121	152	121	100
Herring Gull	3	2008/09	109	138	95	185	118	124	95	276	47	120	177	172
Herring Gull	4	2007/08	61	20	235	150	65	286	43	67	171	30	25	16
Herring Gull	4	2008/09	3	6	110	174	5	6	56	15	57	81	38	36
Herring Gull	5	2007/08	91	40	44	240	34	21	21	40	30	30	50	25
Herring Gull	5	2008/09	12	52	49	111	9	8	12	5	23	19	12	11
Lesser BB Gull	1	2007/08	2	1	2	1	2	5	4				3	
Lesser BB Gull	1	2008/09					1	2						1
Lesser BB Gull	2	2007/08	1	4	4	2					2		1	
Lesser BB Gull	2	2008/09					1							2
Lesser BB Gull	3	2007/08	42	22	7	16	16	11	4		2	3	1	50

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Lesser BB Gull	3	2008/09	16	17	5	4	12	4	1			4	3	13
Lesser BB Gull	4	2007/08	32	1	17	2	5	6					1	3
Lesser BB Gull	4	2008/09	35	2		6	2	1				1	1	15
Lesser BB Gull	5	2007/08	3	2	4	2	10						2	2
Lesser BB Gull	5	2008/09	3				2							2
Great Black-backed Gull	1	2007/08		1		1			3			2		2
Great Black-backed Gull	1	2008/09	1	2	1			1	1	1	1	1		
Great Black-backed Gull	2	2007/08	2	2										
Great Black-backed Gull	2	2008/09	1	2		2								
Great Black-backed Gull	3	2007/08	2	2	2	12	4	1	1	12	2	2	2	2
Great Black-backed Gull	3	2008/09	3	1	2					3	2	1	1	2
Great Black-backed Gull	4	2007/08	1		1	1				1	2	1		1
Great Black-backed Gull	4	2008/09				4		2		1				
Great Black-backed Gull	5	2007/08	1	2	2	1	2			1	2	2	2	2
Great Black-backed Gull	5	2008/09	2	3		1				1	1	2		
Common Tern	2	2008/09					2							
Common Tern	3	2008/09					10							
Common Tern	4	2007/08								1	48	10		
Common Tern	4	2008/09					10				4			
Common Tern	5	2007/08							1					
Arctic Tern	4	2007/08									32	10		
Arctic Tern	4	2008/09								5				

Species	Count Sector	Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Arctic Tern	5	2007/08									3			
Guillemot	2	2007/08								1				

APPENDIX 20C: HINKLEY INTERTIDAL BIRD REPORT

EDF Development Company Ltd

Hinkley

Intertidal Bird Report 2010-11

June 2011

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EDF Development Company Ltd

Hinkley

Intertidal Bird Report 2010-11

June 2011

AMEC Environment & Infrastructure
UK Limited

Document Revisions

28132cw064	Report template changed for consistency reasons but no other changes have been made	Not relevant as content unchanged since original issue date

Contents

1. Introduction

1.1 Purpose of this Report

EDF Development Company Ltd (EDF) is proposing to submit a planning application for a new nuclear power station at Hinkley Point, Somerset. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) has been commissioned to co-ordinate the baseline ornithological and terrestrial ecological survey work to support this application. Ornithological desk study and survey work relating to the development proposal commenced in April 2007. Results from the programme of ornithological work undertaken within the immediate vicinity of the proposed site for new nuclear build during 2007-09 are summarized in the Hinkley Baseline Ornithological Report (Entec doc. ref. 19801cb376).

The effects of warm water emitted from the outfall facility of the new nuclear Power Station has been identified as a potential impact on the populations of waterfowl (including waders, ducks and geese) using the mudflats to the east of the existing built power plant. This intertidal area is located within the Severn Estuary Special Protection Area (SPA) and Ramsar site, and the Bridgwater Bay SSSI. In order to provide additional information on the location and numbers of waterfowl using mudflats that could be potentially affected by the warm water outfall, additional intertidal bird surveys were undertaken between April 2010 and January 2011 inclusive. This report summarises the findings from these surveys.

1.2 Scheme Description

An area of land directly west of the Hinkley 'A' and 'B' Power Stations has been identified as having the potential to accommodate nuclear new build. The new power station and the majority of associated permanent terrestrial infrastructure will be situated in fields adjacent to the coast[1], with additional temporary infrastructure located to the south of this (e.g. construction compounds and areas for soil storage). This area is referred to as The Strategic Site Area (SSA), the boundary of which is shown on **Figure 1.1**.

The new build will also require additional infrastructure remote from the immediate terrestrial site footprint. This will include a warm water intake and outfall and a marine aggregates jetty extending offshore from the intertidal zone adjacent to the northern SSA boundary. The location of the outfall has not been confirmed but is likely to be at least 1km offshore from the existing Hinkley site. Modelling work undertaken to determine the most suitable location for the outfall indicates that the warm water plume emitted from the outfall, is likely to drift onto mudflats to the east of the SSA. The location of the study area for the 2010-11 intertidal surveys has been informed by this modelling work, and incorporates mudflats and other intertidal habitat east of the SSA, between Hinkley Point and Stert Point.

[1] Extending as far inland as the east-west Green Lane (also a footpath) that runs along the ridge towards the middle of the SSA.

1.3 Study Area Description and Context

The study area comprises much of the Stert Flats and includes a 7km stretch of intertidal habitat between Hinkley Point and Stert Point. The extent of intertidal mudflats exposed at low water broadens in the east, being only 800m from Mean High Water at Hinkley Point, to at least 3km offshore between Wall Common and Stert Point. A narrow band of saltmarsh (50-150m wide) runs along the high water mark along much of the length of the study area, from Stolford to Stert Point, with two large intertidal rock platforms located at Hinkley Point and Stolford. Immediately south of this (on the landward side of the Stert Flats) are Catsford Common and Wall Common (areas of rough, unimproved grassland and scrub) and open farmland (comprising both pasture and arable) interspersed by water-filled ditches. There are no major rivers flowing into the intertidal habitat within the study area, although immediately to the east of the study area is the mouth of the Parrett River.

Within the wider area, the Stert Flats form much of the intertidal mudflats of Bridgwater Bay, west of the Parrett River estuary, extending east to the beach front of Burnham-on-Sea. Bridgwater Bay (including the Stert Flats and Parrett Estuary) form a substantial part of the intertidal habitat resource of the Severn Estuary. Bridgwater Bay is located in Somerset on the southern banks of the Severn Estuary along the lower reaches of the Bristol Channel.

1.4 Background and Scope

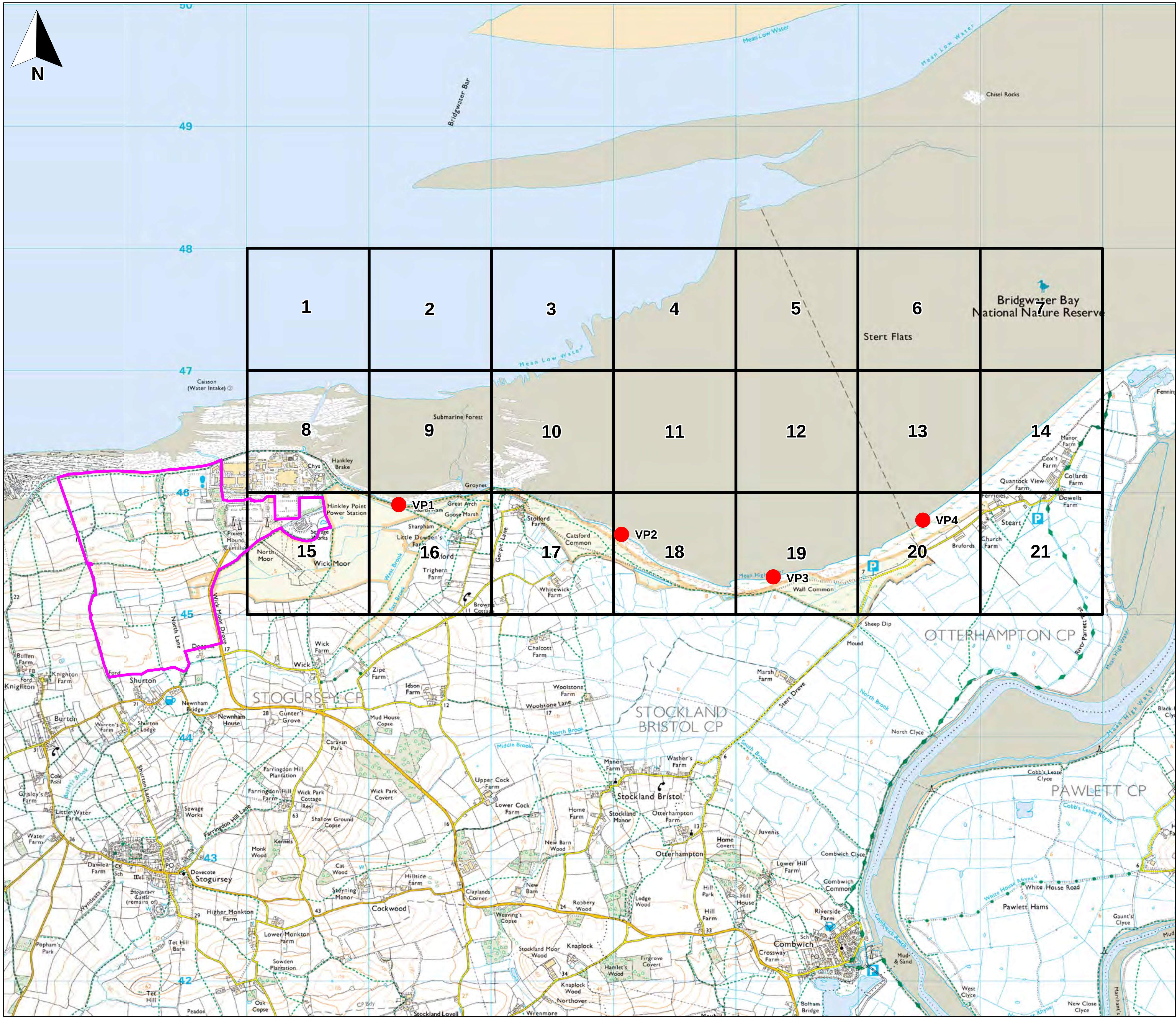
The key potential ornithological issues relating to the proposed warm water outfall at Hinkley are:

- Thermal regime change (caused by discharge of cooling water) leading to changes in the composition of intertidal benthic communities and the abundance and biomass of individual invertebrate prey species within them;
- The potential of the impact identified above to have significant adverse effects on the species that form the cited interest of the European and nationally designated sites adjacent to the planning application boundary.

There is no guidance available that details potentially appropriate methodologies for ornithological survey work aimed at informing EIA for new nuclear power station proposals. The bird survey programme for Hinkley has therefore been based on the results of previous desk study and bird surveys undertaken in the SSA, consultation with Natural England and RSPB and professional judgment. The potential for species protected under Schedule 1 of the Wildlife & Countryside Act 1981 (as amended)[2] and / or listed under Annex 1 of the EC Directive on the Conservation of Wild Birds (79/409/EEC), commonly referred to as the Birds Directive[3] to occur within the study area was the subject of specific investigation. Migratory water birds forming part of the featured interest of designated sites were also considered.

[2] All species of wild birds are afforded some degree of protection under the Wildlife and Countryside Act 1981 (as amended). Some species are considered to be rare or vulnerable and receive increased protection through their inclusion on Schedule 1 of the Act.

[3] Certain endangered, rare, or vulnerable bird species, which warrant special protection, are included on Annex 1 of the European Communities Council Directive on the Conservation of Wild Birds (79/409/EEC).



Hinkley Intertidal Bird Report 2010-11

Figure 1.1
Strategic Site Area and Study Area

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2. Methodology

2.1 Desk Study

To understand the ornithological context of the study area, the locations and qualifying features of Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs) of ornithological importance within, or adjacent to the study area were determined through the use of the websites www.magic.gov.uk, www.jncc.gov.uk, www.naturalengland.org.uk, and other published sources. The location of these statutory designated sites is shown in **Figure 2.1**.

2.2 Bird Surveys

The key objective of the bird surveys undertaken on the Stert Flats in 2010-11 was to provide a suitable baseline for the evaluation of the potential effects of the warm water plume on the intertidal bird communities present in the area, and in particular the effects on those species that form the qualifying interest of the Severn Estuary SPA and Ramsar site.

2.2.1 Intertidal and Inshore Marine Bird Survey

In order to evaluate the level and type of use of the Stert Flats by waterfowl, intertidal and inshore marine bird surveys were undertaken on a regular basis, commencing in April 2010. Surveys were carried out from four observation points. The National Grid References of these are as follows:

- ST 223 459;
- ST 241 456;
- ST 253 453;
- ST 265 457.

The entire study area was divided into a 200m by 200m square grid system. The observation points and the grid area are shown on **Figure 1.1**. Each 1km square was assigned a unique number (1-21), within which, each 200m square was assigned a unique letter (A-N and P-Z). Due to the distance from the nearest observation point to the 1km squares numbered 1-7 (i.e. greater than 1km) very few birds were recorded in these squares. However, for completeness, records from all the 21 1km squares have been included.

In order to describe the type of habitats visible from each observation point, the study area has for ease of description been divided into four areas, those areas visible from each observation point (Count Sectors 1-4 respectively). The area within each count sector approximately equates to that within the following 1km grid square numbers:

- Count Sector 1: 1km grid squares 1, 2, 8, 9, 15 and 16;
- Count Sector 2: 1km grid squares 3, 4, 10, 11, 17 and 18;

- Count Sector 3: 1km grid squares 5, 12 and 19;
- Count Sector 4: 1km grid squares 6, 7, 13, 14, 20 and 21.

Table 2.1 describes the characteristics of the intertidal habitat within each Count Sector.

Table 2.1 Characteristics of the Shore from each Observation Point[4]

Count Sector	Description of Extent and Characteristics of Shore at Mean High Water	Description of Extent and Characteristics of Shore at Mean Low Water
1	Very little intertidal habitat is visible at Mean High Water	The mudflats extend for 600-800m at low water. The rock platform at Hinkley Point (in the west of the count sector) extends 600m from the mean high water mark. In the east of the count sector, the Stolford rock platform extends for 700m. Just below the high water mark between the two rock platforms is a narrow (30-50m wide) band of shingle beach.
2	A narrow band of shingle (20-60m wide) is visible at mean high water, inland of which is Catsford Common (rough grassland and scrub)	The extent of mudflats exposed at low water within the count sector broadens from 800m in the west to 3km in the east. The eastern edge of the Stolford rock platform is visible in the west of the count sector. Just below the high water mark, adjacent to the rock platform is a narrow band of shingle beach.
3	A narrow band of saltmarsh (up to 90m wide) is visible above the mean high water mark, behind which is farmland and Wall Common (rough grassland and scrub).	Up to 3.4km of mudflats extend offshore at low water of which 2.8km are included in the grid area.
4	A band of saltmarsh (150-200m wide) is visible at mean high water behind which is farmland and a number of farmsteads. The eastern end of the count sector extends towards Stert Point and Fenning Island.	Up to 3-4km of mudflats are exposed at low water, of which1.2-2.2km are included in the grid area.

The aim of the survey work was to record the numbers, diversity and activity of waterfowl present and to identify areas of importance for birds (in the intertidal zone and inshore marine waters) during the tidal cycle. On each survey day, surveys were conducted over six full hours from a particular observation point, so that any changes or patterns in bird distribution across the tidal cycle could be identified. During each six hour period, a series of 12 counts were undertaken at 30 minute intervals from the same observation point. Approximately 4-5 six-hour sessions were undertaken from each observation point each month.

During each count, the intertidal area and inshore waters were scanned using binoculars and a high-powered telescope, and all species of waterfowl (including swans, geese, ducks, grebes, cormorants, herons and waders) were recorded. The counts provide a ‘snapshot survey’ of the birds present at that particular time. All wildfowl using (i.e. foraging, resting, etc.) the intertidal habitat and the inshore waters within the grid area were systematically recorded. Numbers and apparent behaviour were noted and their 200m^2 grid square location recorded. The start times of the surveys were varied to incorporate a full range of the tidal cycle at each observation point.

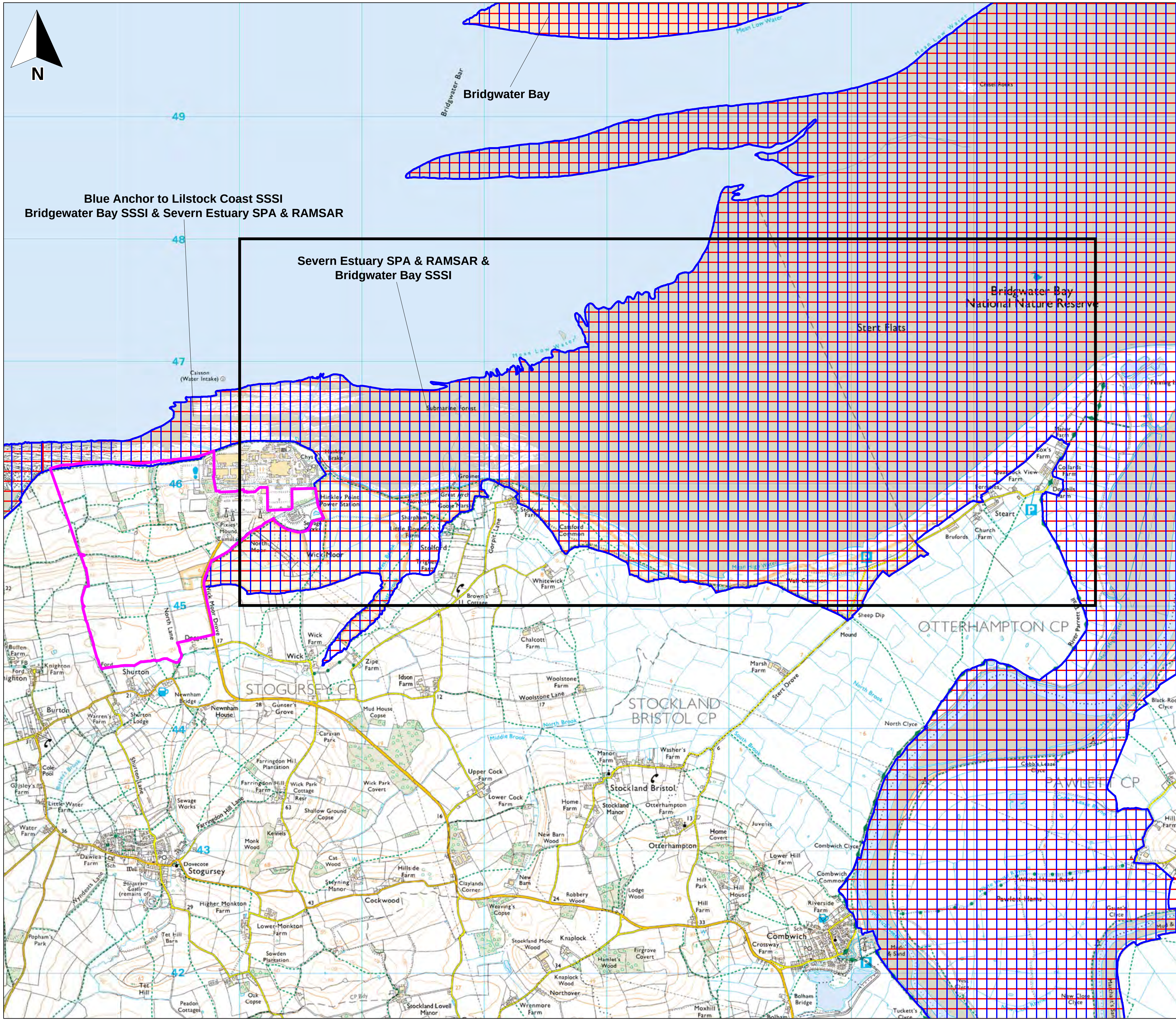
[4] This basic summary of the dominant intertidal habitats within each sector is included here to inform the reader. A more formal and scientific description of the shore will be produced as part of the marine biological studies that will be an integral part of the EIA for the site.

A team of four surveyors were employed to survey the four observation points on a rotational basis over the survey period.

A total of 2,365 counts were undertaken on 123 survey dates between April 2010 and January 2011 inclusive, involving approximately 590 counts from each observation point. **Table 2.2** presents the dates on which surveys were undertaken.

Table 2.2 Intertidal and Inshore Marine Survey Dates from each Observation Point

Month	Obs 1	Obs 2	Obs 3	Obs 4
April 2010	19,20,21,22,23	19,20,21,22,23	19,20,21,22,23	19,20,21,22,23
May	18,19,20,26,28	18,20,21,24,27	11,12,13,27,28	17,18,19,21,22
June	7,8,9,10,11	7,8,9,10	7,8,9,10,11	7,8,9,10,11
July	26,27,28,29,30	8,9,10,22,24	6,19,23,27,28	8,9,10,19,28,29
August	10,12,16,24,31	23,24,27	10,11,13,24,25	16,17,29,30,31
September	20,21,24,30	14,17,20,23,27	25,26,27,30	13,14,16,17,19
October	11,12,14,15,17	7,8,14,22,27	13,21,26,28,29	3,8,12,13
November	10,17,18,25,30	13,16,18,20,22	10,12,15,18,19	16,23,24,26,29
December	5,7,13,15,30	7,8,14,15,16	11,13,15,19,21	6,10,28,29,31
January 2011	11,17,20,24,26	18,19,26,27,28	20,21,29,30,31	18,21,24,25,27



Key

- SSA boundary
- Study area
- SPA and Ramsar
- SSSI

0 m 1000 m

Scale 1:30,000 @ A3

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Hinkley Intertidal Bird Report 2010-11

Figure 2.1
Statutory designated sites of ornithological importance

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3. Results

3.1 Designated Sites of Ornithological Importance

3.1.1 European Designated Sites

The intertidal habitat within the study area is located entirely within the Severn Estuary SPA. The SPA was classified on the basis of its wintering bird interest and for the large numbers of waterfowl that regularly use the site.

The SPA qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex 1 of the Directive:

Over winter:

- Tundra (Bewick's Swan) (*Cygnus columbianus bewickii*), 280 individuals representing approximately 3.9% of the wintering population in Great Britain (5 year peak mean 1991/2 – 1995/6).

The site also qualifies under Article 4.2 of the Directive by supporting populations of European importance of the following migratory species:

Over winter:

- Russian white-fronted goose (*Anser albifrons albifrons*), 2,664 individuals representing 0.4% of the North-western Siberian. North-eastern European and North-western European wintering population (5 year peak mean 1991/2 – 1995/6);
- Dunlin (*Calidris alpina alpina*), 44,624 individuals representing at least 3.2% of the wintering Northern Siberian, European and Western African population (5 year peak mean 1991/2 - 1995/6);
- Gadwall (*Anas strepera*), 282 individuals representing approximately 0.9% of the wintering North-west European population (5 year peak mean 1991/2 - 1995/6);
- Redshank (*Tringa totanus*), 2,330 individuals representing at least 1.6% of the wintering Eastern Atlantic population (5 year peak mean 1991/2 - 1995/6); and
- Shelduck (*Tadorna tadorna*), 3,330 individuals representing at least 1.1% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6).

The SPA also qualifies under **Article 4.2** of the Directive by regularly supporting at least 20,000 waterfowl:

> *"Over winter, the area regularly supports 93,986 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Gadwall, Shelduck, Pintail, Dunlin, Curlew, Redshank, Bewick's Swan, Wigeon, Lapwing (Vanellus vanellus), Teal, Mallard (Anas platyrhynchos), Shoveler, Pochard, Tufted Duck (Aythya*

fuligula), Grey Plover (Pluvialis squatarola), White-fronted Goose and Whimbrel."

Subsequent to the publication of the data above (as included in the Natura 2000 Standard Data Form), the following changes have been suggested by the SPA Review (Stroud *et al.*, 2001):

Removal of the following species that originally qualified under Article 4.2 of the Directive:

- Russian white-fronted goose;
- Gadwall.

Addition of the following species that now qualify under Article 4.2 of the Directive by supporting populations of European importance:

- On passage:
  - Ringed Plover *Charadrius hiaticula*, 655 individuals representing at least 1.3% of the Europe/Northern Africa wintering population (5 year peak mean 1991/2 – 1995/6).
- Over winter:
  - Curlew *Numenius arquata*, 3,903 individuals representing at least 1.1% of the wintering European population (5 year peak mean 1991/2 – 1995/6);
  - Pintail *Anas acuta*, 599 individuals representing at least 1.0% of the wintering Northwestern Europe population (5 year peak mean 1991/2 – 1995/6).

The SPA Review has yet to be formally adopted, although in practice SPA Review information (regarding additional species) is given the same credence by nature conservation consultees as that contained on the Natura 2000 Data Sheets.

3.1.2 Internationally Designated Sites

The intertidal habitat within the study area is located entirely within the Severn Estuary Ramsar Site, which shares a common boundary with the Severn Estuary SPA and Bridgwater Bay SSSI in this location (ref **Figure 2.1**). The Severn Estuary qualifies as a Ramsar site under Criterions 5 and 6 of the Ramsar Convention due to the internationally important bird assemblage and individual populations that occur.

Qualifying ornithological interest listed on the Ramsar Information Sheet is summarised as follows:

- During winter the site supports an assemblage of 70,919 waterfowl (5 year peak mean 1998/99-2002/03).

Under Criterion 6, during the winter the site supports internationally important numbers of:

- Tundra (Bewick's) swan (*Cygnus columbianus bewickii*), 229 individuals representing an average of 2.8% of the GB population (5 year peak mean 1998/99-2002/03);
- Greater white-fronted goose (*Anser albifrons*), 2,076 individuals representing an average of 35.8% of the GB population (5 year peak mean for 1996/97-2000/01);

- Common shelduck (*Tadorna tadorna*), 3,223 individuals representing an average of 1% of the north-western European population (5 year peak mean 1998/99-2002/03);
- Gadwall (*Anas strepera strepera*), 241 individuals representing an average of 1.4% of the GB population (5 year peak mean 1998/99-2002/03);
- Dunlin (*Calidris alpina alpina*), 25,082 individuals representing an average of 1.8% of the Western Siberian / Western European population (year peak mean 1998/99-2002/03);
- Redshank (*Tringa totanus totanus*), 2,616 individuals representing an average of 1% of the population (5 year peak mean 1998/99-2002/03).

Species identified on the Ramsar Information Sheet for possible future consideration under Criterion 6 are as follows:

- Lesser black-backed gull (*Larus fuscus graellsii*), a breeding season population of 4,617 apparently occupied nests, representing an average of 2.8% of the breeding population (Seabird 2000 Census);
- Ringed plover (*Charadrius hiaticula*), 740 individuals representing an average of 1% of the European / North-west African passage population (5 year peak mean 1998/99-2002/03);
- Teal (*Anas crecca*), 4,456 individuals representing an average of 1.1% of the north-west European wintering population year (5 peak mean 1998/99-2002/03);
- Pintail (*Anas acuta*), 756 individuals representing an average of 1.2% of the population (5 year peak mean 1998/99-2002/03).

In addition to these species currently and potentially forming the cited interest of the Ramsar Site, a number of species occur at nationally important levels during the breeding season, passage periods and over winter. These are:

- Herring gull (*Larus argentatus argentatus*), 1,540 apparently occupied nests, representing an average of 1.1% of the GB breeding population (Seabird 2000 Census);
- Little egret (*Egretta garzetta*), 17 individuals, representing an average of 1% of the GB passage population (5 year peak mean 1998/9-2002/3);
- Ruff (*Philomachus pugnax*), 12 individuals, representing an average of 1.7% of the GB passage population (5 year peak mean 1998/9-2002/3);
- Whimbrel (*Numenius phaeopus*), 333 individuals, representing an average of 11.1% of the GB passage population (5 year peak mean 1998/9-2002/3);
- Curlew (*Numenius arquata arquata*) 2,021 individuals, representing an average of 1.3% of the GB passage population (5 year peak mean 1998/9-2002/3);
- Common greenshank (*Tringa nebularia*), 26 individuals, representing an average of 4.3% of the GB passage population (5 year peak mean 1998/9-2002/3);

- Wigeon (*Anas penelope*), 4,658 individuals, representing an average of 1.1% of the GB wintering population (5 year peak mean 1998/9-2002/3);
- Northern shoveler (*Anas clypeata*) 297 individuals, representing an average of 2% of the GB wintering population (5 year peak mean 1998/9-2002/3);
- Common pochard (*Aythya farina*) 1,118 individuals, representing an average of 1.8% of the GB wintering population (5 year peak mean 1998/9- 2002/3);
- Water rail (*Rallus aquaticus*), 11 individuals, representing an average of 2.4% of the GB wintering population (5 year peak mean 1998/9-2002/3);
- Spotted redshank (*Tringa erythropus*) 10 individuals, representing an average of 7.3% of the GB wintering population (5 year peak mean 1998/9-2002/3).

In addition to the bird interest the site has also been designated for extensive areas of intertidal sand and mudflats, intertidal rock platforms, vegetated shingle beach and maritime grasslands with freshwater and brackish ditches, which support nationally important plant species. Sea lamprey (*Petromyzon marinus*) occurs at the site at an internationally important level.

3.1.3 Nationally Designated Sites

The intertidal habitat within the study area is located entirely within the Bridgwater Bay SSSI which covers a total area of 3,574ha (35.74km^2). Its position is shown on **Figure 2.1**.

The SSSI is of national importance for the succession of habitats it supports. These include intertidal mud, wave-cut platforms, cliffs, sand dunes, shingle ridges and extensive areas of saltmarsh. Associated with these habitats are internationally and nationally important assemblages of wintering and passage migrant waders and waterfowl, and a diverse invertebrate fauna. The SSSI supports internationally important numbers of passage whimbrel[5] and black-tailed godwit (*Limosa limosa*) and nationally important numbers of overwintering dunlin and wigeon. Shelduck use the bay as a moulting ground, and are also present in nationally important numbers.

The Severn Estuary is used by internationally important numbers of dunlin, shelduck, wigeon, curlew, redshank and teal and nationally important numbers of ringed plover and grey plover. Knot (*Calidris canutus*), turnstone (*Arenaria interpres*), snipe (*Gallinago gallinago*) and mallard also occur. Bridgwater Bay SSSI is used by a substantial proportion of the overall waterfowl and wader populations of the Severn Estuary. The SSSI is also ecologically linked to the Somerset Levels, which provide additional winter-feeding grounds for large numbers of waders and wildfowl.

[5] The information contained in the SSSI site description is dated, and for black-tailed godwit may never have been wholly accurate. Since the early 1980s there has been a decline in the whimbrel population using Bridgwater Bay. It is possible that birds have moved to other locations within the estuary, but the precise reason for the decline is unknown. It remains of national importance (Archer, *in litt*). Black-tailed godwit numbers, in contrast, are increasing at regional and national level. This is due to the success of the Icelandic breeding population, and numbers of birds using the area on autumn passage regularly exceed the threshold of national importance, while winter numbers are also approaching this threshold (Archer, *in litt*).

3.2 Intertidal and Inshore Marine Bird Surveys

Intertidal and inshore marine surveys conducted between April 2010 and January 2011 inclusive (the survey period) resulted in a total of 16 species of wildfowl, 19 species of wader and 6 additional species of seabird and water bird being recorded. A summary account of the type and level of use of the study area by each species that appears as designated or cited interest of the Severn Estuary SPA/Ramsar site and/or Bridgwater Bay SSSI is provided below. The peak and mean monthly counts recorded (for all species) from each observation point are presented in **Table A1** in **Appendix A**. The peak counts (sum of all counts) recorded in each 200m grid square between April 2010 and January 2011 inclusive are shown in **Figures 3.1a-p**, for shelduck, wigeon, gadwall, teal, mallard, pintail, shoveler, tufted Duck, ringed Plover, grey plover, lapwing, dunlin, black-tailed godwit, whimbrel, curlew and redshank respectively.

3.2.1 Qualifying / Assemblage Species

Of the species that appear as designated features of the Severn Estuary SPA; gadwall, shelduck, dunlin and redshank were recorded during the intertidal surveys undertaken between April 2010 and January 2011, but not Bewick's swan or white-fronted goose. Ringed plover, curlew and pintail (which appear in the SPA Review) were noted. Teal, wigeon, mallard, shoveler, tufted duck, lapwing, grey plover and whimbrel which are listed in the waterfowl assemblage qualification for the SPA were recorded, but not pochard. Black-tailed godwit, which appears as a cited feature of the Bridgwater Bay SSSI was also recorded.

Shelduck *(Tadorna tadorna)* [SPA, Ramsar & SSSI Qualifying Species]
Shelduck were recorded in the study area on all 123 survey dates between April 2010 and January 2011 inclusive, with the largest numbers generally seen between late July and early November, including a peak count of 2,049 foraging and loafing birds from observation point 4 on 31 August. Foraging shelduck were widely distributed across the intertidal habitat within the study area (see **Figure 3.1a**). Large counts included 1,670 birds foraging on mudflats, offshore between Catsford Common and Wall Common on 26 October, with 1,520 birds there on 26 September. Other counts in excess of 1,000 birds were noted on mudflats between Hinkley Point and Stolford, and in the east of the study area, offshore of Stert village. Large congregations of roosting shelduck were also noted at a number of locations, including 450 birds on rocks at Stolford on 31 August, and 425 on nearby mudflats on 30 September. Further west, 206 shelduck were roosting on rocks at Hinkley Point on 31 August, with 400 on nearby mudflats on 17 October. The largest numbers of foraging birds were present on the tidal mudflats at low water, with birds moving off these areas, with incoming water, to loaf on the sea or roost on the upper reaches of the shoreline, including on the rock platforms at Stolford and Hinkley Point. Numbers of shelduck in excess of 1% of the Severn Estuary SPA qualifying population of this species (3,330 birds) were recorded from observation points 1-4, on 46, 47, 45 and 39 survey dates respectively.

Wigeon (*Anas penelope*) [SPA Assemblage and SSSI Qualifying Species]
Wigeon were recorded in the study area on 37 (of 123) survey dates, with the first birds seen on 20 September 2010. Wigeon were widely distributed across the study area (see **Figure 3.1b**), with the largest numbers seen in November-January, and a peak count of 312 birds seen from observation point 1 on 24 January. Numbers however were generally much lower than this, with total counts from each observation point generally in the region of 20-100 birds. Small groups of wigeon were seen foraging along creeks and in the shallows along the shoreline

throughout the study area. Flocks of roosting wigeon were more infrequently seen, with the largest being 211 birds on mudflats between Hinkley Point and Stolford on 20 January. Numbers of wigeon in excess of 1% of the Severn Estuary population of this species (8,466 birds, Calbrade *et al.*, 2010) were recorded from observation points 1-4, on 4, 3, 1 and 0 survey dates respectively.

Gadwall (*Anas strepera*) [SPA and Ramsar Qualifying Species]

Gadwall were recorded on two survey dates, involving one bird loafing on mudflats offshore of Wall Common on 16 November, and two loafing on mudflats between Hinkley Point and Stolford on 30 December (see **Figure 3.1c**). Numbers of gadwall in excess of 1% of the Severn Estuary SPA qualifying population of this species (282 birds) were not recorded from any observation point during the intertidal surveys.

Teal (*Anas crecca*) [SPA Assemblage and Possible Future Ramsar Site Qualifying Species, SSSI Qualifying Species]

Teal were recorded on seven survey dates (six of which were in December 2010). The peak count was of 27 teal loafing on the upper shore, between Hinkley Point and Stolford on 30 December. However, most records were of 1-5 birds either loafing or roosting on the upper shoreline, or foraging in mudflat creeks (see **Figure 3.1d**). Numbers of teal in excess of 1% of the Severn Estuary population of this species (4,916 birds, Calbrade *et al.*, 2010) were not recorded from any observation point during the intertidal surveys.

Mallard (*Anas platyrhynchos*) [SPA Assemblage Species]

Mallard were recorded on 84 (of 123) dates throughout much of the survey period, although the largest numbers were most consistently recorded between August and January, and the lowest numbers in April and May. There was a clear bias towards the western half of the study area, with very few mallard noted from observation point 4 in the east (see **Figure 3.1e**). The largest count of mallard was of 87 birds roosting on rocks at Hinkley Point on 31 August, and other groups of roosting birds were noted at various locations on the mudflats and rocks around Hinkley and Stolford. The largest numbers of foraging birds were seen on mudflats between Hinkley Point and Wall Common, including 40 offshore from Wall Common on 27 September. Numbers of mallard in excess of 1% of the Severn Estuary population of this species (3,385 birds, Calbrade *et al.*, 2010) were recorded from observation points 1-4, on 2, 10, 0 and 0 survey dates respectively.

Pintail (*Anas acuta*) [SPA Review and Possible Future Qualifying Ramsar Site Species]

Pintail were recorded on a total of 67 (of 123) survey dates between April 2010 and January 2011. Up to two birds were seen at various locations within the study area between 19 April and 9 June, after which none were seen until 31 August. Larger numbers of pintail were then seen from late September until the end of the survey period in January. The largest numbers of pintail were recorded most consistently from October to December, with a peak total of 158 birds seen from observation point 3 on 14 December. There was a bias of records towards the west and centre of the study area, with few pintail seen from observation point 4 in the east (see **Figure 3.1f**). In the west of the study area, groups of pintail were seen foraging on the mudflats, or loafing and roosting on the upper reaches of the shoreline and rock platforms at various locations. Large counts of pintail included 135 loafing on mudflats between Hinkley Point and Stolford on 13 December, and 130 foraging on mudflats near Stolford on 14 December. Numbers of pintail in excess of 1% of the Severn Estuary SPA Review population of this species (599 birds) were recorded from observation points 1-4, on 21, 18, 12 and 0 survey dates respectively.

Shoveler (*Anas clypeata*) [SPA Assemblage]

Shoveler were recorded on a total of 10 (of 123) survey dates between April 2010 and January 2011 inclusive. A single bird was seen from observation point 4 on 28 July, followed by 90 birds loafing on mudflats between Catsford and Wall Commons on 18 November. These records were then followed by a scattering of sightings of 1-3 birds across the study area from 30 November to 31 December (see **Figure 3.1g**). Numbers of shoveler in excess of 1% of the Severn Estuary population of this species (561 birds, Calbrade *et al.*, 2010) were recorded on one survey date (from observation point 3).

Tufted Duck (*Aythya fuligula*) [SPA Assemblage]

One or two tufted ducks were seen on four surveys dates, loafing or foraging in creeks between Hinkley Point and Stert village, on 28 July, 8 and 17 October and 5 December (see **Figure 3.1h**).

Ringed Plover *(Charadrius hiaticula)* [SPA Review and Possible Future Qualifying Ramsar Site Species]

Ringed plovers were recorded on 64 (of 123) survey dates between April 2010 and January 2011, although there were a number of periods when the species was not seen for several consecutive survey dates. The largest numbers of ringed plovers were seen in April-June and in August, although the intertidal habitat viewed from observation point 2 held high numbers of birds until November, and relatively few birds were seen in the west of the study area from observation point 1. In general, up to 70 ringed plover were counted in the study area on most survey dates, primarily on mudflats between Stolford and Stert village in the east of the study area (see **Figure 3.1i**). However, on two consecutive dates (16 and 17 August) very large numbers of ringed plover (378 and 702 birds respectively) were seen in the east of the study area. On 16 August, a flock of 350 ringed plover were foraging on mudflats offshore of Stert village, and on the following day, 687 birds were counted there. Much smaller numbers of roosting ringed plover were seen, with the largest count being on 40 birds on the shingle beach between Catsford and Wall Commons on 19 April. This site was used infrequently however, and nowhere within the study area held more than 20 birds on a regular basis. Numbers of ringed plover in excess of 1% of the Severn Estuary SPA Review population of this species (655 birds) were recorded from observation points 1-4, on 4, 18, 15 and 17 survey dates respectively.

Grey Plover *(Pluvialis squatarola)* [SPA Assemblage Species]

Grey plover were recorded on a total of 71 (of 123) survey dates between April 2010 and January 2011 inclusive. Birds were primarily seen during two periods, with very small numbers of grey plover (maximum of 7 birds) recorded during spring passage in April and May, and much larger numbers during autumn passage and winter, from September onwards. The largest numbers of grey plover were counted from October to January, with a peak count of 975 birds seen from observation point 4 on 18 November. There was a clear bias towards the eastern half of the study area, with relatively few birds seen on the mudflats in the west, between Hinkley Point and Stolford (see **Figure 3.1j**). Other large counts of grey plover included 890 foraging on mudflats offshore of Wall and Catsford Commons on 19 November, and 590 foraging offshore of Stert village on 3 October. Large congregations of roosting grey plover were seen at high tide on the saltmarsh and adjacent mudflats, offshore of Stert village, with 200 birds there on 12 November. The shingle beach and mudflats adjacent to Wall and Catsford Commons were also favoured areas for roosting grey plovers, albeit in smaller numbers (up to 70 birds). Numbers of grey plover in excess of 1% of the Severn Estuary population of this species (416 birds, Calbrade *et al.*, 2010) were recorded from observation points 1-4, on 0, 7, 19 and 26 survey dates respectively.

Lapwing (*Vanellus vanellus*) [SPA Assemblage Species]

Lapwing were recorded on a total of 24 (of 123) survey dates between April 2010 and January 2011 inclusive. Birds were seen from 26 September to 28 January and were recorded from all observation points (see **Figure 3.1k**). The largest number of lapwings were recorded from October to January, with a peak count of 412 loafing and foraging birds on mudflats and adjacent shingle from observation point 3 (i.e. between Catsford and Wall Commons) on 19 December. This was followed by 209 birds in the same area on 21 December. Apart from the two counts in December, foraging lapwing were seen infrequently in the study area. Small groups of up to 45 roosting lapwing were seen at various locations in the study area, on mudflats and on the upper reaches of the shoreline. Numbers of lapwing in excess of 1% of the Severn Estuary population of this species (15,693 birds, Calbrade *et al.*, 2010) were recorded on two survey dates, both from observation point 3.

Dunlin (*Calidris alpina*) [SPA, Ramsar Site and SSSI Qualifying Species]

Dunlin were recorded on a total of 99 (of 123) survey dates between April 2010 and January 2011 inclusive. Birds were seen throughout much of the survey period, with by far the largest numbers occurring during winter, from October onwards. There was again, a clear bias towards the eastern half of the study area, with very large numbers of dunlin recorded on the mudflats east of Stolford, and relatively few around Hinkley Point (see **Figure 3.1l**). The largest count was of 12,590 dunlin, which were seen from observation point 4 on 31 December, and numbers in excess of 5,000 birds were noted on a further seven survey dates from observation point 4, and on two dates from observation point 3. Overall, flocks of 1,000 or more dunlin were seen on a frequent basis during winter, foraging on the mudflats east of Stolford. Congregations of roosting dunlin at high tide were also seen at a number of locations at high tide, included 860 birds on mudflats adjacent to Wall and Catsford Commons on 28 December, and 700 on the saltmarsh by Stert village on 12 November. Numbers of dunlin in excess of 1% of the Severn Estuary SPA qualifying population of this species (44,624 birds) were recorded from observation points 1-4, on 0, 13, 19 and 20 survey dates respectively.

Black-tailed Godwit (*Limosa limosa*) [SSSI Qualifying Species]

Black-tailed godwits were recorded on 27 (of 123) survey dates between April 2010 and January 2011 inclusive. This species was seen infrequently throughout much of the survey period, although there was a concentration of records during the period from 10 August to 14 October (the autumn passage period), and there was a bias of sightings towards the eastern half of the study area (see **Figure 3.1m**). Black-tailed godwits were seen on one survey date during the spring passage period (April-May) involving nine birds foraging on mudflats between Hinkley Point and Stolford on 18 May. The species was also seen infrequently during the winter period covered by the surveys (November-January), with up to 14 birds noted on five survey dates. During the autumn passage period (July-October) the largest counts of black-tailed godwit were recorded in September, with up to 160 birds foraging on mudflats offshore between Catsford and Wall Commons, and up to 125 on mudflats off Stert village. Very few black-tailed godwits were recorded in the study area west of Stolford and very few roosting birds were seen. Numbers of black-tailed godwit in excess of 1% of the Bridgwater Bay population of this species (226 birds[6]) were recorded from observation points 1-4, on 3, 1, 5 and 12 survey dates respectively.

Whimbrel *(Numenius phaeopus)* [SPA Assemblage and SSSI Qualifying Species]

Whimbrel were recorded on 37 (of 123) survey dates between April 2010 and January 2011 inclusive. Birds were seen during two periods, with much larger numbers noted during spring passage (April to early June) than autumn passage (July to September). During the spring passage period, whimbrel were recorded on all but one survey date between 19 April (the start of the survey) and 11 June. Large numbers of whimbrel were recorded in April, with a total of 254 birds counted in the entire study area on 21 April, 173 birds on 22 April and 115 on 23 April (surveys were undertaken from all observation points on these dates). Smaller numbers of whimbrel were recorded during May and early June (generally 10-20 birds). Flocks of foraging whimbrel were widely distributed across much of the mudflats in the study area (see **Figure 3.1h**). A total of 104 whimbrel were seen foraging on mudflats just east of Stolford on 21 April, and counts of 20-30 birds were noted off Stert village, also during late April. The mudflats between Hinkley Point and Stolford rock platform were also used by good numbers of foraging whimbrel, with a peak count of 43 birds there on 22 April. Groups of roosting birds at high tide were primarily seen in April, with very few noted thereafter. No regular roosting areas were identified during the surveys, with the only count in excess of ten birds being 46 on the saltmarsh and mudflats adjacent to Stert village on 23 April. Returning whimbrel were first seen on 19 July after which generally 5-10 birds were noted regularly until the last record on 14 September. Numbers of whimbrel in excess of 1% of the Severn Estuary population of this species (171 birds, Calbrade *et al.*, 2010) were recorded from observation points 1-4, on 15, 12, 15 and 14 survey dates respectively.

Curlew *(Numenius arquata)* [SPA Review Qualifying Species, Potential Future Ramsar Qualifying Species]

Curlew were recorded on all but one of the 123 survey dates between April 2010 and January 2011 inclusive. During spring passage, curlew were seen in April (generally 20-40 birds on mudflats between Stolford and Stert village), with numbers declining in May to 5-10 birds from each observation point. The largest numbers of curlew were however recorded from July to January, during the autumn passage and winter periods, covered by the surveys. There was a bias towards the eastern half of the study area (see **Figure 3.1o**), with counts exceeding 500 birds noted from observation points 3 and 4 during November and December, including a peak count of 739 birds from observation point 4 on 28 December. The largest numbers of foraging birds were seen on mudflats offshore of Catsford and Wall Commons (peak count of 400 birds on 26 September) and on mudflats adjacent to Stert village (peak count of 706 on 28 December). Much smaller numbers of curlew were seen foraging on mudflats around Hinkley Point (generally up to 10 birds), and Stolford (generally, 10-30 birds). Notable congregations of roosting and loafing birds at high tide were seen on the saltmarsh and adjacent mudflats next to Stert village (110 birds on 27 January) and on the shingle and mudflats adjacent to Catsford Common, including 229 birds on 22 October. Roosting birds were more infrequently recorded on the rocks and surrounding mudflats at Hinkley Point, where generally 1-10 birds were noted. Numbers of curlew in excess of 1% of the Severn Estuary SPA Review population of this

[6] This figure is derived from the peak monthly count on the Parrett Estuary in 2008 (Gibbs [ed], 2010)

species (3,903 birds) were recorded from observation points 1-4, on 0, 30, 33 and 31 survey dates respectively.

Redshank *(Tringa totanus)* [SPA and Ramsar Site Qualifying Species]
Redshank were recorded on 56 (of 123) survey dates between April 2010 and January 2011 inclusive. Very few redshank were seen during the spring passage period (primarily in April), with 1-4 birds seen on two survey dates. This was followed by infrequent records of 1-5 birds, until 3 October when a total of 355 redshank were counted from observation point 4. Between 10 November and the end of the survey period on 31 January, redshank were recorded more regularly in larger numbers, with counts exceeding 100 birds noted on six survey dates. There was a bias of records towards the eastern half of the study area, with by far the largest numbers seen from observation points 3 and 4 (from October to January). Much smaller numbers (generally 1-10 birds) were counted from observation points 1 and 2. The largest numbers of foraging redshank were seen on mudflats offshore of Catsford and Wall Commons (peak count 166 birds on 18 November) and Stert village (peak count of 310 birds on 3 October). The mudflats between Hinkley Point and Stolford held much smaller numbers of foraging redshank, generally 1-10 birds in the winter. Small groups of loafing and roosting redshank were seen at high tide at a number of locations, with the largest numbers recorded on the shingle and adjacent mudflats at Stolford (peak count 20 birds on 14 December) and the mudflats and saltmarsh adjacent to Stert village (peak count of 15 birds on 3 October). Numbers of redshank in excess of 1% of the Severn Estuary SPA qualifying population of this species (2,330 birds) were recorded from observation points 1-4, on 0, 0, 6 and 11 survey dates respectively.

3.2.2 Non-Cited Species

A range of species that do not appear as designated or cited features of the Severn Estuary Ramsar/SPA or Bridgwater Bay SSSI were recorded during the intertidal surveys undertaken between April 2010 and January 2011 inclusive. A brief summary account of use of the study area by each species that were recorded is provided below.

Wildfowl
A further eight species of wildfowl (swans, geese and ducks) that do not appear as designated features of the Severn Estuary SPA/Ramsar site were recorded in the study area, as follows:

- Mute swan (*Cygnus olor*). Up to five foraging and loafing birds were seen on seven survey dates (between Hinkley Point and Wall Common), on 19 April, 22 and 28 July, 24 August, 14 October and 18 November;

- Greylag goose (*Anser anser*). Four birds were seen loafing on mudflats between Catsford and Wall Commons on 18 November;

- Canada goose (*Branta canadensis*). Two birds were seen loafing in the study area on 10 June;

- Brent goose (*Branta bernicla*). A flock of brent geese, probably involving up to 17 birds was seen regularly (on 31 survey dates) from 11 October to 30 January. These birds were seen foraging and loafing on mudflats between Hinkley Point and Wall Common. The flock contained similar numbers of both pale-bellied (*B. b. hrota*) and dark-billed (*B. b. bernicla*) race birds;

- Scaup (*Aythya marila*). A flock of up to 11 birds were seen foraging and loafing on the sea (from Hinkley Point to Stert village), close inshore on nine survey dates between 13 November and 26 January;
- Eider (*Somateria mollissima*). A single bird was seen loafing on the sea close inshore, around Hinkley Point on three survey dates: 5 and 10 December, and 17 January;
- Common scoter (*Melanitta nigra*). A flock of eight birds were seen loafing on the sea at high tide on 23 July. This record was followed by 1-2 birds on the sea between Hinkley and Wall Common, on three survey dates from October to January, and a larger count of 26 loafing birds offshore between Hinkley and Stolford on 5 December;
- Goosander (*Mergus merganser*). Four birds were seen loafing on the mudflats between Catsford Common and Wall Common on 19 December (during a period of very cold weather conditions).

Waders

A further 11 species of wader that do not appear as qualifying interest of the Severn Estuary SPA/Ramsar site or cited interest of the Bridgwater Bay SSSI were recorded in the study area, as follows:

- Oystercatcher (*Haematopus ostralegus*) were recorded on 117 (of 123) survey dates, with the largest numbers seen in August during the autumn passage period. Large numbers of oystercatchers were recorded foraging on the mudflats between Hinkley Point and Wall Common (from observation points 1-3), which much smaller numbers in the east of the study area, offshore from Stert village (from observation point 4). During the spring passage period (April-May), 20-40 birds were generally counted in each of the areas surveyed from observation points 1, 2 and 3. Numbers remained at this level during the early part of the autumn passage period (June-July), but then increased greatly in August, when numbers regularly exceeding 100 birds on each visit. Numbers then declined in September, and remained at similar levels during winter, when 20-60 birds were counted on most visits. Large groups of loafing and roosting oystercatchers were seen at high tide at a number of locations, including on the rocks around Hinkley Point, where 504 birds were counted on 31 August, although numbers here were usually much lower (10-20 birds). The most regularly used roosting site was however on the shingle and mudflats adjacent to Wall and Catsford Commons, where 20-50 birds were frequently seen, with a peak count of 176 birds on 25 August. The rocks and adjacent mudflats by Stolford also regularly held 20-40 loafing and roosting oystercatchers;
- Golden plover (*Pluvialis apricaria*) were recorded in the study area infrequently (on ten survey dates from 29 July to 13 December 2010). Golden plover were recorded on five surveys dates from 16 and 24 November, primarily on intertidal habitat by Stert village Numbers were generally small, but occasionally larger groups of golden plover were noted, including a flock of 500 birds roosting on mudflats off Stert village on 3 October, with 400 there on 24 November. Golden

plover were seen loafing on the mudflats between Hinkley and Stolford on two survey dates, involving 4 and 6 birds repectively;

- Knot (*Calidris canutus*) were recorded on 51 (of 123) survey dates. Small numbers of knot were seen sporadically from May until the end of August after which numbers increased and birds were seen regularly, with a peak count of 3,575 birds counted from observation point 4 on 24 November. Large numbers of knot were recorded foraging on the mudflats west of Stolford from October to January, when numbers exceeding 1,000 birds on a regular basis. The mudflats offshore between Stolford and Wall Common and adjacent to Stert village held large numbers of foraging knot, with peak counts of 2,100 birds on 18 November and 2,425 birds on 24 November at each site respectively. Knot were recorded on only one survey date on mudflats between Hinkley Point and Stolford, involving three birds. Flocks of roosting and loafing knot were seen on the shingle beach and adjacent mudflats between Catsford and Wall Commons (peak count of 450 birds on 28 December), and on the mudflats and saltmarsh adjacent to Stert village (peak count of 740 on 26 November);

- Sanderling (*Calidris alba*) were recorded on a total of nine survey dates, during two periods. Up to five sanderlings were seen feeding on intertidal habitat between Stolford and Stert village on three dates in May. During the return autumn passage period, 1-3 foraging birds were seen in the same area on six dates between 29 July and 29 August;

- Little stint (*Calidris minuta*). A single bird was seen foraging on mudflats adjacent to Stert village on 12 October;

- Ruff (*Philomachus pugnax*). A single bird was seen foraging on mudflats adjacent to Stert village on 8 October;

- Snipe (*Gallinago gallinago*). Single birds were seen on intertidal habitat between Catsford and Wall Commons on 18 November and at Hinkley Point on 15 December;

- Bar-tailed godwit (*Limosa lapponica*) was recorded on 26 (of 123) survey dates between April 2010 and January 2011. Birds were seen during the spring passage period (April to early June), when 10-30 birds were foraging on mudflats, primarily between Stolford and Stert village. The first return autumn passage birds were seen on 17 August, and relatively large numbers of bar-tailed godwits were then recorded in the east of the study area until 13 October. During this autumn passage period, peak counts included 170 foraging bar-tailed godwits on mudflats between Catsford and Wall Commons on 17 September, and 175 loafing on mudflats adjacent to Stert village also on 17 September (feasibly the same flock of birds). Bar-tailed godwits were rarely seen west of Stolford (on a total two survey dates);

- Common sandpiper (*Actitis hypoleucos*). One bird was seen foraging on the edge of Catsford Common on 14 September;

- Greenshank (*Tringa nebularia*) were recorded on six survey dates from 19 July to 29 August (during the autumn passage period), mostly involving 1-2 birds foraging on mudflats between Stolford and Stert village;

- Turnstone (*Arenaria interpres*) were recorded on 67 (of 123) survey dates, primarily during the spring passage (April-May) and autumn passage and winter (August-January) periods covered by the surveys. The largest numbers of turnstone were recorded in the eastern half of the study area from October to January, when 20-40 birds were generally seen from each of observation points 2, 3 and 4. The favoured areas for foraging birds were on the shoreline and mudflats between Catsford and Wall Commons (peak count of 62 birds on 12 October), the mudflats around Stolford (peak count of 50 birds on 19 January), and Stert village (peak count of 45 birds on 24 January). Similar numbers of roosting turnstone were seen at high tide in the same areas, with the largest count being of 90 birds on intertidal habitat between Catsford and Wall Commons on 26 January. Turnstone were seen infrequently in and in very low numbers on the rocks and adjacent mudflats around Hinkley Point (1-6 birds).

Other Waterfowl and seabirds

A further five species of water bird and seabirds, that do not appear as qualifying interest of the Severn Estuary SPA/Ramsar site were recorded in the study area, as follows:

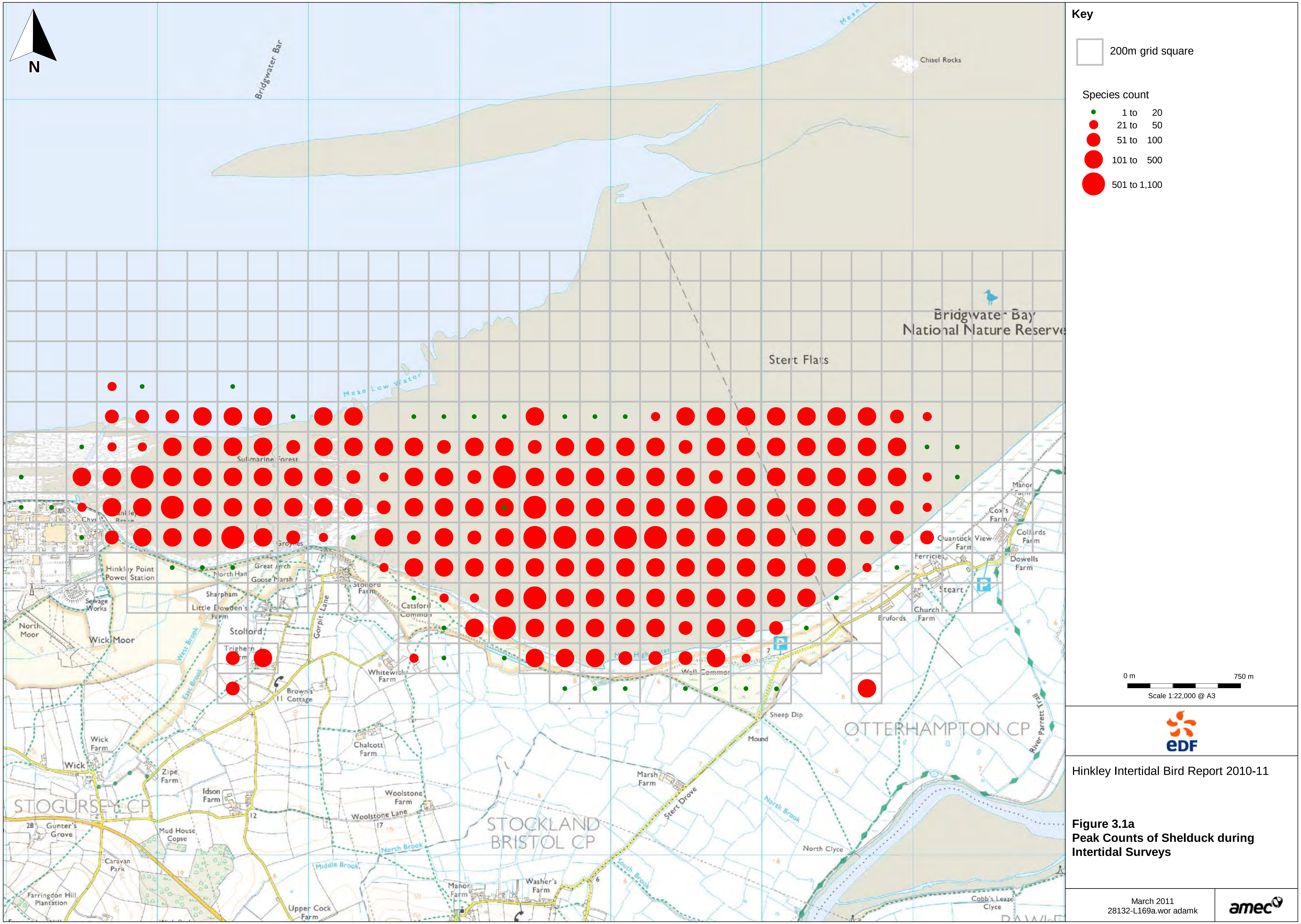
- Great Crested Grebe (*Podiceps cristatus*). One bird was seen loafing on the sea between Catsford and Wall Commons on 8 July;

- Cormorant (*Phalacrocorax carbo*). Cormorants were seen loafing on the rocks at Hinkley Point and foraging on the surrounding sea on a reasonably regular basis (on a total of 31 survey dates) throughout much of the survey period. A peak count of four birds was recorded at Hinkley Point on 31 August, with five birds seen from observation point 4 on 16 September;

- Little egret (*Egretta garzetta*) were recorded on 88 (of 123) survey dates between April 2010 and January 2011 inclusive, with the largest numbers seen from April to October. During this period, counts of 10-20 birds were regularly recorded from each of observation points 2, 3 and 4. The largest numbers were on the wider mudflats found in the eastern two-thirds of the study area, with a peak count of 44 birds recorded from observation point 4 on 17 August. Numbers declined to 1-2 birds during November, and the species disappeared from the area altogether (apart from one record of two birds on 19 January) from late November until the end of the survey period (probably due to the extremely cold weather experienced in late November and December). The largest numbers of foraging little egrets were seen in the mudflat creeks between Stolford and Stert village, with the area offshore of Catsford and Wall Commons supporting 10-25 birds during the spring and summer (a peak count of 38 birds was noted there on 8 June). Groups of loafing and roosting little egret were most numerous on the mudflats and shingle between Catsford and Wall Commons, with a peak count of 22 birds there on 17 August. The mudflats and rocks at Hinkley Point held much smaller numbers of little egret, generally 1-2 birds during spring and summer;

- Grey heron (*Ardea cinerea*). Up to four birds were seen on a regular basis throughout the survey period, foraging in creeks and along the shoreline throughout much of the study area;

- Little tern (*Sternula albifrons*). Two birds were seen loafing on the rocks at Hinkley Point on 20 April.



EDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1a
Peak Counts of Shelduck during Intertidal Surveys

March 2011
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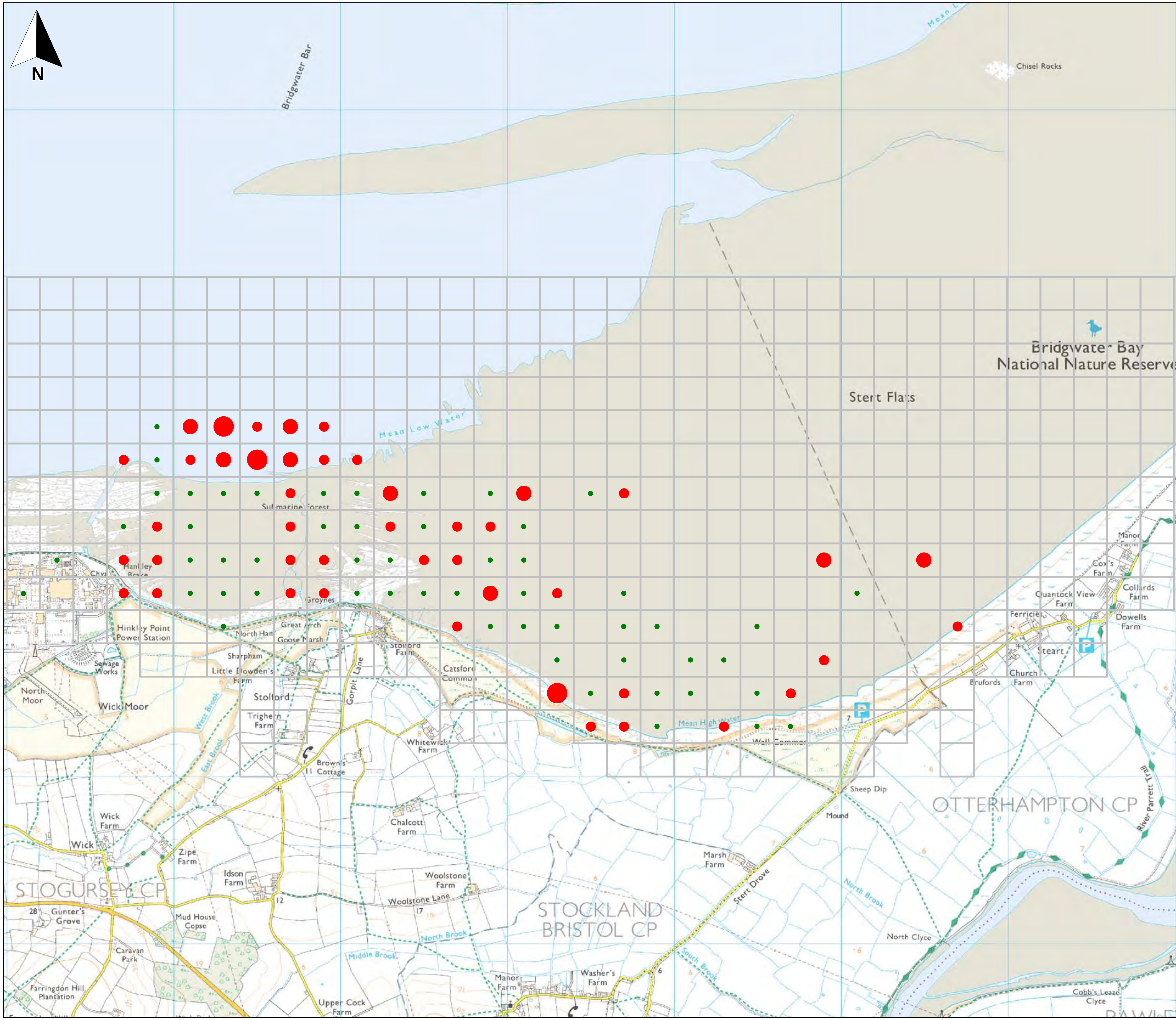

Key

200m grid square

Species count

- 1 to 20
- 21 to 50
- 51 to 100
- 101 to 200

Hinkley Intertidal Bird Report 2010-11

Figure 3.1b
Peak Counts of Wigeon during Intertidal Surveys

March 2011
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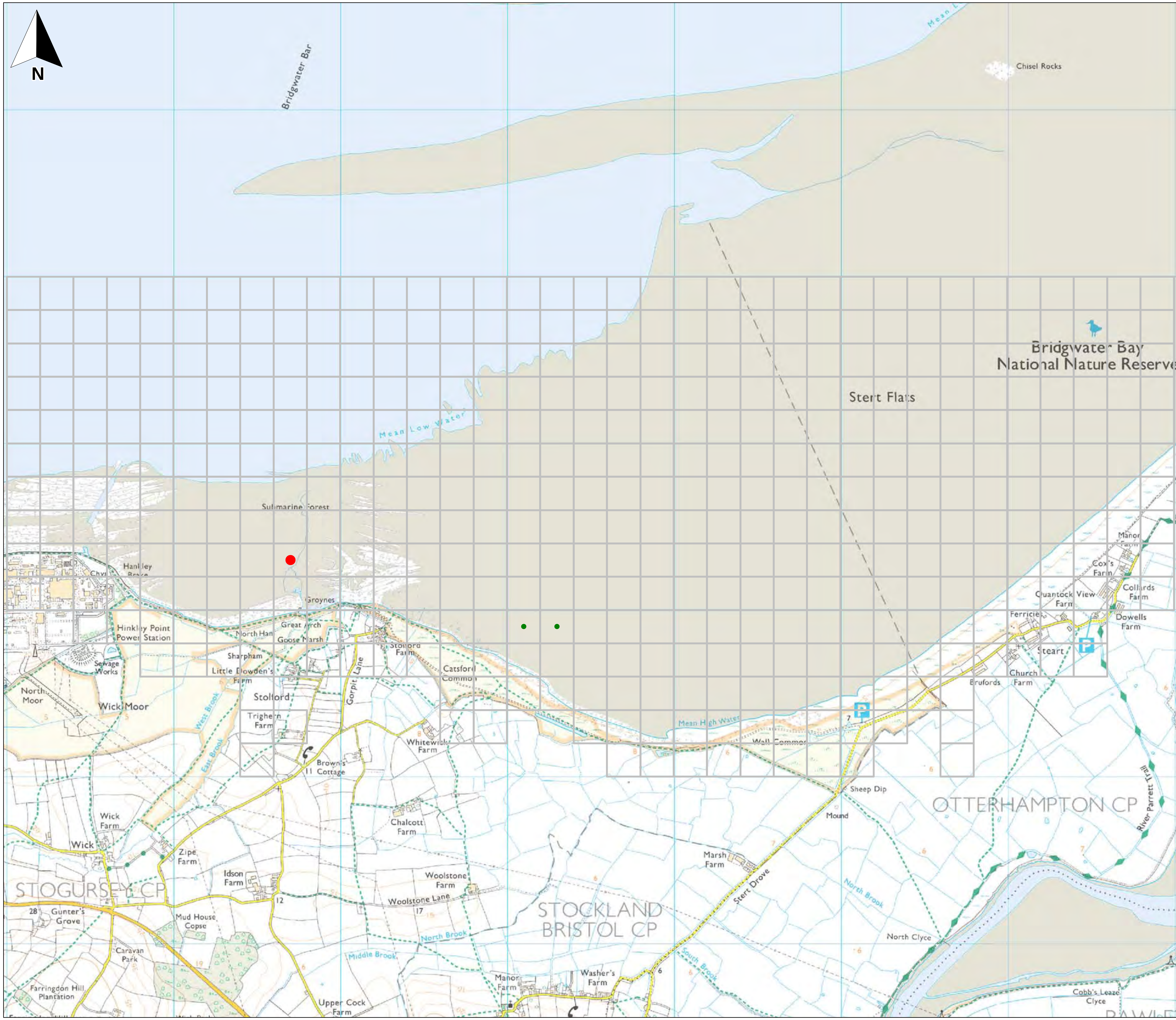


Key

200m grid square

Species count

- 1
- 2

0 m 750 m

Scale 1:22,000 @ A3

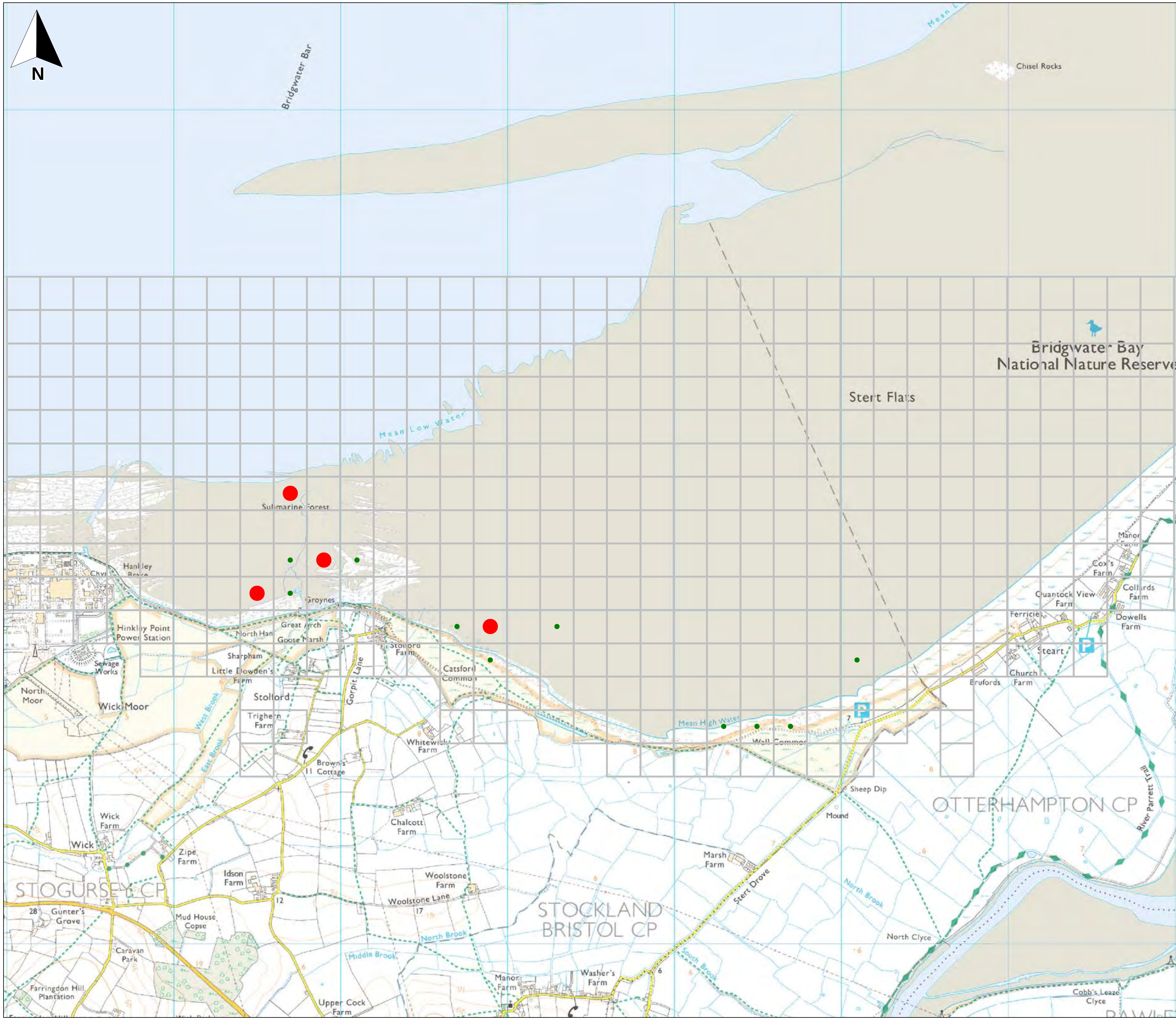
EDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1c
Peak Counts of Gadwall during Intertidal Surveys

March 2011
28132-L171a.wor adamk

amec



Key

200m grid square

Species count

- 1 to 5
- 11 to 24

0 m 750 m

Scale 1:22,000 @ A3

eDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1d
Peak Counts of Teal during Intertidal Surveys

March 2011
28132-L172a.wor adamk

amec

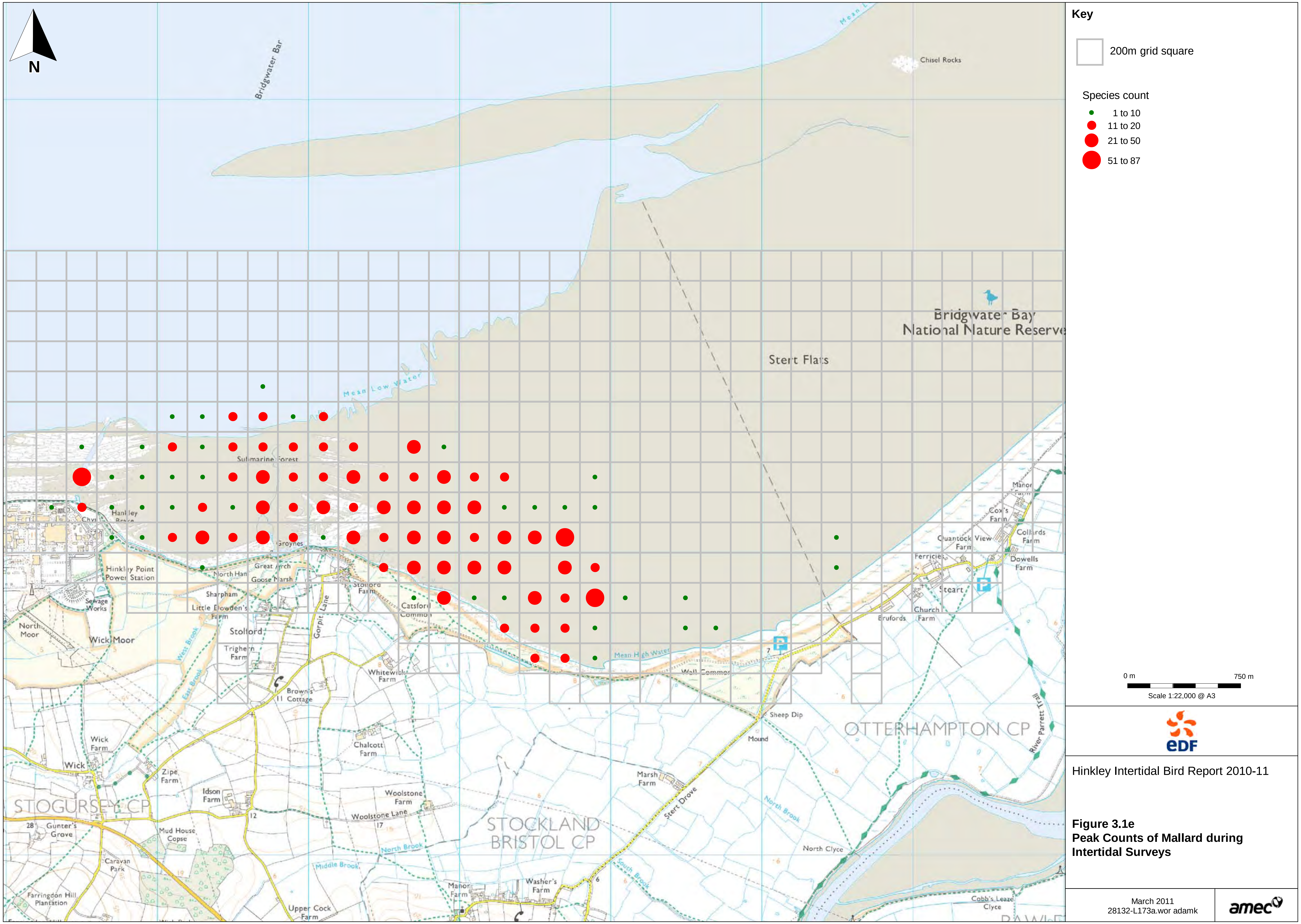
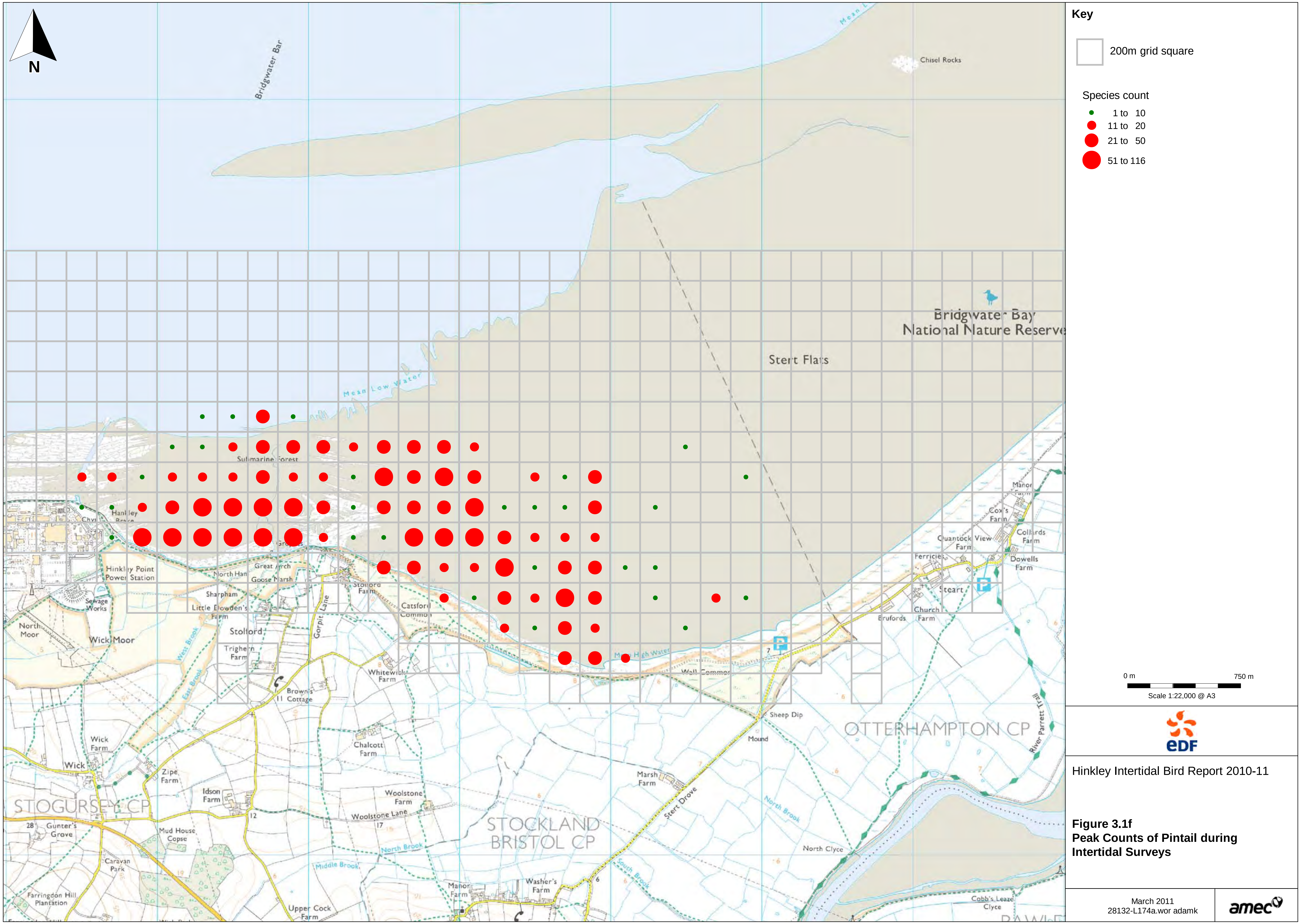


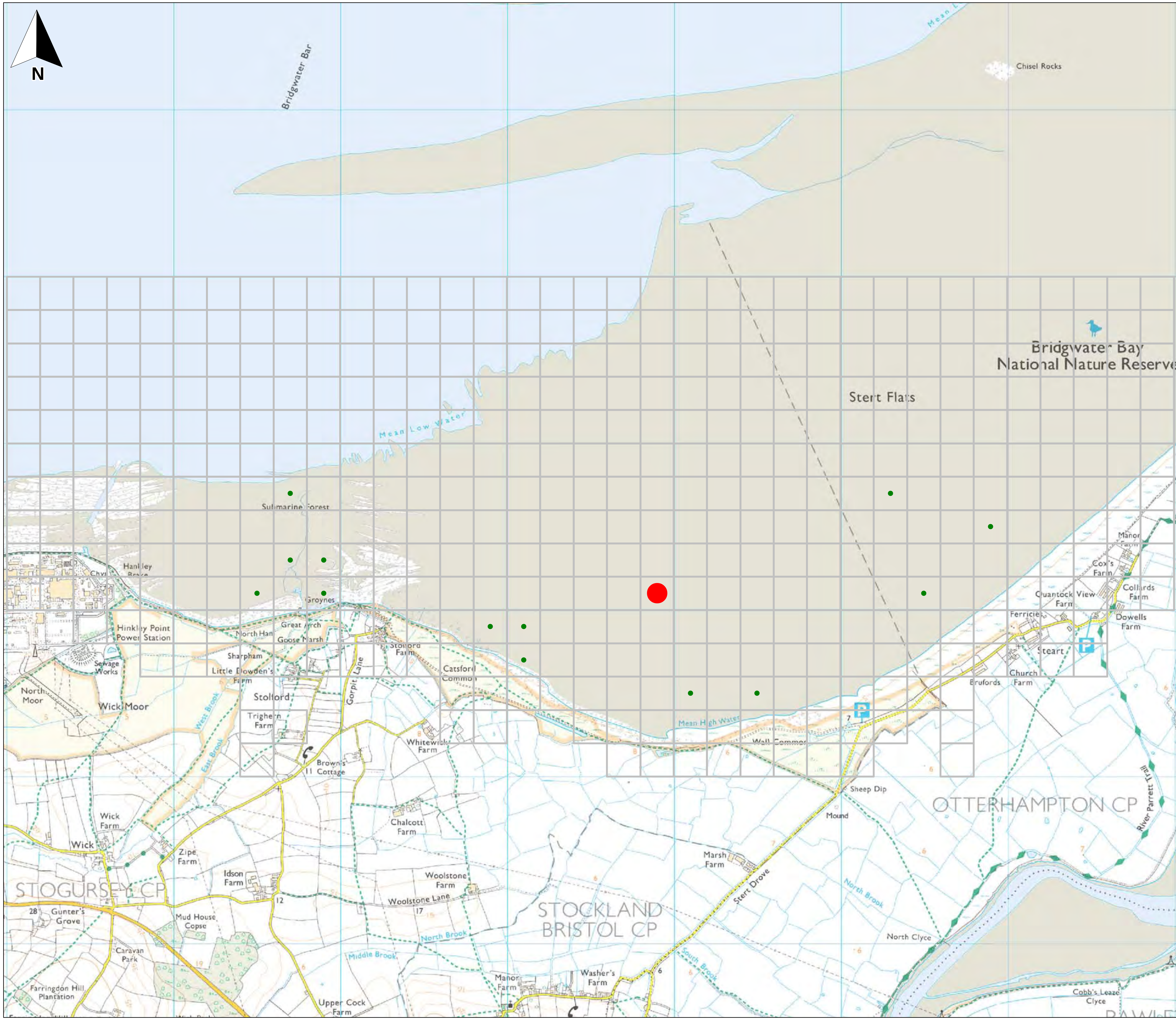
Figure 3.1e
Peak Counts of Mallard during Intertidal Surveys



Hinkley Intertidal Bird Report 2010-11

Figure 3.1f
Peak Counts of Pintail during Intertidal Surveys

March 2011
28132-L174a.wor adamk



Key

200m grid square

Species count

1 to 10

51 to 90

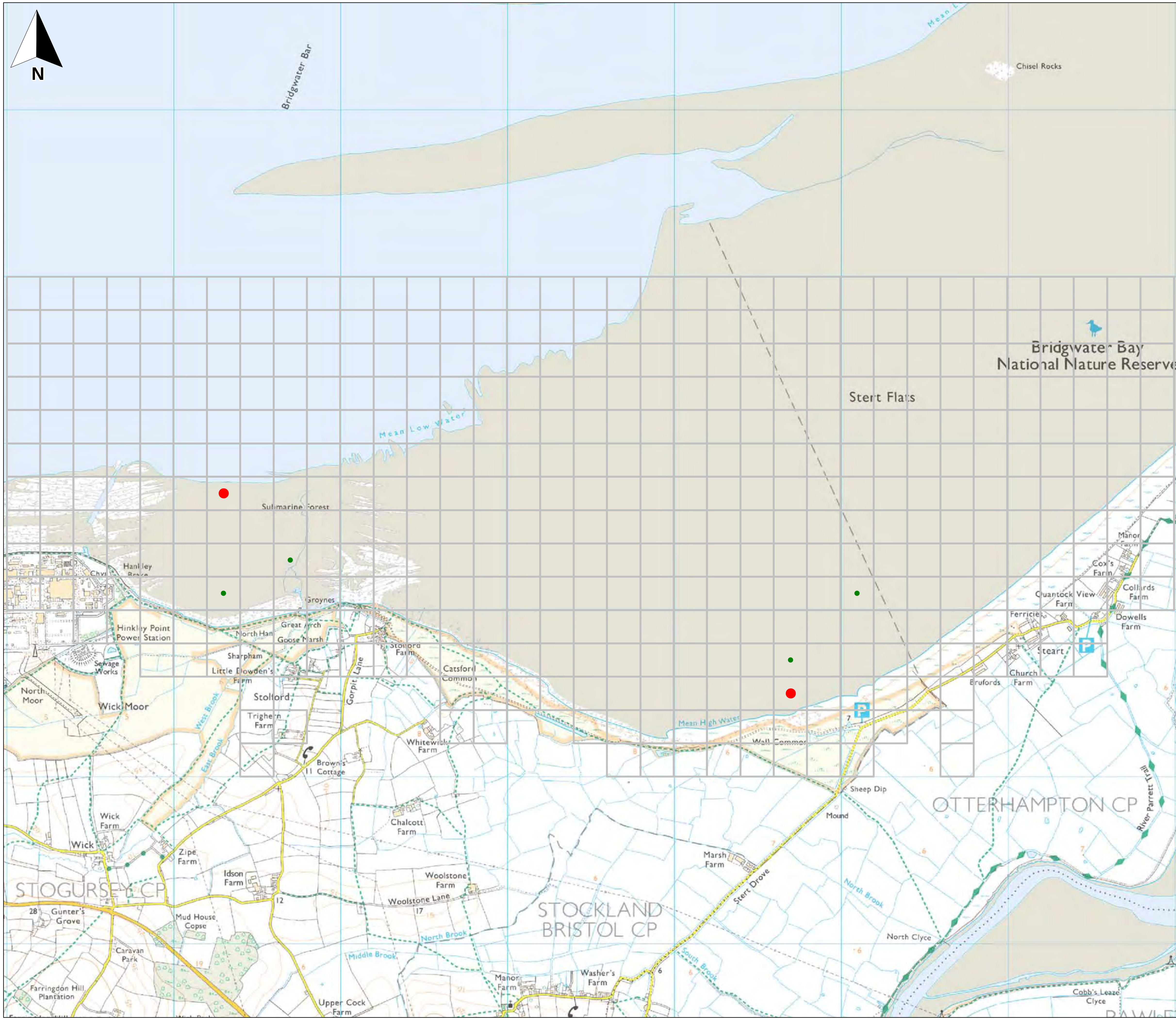
0 m 750 m

Scale 1:22,000 @ A3

Hinkley Intertidal Bird Report 2010-11

Figure 3.1g
Peak Counts of Shoveler during Intertidal Surveys

March 2011
28132-L175a.wor adamk



Key

200m grid square

Species count

1

2

0 m 750 m

Scale 1:22,000 @ A3

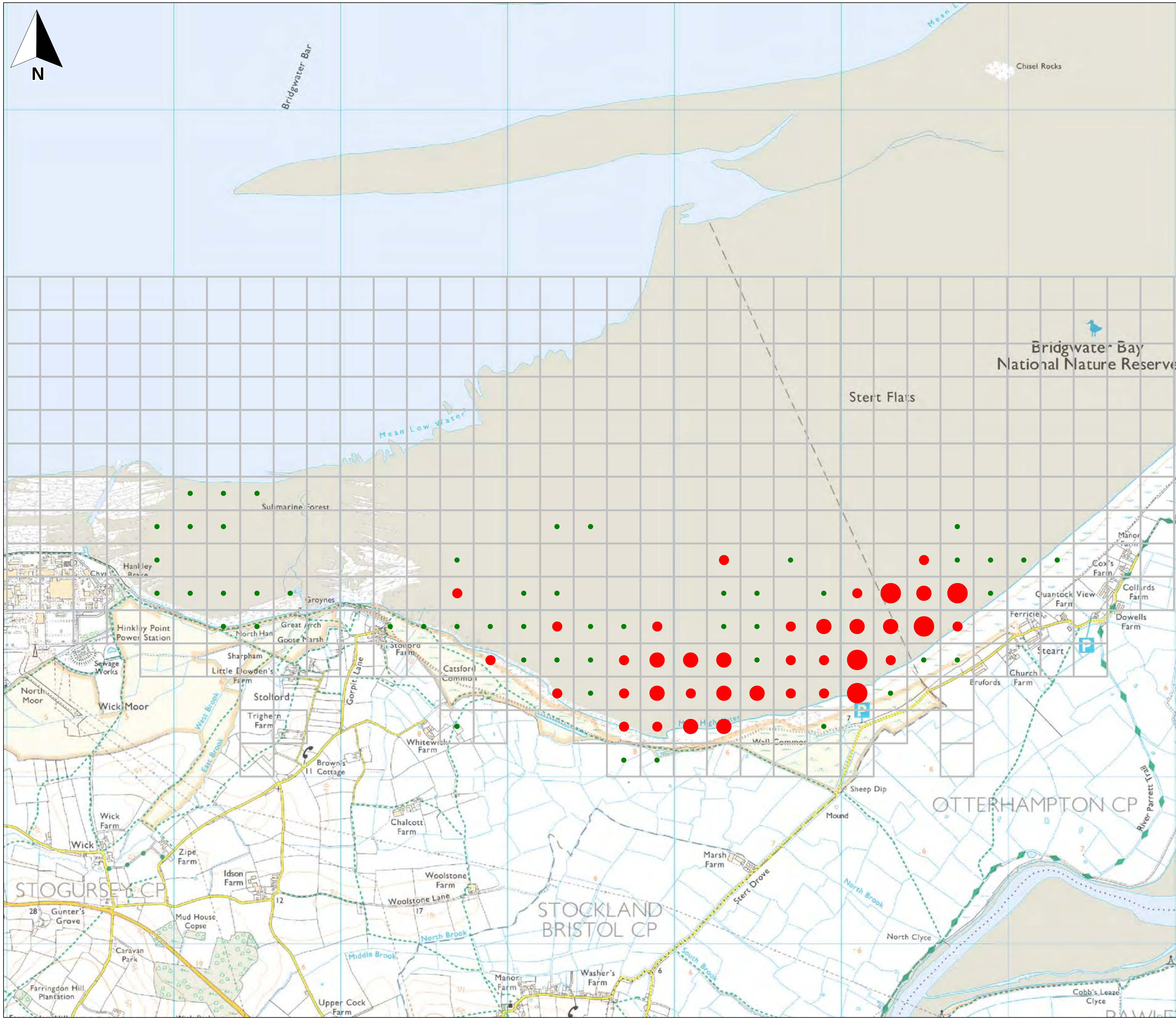
EDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1h
Peak Counts of Tufted Duck during Intertidal Surveys

March 2011
28132-L176a.wor adamk

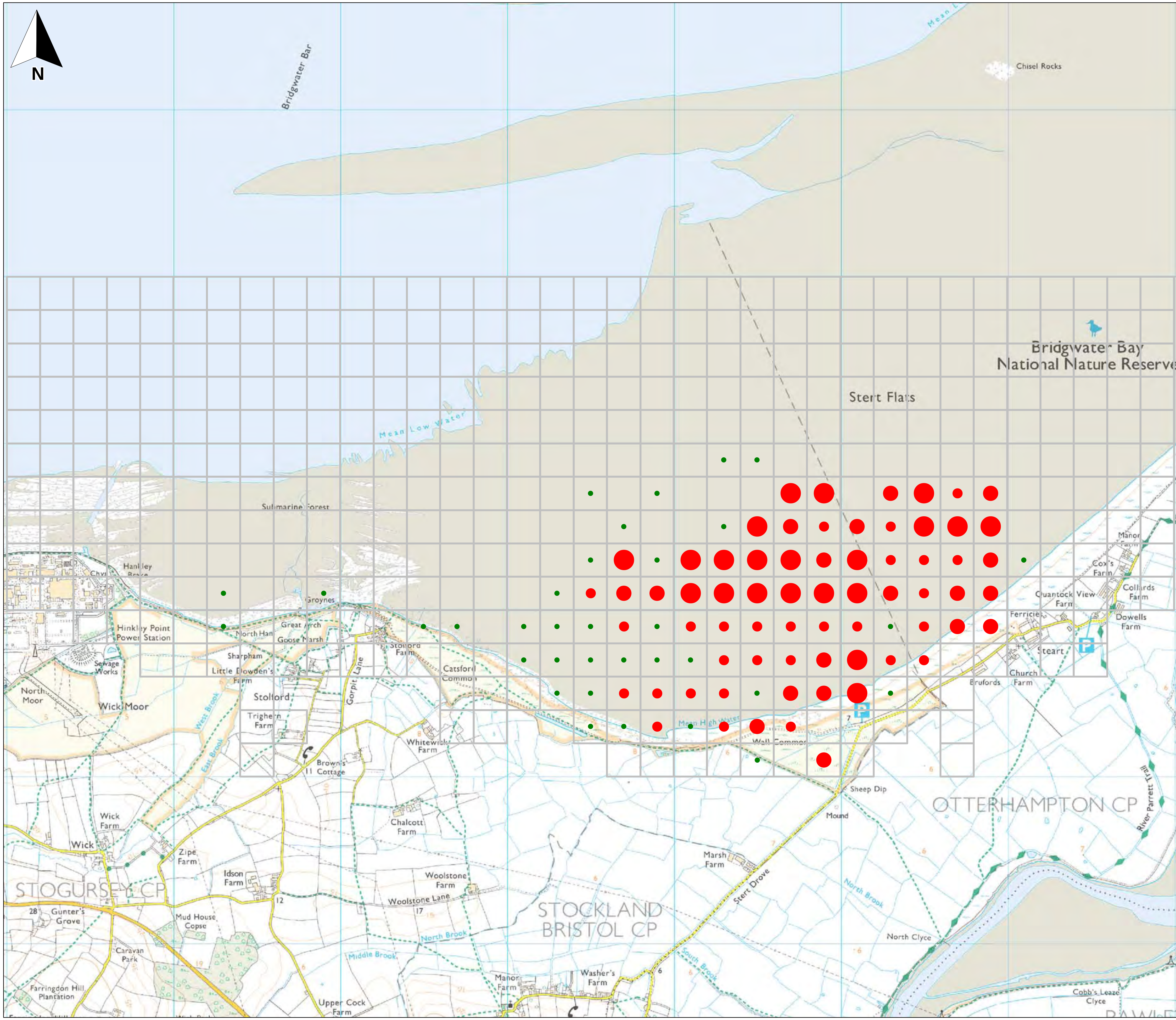
amec



Hinkley Intertidal Bird Report 2010-11

Figure 3.1i
Peak Counts of Ringed Plover during Intertidal Surveys

March 2011
28132-L177a.wor adamk



Key

200m grid square

Species count

- 1 to 20
- 21 to 50
- 51 to 100
- 101 to 750

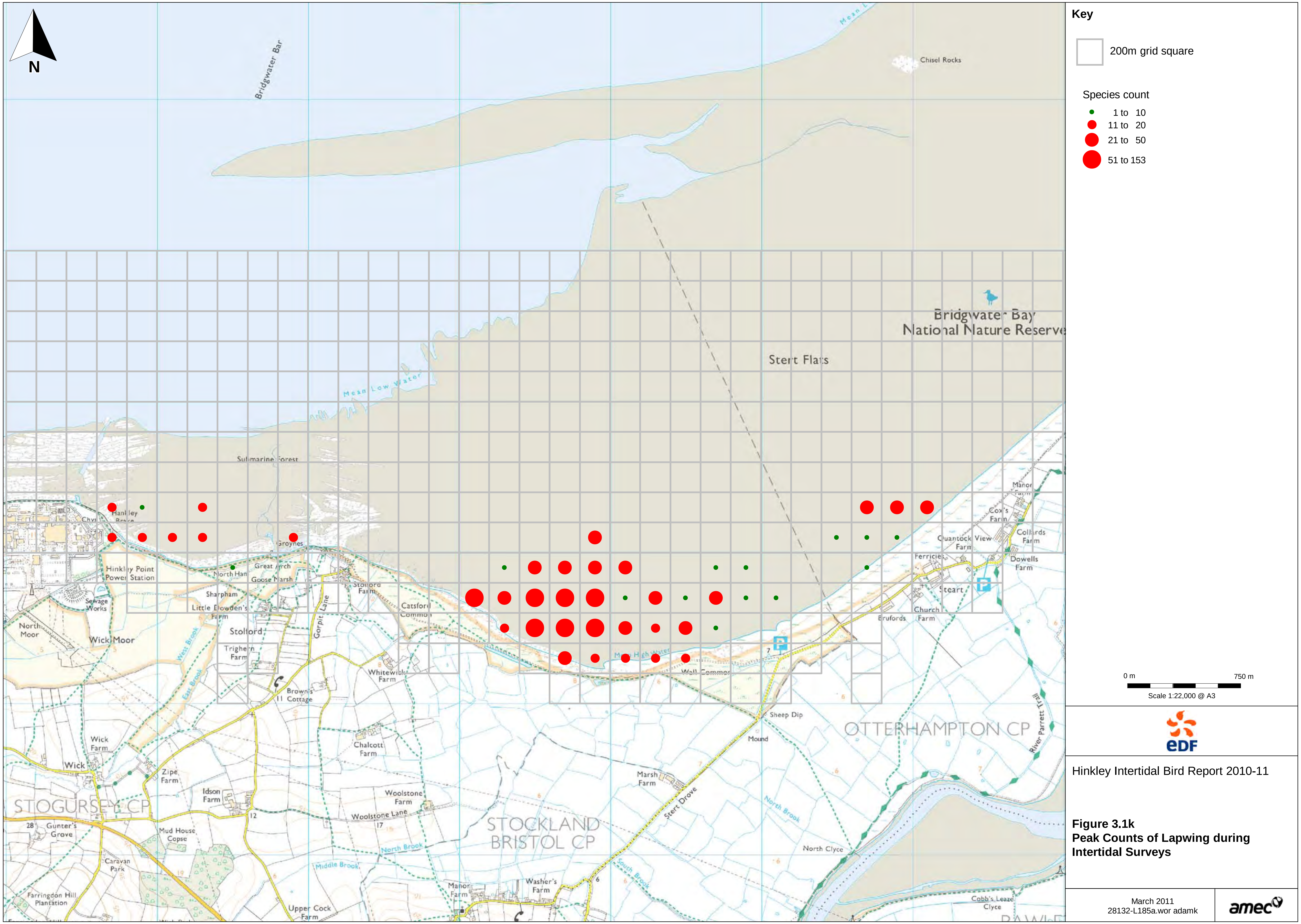
0 m 750 m

Scale 1:22,000 @ A3

Hinkley Intertidal Bird Report 2010-11

Figure 3.1j
Peak Counts of Grey Plover during Intertidal Surveys

March 2011
28132-L178a.wor adamk



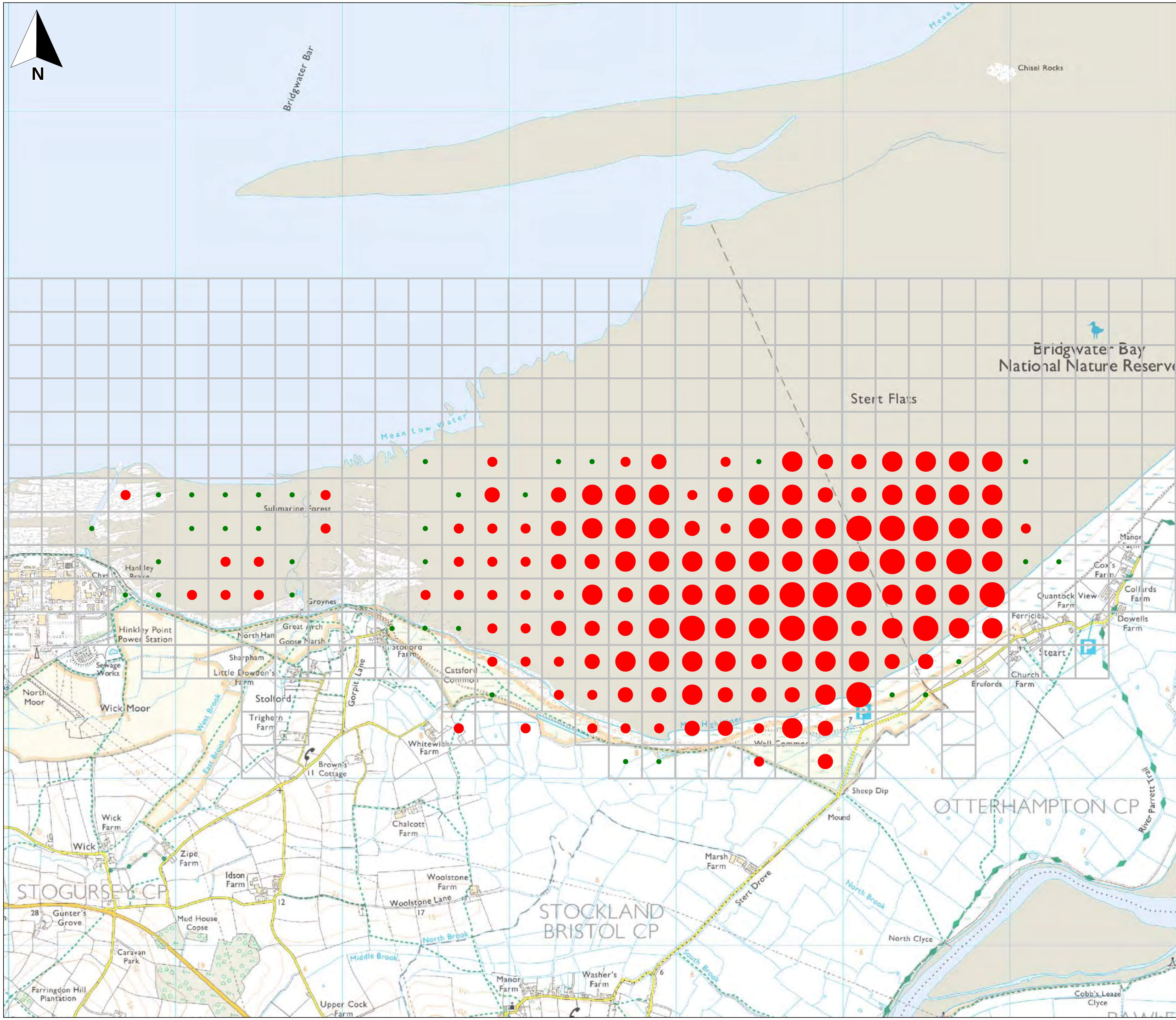
EDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1k
Peak Counts of Lapwing during Intertidal Surveys

March 2011
28132-L185a.wor adamk

amec



Key

200m grid square

Species count

- 1 to 50
- 51 to 250
- 251 to 500
- 501 to 2,000
- 2,001 to 4,700

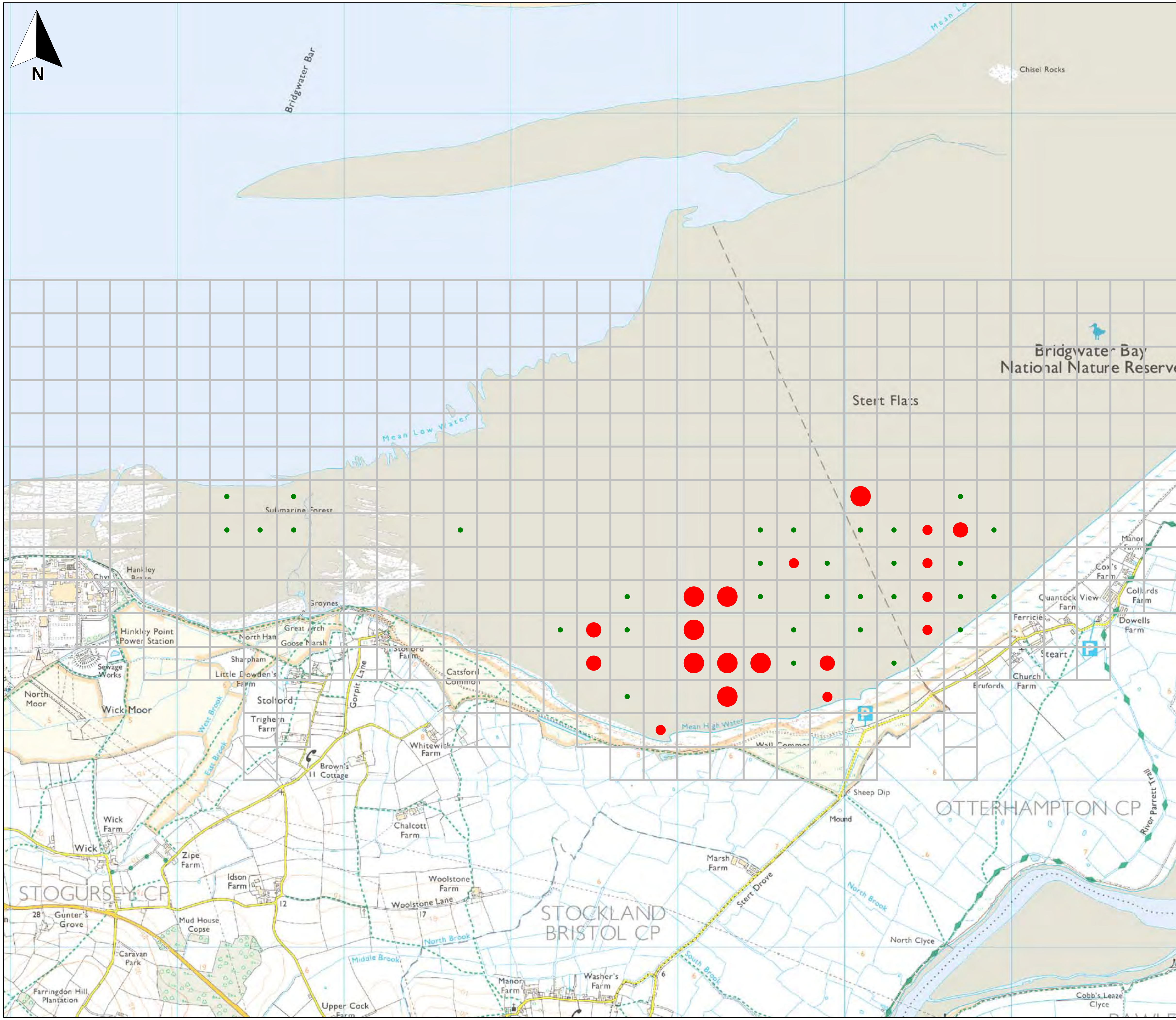
eDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1l
Peak Counts of Dunlin during Intertidal Surveys

March 2011
28132-L186a.wor adamk

amec



Key

200m grid square

Species count

- 1 to 10
- 11 to 20
- 21 to 50
- 51 to 158

0 m — 750 m

Scale 1:22,000 @ A3

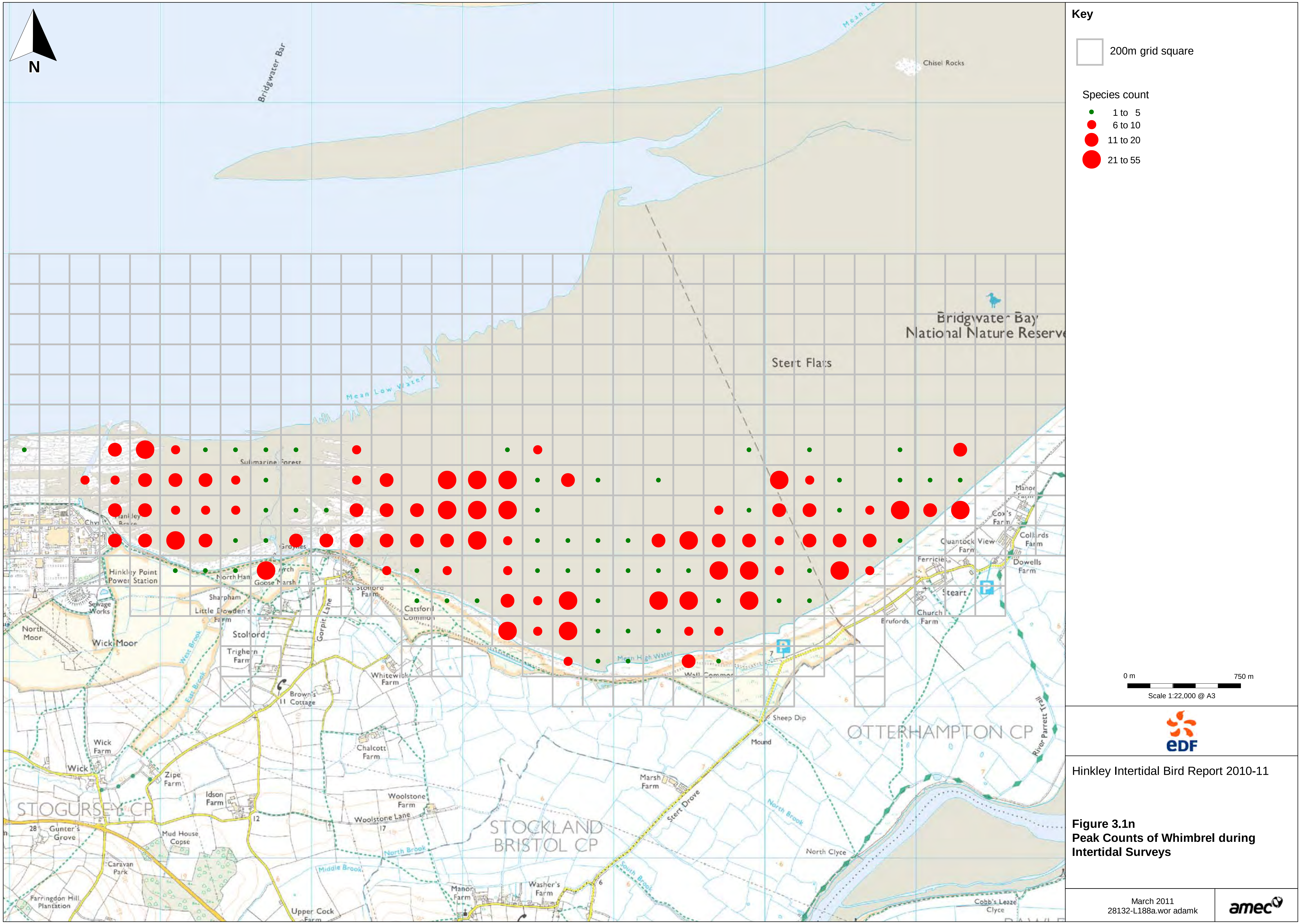
EDF

Hinkley Intertidal Bird Report 2010-11

Figure 3.1m
Peak Counts of Black-tailed Godwit during Intertidal Surveys

March 2011
28132-L187a.wor adamk

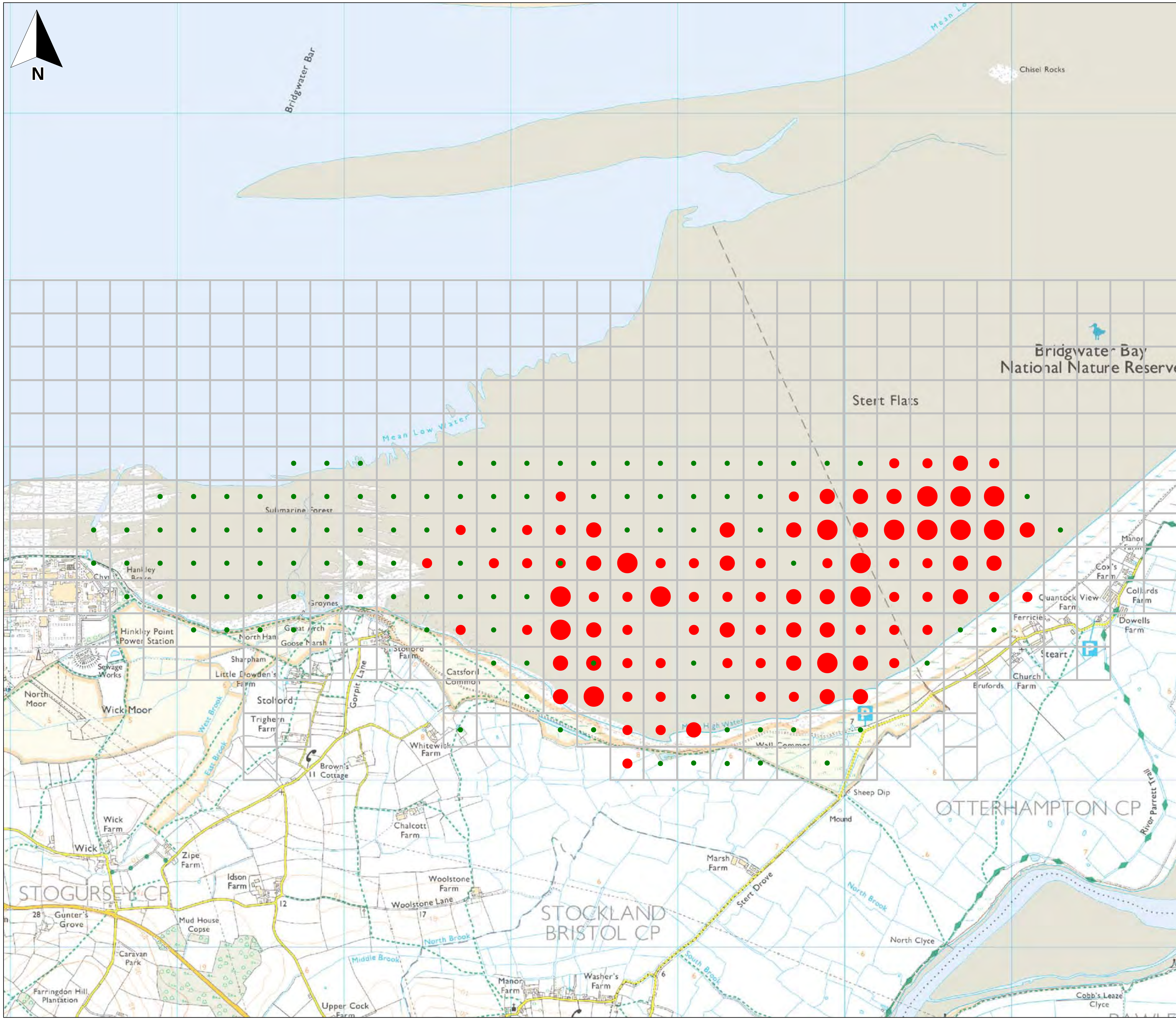
amec



Hinkley Intertidal Bird Report 2010-11

Figure 3.1n
Peak Counts of Whimbrel during Intertidal Surveys

March 2011
28132-L188a.wor adamk



Key

200m grid square

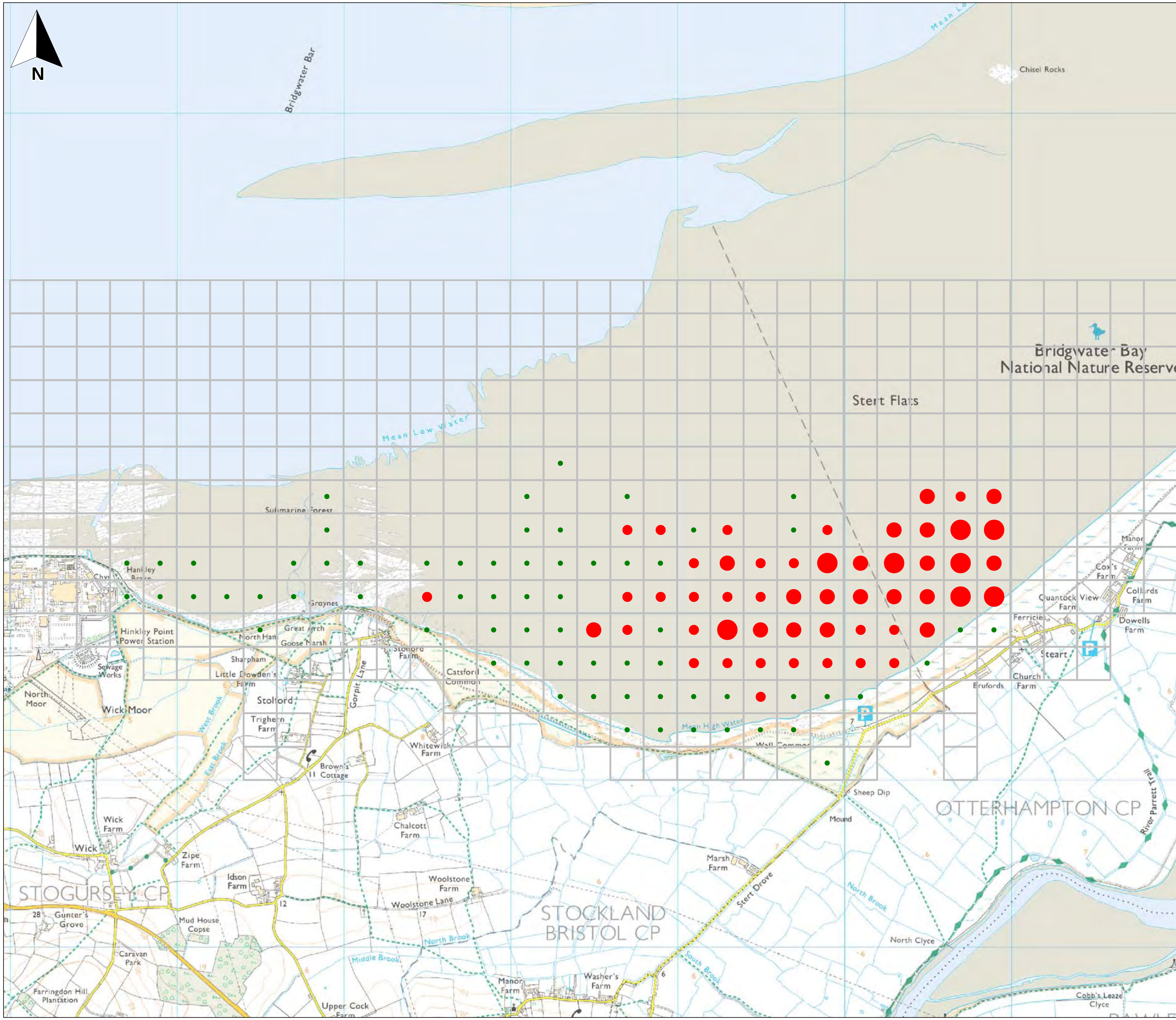
Species count

- 1 to 20
- 21 to 50
- 51 to 100
- 101 to 400

Hinkley Intertidal Bird Report 2010-11

Figure 3.1o
Peak Counts of Curlew during Intertidal Surveys

March 2011
28132-L189a.wor adamk



Hinkley Intertidal Bird Report 2010-11

Figure 3.1p
Peak Counts of Redshank during Intertidal Surveys

March 2011
28132-L190a.wor adamk

4. Discussion

When considering bird populations during the spring and autumn passage and winter periods, the threshold of importance (or significance) in population terms, is often taken as 1% of the (peak) number of a species known to occur within a given area. From this starting point, taking into account regularity and nature of use, it is possible to undertake a subjective analysis of the importance of an area to a bird species. The first step towards doing this for the intertidal study area between Hinkley Point and Stert Point, is to define the relevant areas. In the discussion that follows, the local area has been taken as Bridgwater Bay and the immediate surrounding land, while the county is Somerset and the region is that covered in The Southwest Biodiversity Implementation Plan[7]. National refers to the United Kingdom and International to World distribution (of the bird species or race of that species concerned).

Numbers of those species (recorded in the study area) that form part of the designated or cited interest of local statutory sites (in this case, the Severn Estuary SPA and Ramsar site, and the Bridgwater Bay SSSI) have been considered important if found to exceed 1% of the qualifying number listed in any of these site citations. To establish population estimates to provide a basis for evaluation, relevant regional and national accounts, including Ballance (2006), Calbrade *et al*. (2010) and the citations of designated sites, have been used in conjunction with bird reports (Gibbs [ed], 2010).

Results from the intertidal surveys undertaken between Hinkley Point and Stert Point from April 2010 to January 2011 inclusive, indicate that the mudflats within the study area hold important numbers of waders and waterfowl, particularly the intertidal habitat between Stolford rock platform and Stert Point, with smaller numbers occurring between Hinkley Point (adjacent to the SSA) and Stolford. The rock platforms at Hinkley Point and Stolford are also important sites for loafing and roosting waterfowl, and the shingle beach, saltmarsh and adjoining mudflats between Stolford and Stert village are an important area for waders roosting at high tide.

4.1.1 Cited Species

A total of 16 species that appear as designated or cited features of the Severn Estuary SPA or Ramsar Site, or the Bridgwater Bay SSSI, were recorded in the study area. Of these, seven species appear as qualifying features of the Severn Estuary SPA (gadwall, shelduck, dunlin and redshank) or appear in the SPA Review (ringed plover, curlew and pintail). In addition, wigeon, teal, mallard, shoveler, tufted duck, grey plover, lapwing and whimbrel were recorded during the surveys and are listed in the waterfowl assemblage qualification for the SPA. Black-tailed godwit, which appears as cited interest for the Bridgwater Bay SSSI was also recorded.

[7] The South-west Biodiversity Implementation Plan, which is available through the website (http://www.biodiversitysouthwest.org.uk) covers the south-west region and includes Somerset (as well as Devon, Dorset, Gloucestershire, Wiltshire, Cornwall and the Isles of Scilly). As such there is ecological data available and targets have been set for this biogeographical region. It therefore seems sensible to include this as the region for the purposes of assessment.

Of the cited/qualifying species, gadwall, teal, shoveler, tufted duck and lapwing were recorded infrequently within the study area during the intertidal surveys, and generally in low numbers in terms of their respective Severn Estuary populations. Shelduck, pintail, grey plover, ringed plover, dunlin, whimbrel, black-tailed godwit and curlew were regularly recorded in numbers exceeding 1% of their respective Severn Estuary populations (or Bridgewater Bay population for black-tailed godwit). Wigeon, mallard and redshank were also recorded in numbers that exceed 1% of the Severn Estuary populations, although on a less frequent or occasional basis. For ease of description, the study area has been divided into the areas viewable from the four observation points (Count Sectors 1-4). The importance of each count sector to these species is discussed further below.

Shelduck

Numbers of shelduck that exceed 1% of the Severn Estuary SPA qualifying population were recorded on a regular basis in all count sectors throughout much of the year, but particularly from July to November, which covers much of the period when this species undergoes a moult of its feathers, and becomes temporarily flightless. The peak count of 2,049 shelduck represents 61.5% of the SPA population. In addition, counts that exceed the threshold of national importance for shelduck (782 birds, Calbrade *et al*., 2010) were recorded on 5-8 survey dates in each of the count sectors. To summarise, evidence from the surveys indicates that the intertidal habitat within the study area is likely to support a substantial proportion of the Severn Estuary population of shelduck during much of the year. The mudflats in the study area provide an important foraging resource to the Severn Estuary population of shelduck, and occasionally support numbers of national importance from July to November.

Wigeon

Numbers of wigeon that exceed 1% of the Severn Estuary population were recorded occasionally in Count Sectors 1-3 from November to January. The peak count of 312 wigeon represents 3.7% of the Severn Estuary population. Evidence from the surveys indicates that the mudflats in Count Sectors 1-3 (primarily between Hinkley Point and Wall Common) occasionally support numbers of wigeon that are important in terms of the Severn Estuary population during winter.

Mallard

Numbers of mallard that exceed 1% of the Severn Estuary population were recorded occasionally in Count Sectors 1 and 2, primarily from August to January. The peak count of 87 mallard represents 2.6% of the Severn Estuary population. Evidence from the surveys indicates that the mudflats in count sectors 1-2 (primarily between Hinkley Point and Stolford) occasionally support numbers of mallard that are important in terms of the Severn Estuary population during autumn and winter.

Pintail

Numbers of pintail that exceed 1% of the Severn Estuary Review population were recorded regularly in Count Sectors 1-3, from October to January. The peak count of 158 pintail represents 26.4% of the Severn Estuary Review population. Evidence from the surveys indicates that the mudflats in Count Sectors 1-3 (primarily between Hinkley Point and Wall Common) provide an important foraging resource to the Severn Estuary population of pintail during winter.

Ringed Plover

Numbers of ringed plover that exceed 1% of the Severn Estuary SPA Review population were recorded on a regular basis in Count Sector 2-4, during the spring passage period (April-May) and during part of the autumn passage period (in August). The peak count of 687 ringed plover exceeded the SPA Review population, and exceeded the national threshold of importance (330 birds, Calbrade *et al*., 2010). To summarise, evidence from the surveys indicates that the mudflats and rock platforms within the eastern half of the study area (primarily between Stolford and Stert Point) are likely to support a substantial proportion of the Severn Estuary population of ringed plover during the passage periods, providing high tide roost sites, and an important foraging resource.

Grey Plover

Numbers of grey plover that exceed 1% of the Severn Estuary population were recorded on a regular basis in Count Sectors 3 and 4, and occasionally in Count Sector 2, from October to January. The peak count of 975 grey plover is more than double the Severn Estuary population, derived from the 5-year peak mean WeBS counts for 2003/04 to 2008/09. This peak count also exceeded the national threshold of importance (530 birds, Calbrade *et al*., 2010). To summarise, evidence from the surveys indicates that the mudflats within the eastern half of the study area (primarily between Stolford and Stert Point) are likely to support a substantial proportion of the Severn Estuary population of grey plover during the winter, providing high tide roost sites, and an important foraging resource.

Dunlin

Numbers of dunlin which exceed 1% of the Severn Estuary SPA qualifying population of this species were recorded on a regular basis in Count Sectors 2-4 from October to January. The peak count of 12,590 dunlin represents 28.2% of the SPA population, and exceeds the threshold of national importance (5,600 birds, Calbrade *et al*., 2010). To summarise, evidence from the surveys indicates that the mudflats within the eastern half of the study area (primarily between Stolford and Stert Point) are likely to support a substantial proportion of the Severn Estuary population of dunlin during the winter, providing high tide roost sites, and an important foraging resource.

Black-tailed Godwit

Numbers of black-tailed godwit which exceed 1% of the Bridgewater Bay population of this species were recorded on a regular basis in Count Sector 4, and occasionally in Count Sectors 1-3, primarily from August to October (the autumn passage period). The peak count of 160 black-tailed godwits represents 70.8% of the Bridgewater Bay population. To summarise, evidence from the surveys indicates that the mudflats in the study area (particularly those adjacent to Stert village) are likely to support a substantial proportion of the Bridgwater Bay population of black-tailed godwit during the autumn passage period providing an important foraging resource.

Whimbrel

Numbers of whimbrel which exceed 1% of the Severn Estuary population of this species were recorded on a regular basis in Count Sectors 1-4 primarily from April to early June (the spring passage period) and to a lesser extent from Mid-July to Mid-September (the autumn passage period). The peak count of 254 whimbrel exceeds the Severn Estuary population derived from the 5-year peak mean WeBS counts for 2003/04 to 2008/09, and is likely to represent a substantial proportion of the national total (the maximum count of whimbrel in Great Britain in

2008, was 1,284 birds, in August, Calbrade *et al*., 2010). To summarise, evidence from the surveys indicates that the mudflats in the study area are likely to support a substantial proportion of the Severn Estuary population of whimbrel during the spring and autumn passage periods providing high tide roost sites and an important foraging resource.

Curlew

Numbers of curlew which exceed 1% of the Severn Estuary SPA Review population of this species were recorded on a regular basis in Count Sectors 2-4, particularly from July to January (the autumn passage and winter periods). The peak count of 739 curlew represents 18.9% of the SPA Review population. To summarise, evidence from the surveys indicates that the mudflats within the eastern half of the study area (primarily between Stolford and Stert Point) are likely to support a substantial proportion of the Severn Estuary population of curlew during autumn passage and winter, providing high tide roost sites, and an important foraging resource.

Redshank

Numbers of redshank which exceed 1% of the Severn Estuary SPA qualifying population of this species were recorded on a regular basis in Count Sector 4 (and occasionally in Count Sector 3), primarily from November to January. The peak count of 355 redshank represents 15.2% of the Severn Estuary population. To summarise, evidence from the surveys indicates that the mudflats within the eastern half of the study area (primarily between Wall Common and Stert Point) are likely to support a substantial proportion of the Severn Estuary population of redshank during winter, providing high tide roost sites, and an important foraging resource.

4.1.2 Non-cited Species

A wide range of species of waterfowl that do not appear as cited or designated features of the Severn Estuary SPA and Ramsar site or Bridgwater Bay SSSI were also recorded during the intertidal surveys, with most seen sporadically, or in relatively small numbers. However, little egret, oystercatcher, knot, bar-tailed godwit and turnstone were recorded regularly, in numbers that are potentially important in terms of their respective county (Somerset) populations. The importance of the study area to these species is discussed further below.

Little Egret

The peak counts of little egret on the Parrett Estuary in 2007 and 2008 were 62 (in July) and 31 birds (in June) respectively (Gibbs [ed] 2009, 2010). The monthly maximum counts of little egret reported in Somerset Birds 2007 and 2008 probably under-estimate the true population in the county, with many birds now occurring away from the main (well monitored) sites. However, even allowing for this, the numbers recorded in the study area between April and October 2010, will be of at least county importance. The intertidal habitat within the study area is likely to provide an important foraging resource for the county population of little egret.

Oystercatcher

Oystercatcher is described as a fairly common winter visitor and passage migrant in Somerset (Gibbs [ed], 2010). Large numbers of oystercatchers were recorded foraging and roosting on intertidal habitat within the study area throughout much of the survey period. The peak count of 506 oystercatchers recorded during the Entec surveys represents a substantial proportion of the peak monthly count of 571 birds recorded in Somerset in November 2008 (Gibbs [ed], 2010).

In view of this, the intertidal habitat within the study area (particularly in Count Sectors 1-3) is likely to provide an important foraging resource to the county population of oystercatcher.

Knot

Knot is described as a locally common winter visitor and passage migrant in Somerset (Gibbs [ed], 2010). The Parrett Estuary holds the vast majority of the Somerset population of knot, (all but 6 of the 4,036 knot recorded in Somerset in November 2008 were from the Parrett Estuary, Gibbs [ed], 2010). Large numbers of knot were recorded foraging and roosting on intertidal habitat within the study area (particularly between Stolford and Stert Point) during the Entec surveys from October 2010 to January 2011. The peak count of 3,575 knot recorded during the Entec surveys represents a substantial proportion of the county total, and exceeds the national threshold of importance for a site (2,800 birds, Calbrade *et al*., 2010). In view of this, the intertidal habitat within the study area (particularly in Count Sectors 2-4) is likely to provide an important foraging resource to the county population of knot, and occasionally hold nationally important numbers of this species.

Bar-tailed Godwit

Bar-tailed godwit is described as a scarce winter visitor and erratic passage migrant in Somerset (Gibbs [ed] 2010). The Parrett Estuary supports the bulk of the population where in 2008 a peak monthly count of 34 birds was recorded in Somerset in April (Gibbs [ed] 2010). The peak count of 175 birds recorded during the Entec surveys is likely to represent a substantial proportion of the county total, and on this basis, the intertidal habitat within the study area (particularly that within Count Sectors 2-4) is likely to provide an important foraging resource to the county population of bar-tailed godwit during the spring and autumn passage periods.

Turnstone

Turnstone is described as a locally common winter visitor and passage migrant in Somerset (Gibbs [ed] 2010). The Parrett Estuary supports the bulk of the county population where in 2008 a peak monthly count of 349 birds (of which 243 birds were on the Parrett Estuary) was recorded in Somerset in September (Gibbs [ed], 2010). The peak count of 95 birds recorded during the Entec surveys in April 2010 represents 27% of the September 2008 county total. Evidence from the 2010-11 intertidal surveys indicates that the intertidal habitat within the study area (particularly that within Count Sectors 2-4) is likely to provide an important foraging resource to the county population of turnstone during the spring and autumn passage periods and winter.

5. Conclusions

Evidence from the intertidal surveys undertaken between Hinkley Point and Stert Point between April 2010 and January 2011 inclusive, indicates that the mudflats and other intertidal habitat in this area (particularly that between Stolford and Stert Point, in the east of the study area) provides an important foraging resource to the Severn Estuary populations of shelduck, wigeon, mallard, pintail, ringed plover, grey plover, dunlin, whimbrel, curlew and redshank during the passage and /or winter periods. The intertidal areas also provide important high tide roost sites for these species, particularly on the rock platforms at Hinkley Point and Stolford, and on the shingle beaches, saltmarsh and adjoining mudflats along or above the high water mark. The intertidal habitat is also likely to support numbers of little egret, oystercatcher, knot, bar-tailed godwit and turnstone that are important in terms of the county (Somerset) population. The study area also occasionally supports nationally important numbers of shelduck, ringed plover, grey plover, knot, dunlin and whimbrel.

6. References

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Appendix A
Peak and Mean Intertidal Survey Counts

Table A1 Peak and Mean Counts of Birds Recorded from Each Observation Point

		Peak Monthly Counts (April 2010 to January 2011 inclusive)										Mean Monthly Counts (April 2010 to January 2011 inclusive)[8]									
Species	**Obs Pt**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
Mute Swan	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mute Swan	2	2	0	0	5	1	0	4	5	0	0	0	0	0	1	0	0	1	1	0	0
Mute Swan	3	2	0	0	1	1	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0
Greylag Goose	3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0
Canada Goose	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canada Goose	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brent Goose	1	0	0	0	0	0	0	6	9	16	12	0	0	0	0	0	0	2	5	10	4
Brent Goose	2	0	0	0	0	0	0	0	17	12	14	0	0	0	0	0	0	0	14	8	12
Brent Goose	3	0	0	0	0	0	0	2	14	18	12	0	0	0	0	0	0	0	4	8	5
Shelduck	1	132	176	221	1,257	854	1,020	1,120	1,542	474	270	82	110	83	511	334	685	890	670	366	93
Shelduck	2	108	293	205	752	2,000	1,249	1,537	497	264	500	71	131	153	315	881	752	947	316	154	324
Shelduck	3	88	271	273	860	1,552	1,608	1,712	862	412	518	62	90	231	496	701	1,309	843	305	167	386
Shelduck	4	42	37	334	253	2,049	787	1,050	159	638	327	27	32	239	177	921	501	578	43	216	248
Wigeon	1	0	0	0	0	0	3	22	34	90	312	0	0	0	0	0	2	14	22	58	128
Wigeon	2	0	0	0	0	0	0	0	5	130	112	0	0	0	0	0	0	0	2	44	46
Wigeon	3	0	0	0	0	0	11	0	18	105	0	0	0	0	0	0	3	0	3	38	0

[8] The figures presented show the mean of the peak daily counts during that month

Species	Obs Pt	Peak Monthly Counts (April 2010 to January 2011 inclusive)										Mean Monthly Counts (April 2010 to January 2011 inclusive)[8]									
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Wigeon	4	0	0	0	0	0	0	0	32	5	70	0	0	0	0	0	0	0	6	1	14
Gadwall	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Gadwall	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Teal	1	0	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0	8	0
Teal	2	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	4	0
Teal	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Teal	4	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0
Mallard	1	4	6	21	22	94	15	8	27	24	48	1	4	17	8	34	8	4	12	19	31
Mallard	2	2	11	24	37	72	40	30	51	28	78	1	5	10	17	34	25	21	31	19	46
Mallard	3	2	1	17	0	15	15	14	3	5	1	1	0	4	0	4	9	3	1	1	0
Mallard	4	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pintail	1	1	2	1	0	2	12	45	94	135	21	1	1	1	0	0	7	25	56	94	9
Pintail	2	1	1	0	0	0	23	58	53	158	13	0	0	0	0	0	9	34	23	90	7
Pintail	3	1	0	0	0	0	22	53	31	54	22	0	0	0	0	0	8	15	9	14	10
Pintail	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0
Shoveler	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0
Shoveler	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0
Shoveler	3	0	0	0	0	0	0	0	90	3	0	0	0	0	0	0	0	0	15	1	0
Shoveler	4	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Tufted Duck	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0
Tufted Duck	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species	Obs Pt	Peak Monthly Counts (April 2010 to January 2011 inclusive)										Mean Monthly Counts (April 2010 to January 2011 inclusive)[8]									
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Tufted Duck	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Scaup	1	0	0	0	0	0	0	0	1	2	11	0	0	0	0	0	0	0	0	0	8
Scaup	2	0	0	0	0	0	0	0	3	0	11	0	0	0	0	0	0	0	1	0	2
Scaup	4	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	2
Eider	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Common Scoter	1	0	0	0	0	0	0	1	2	26	1	0	0	0	0	0	0	0	0	5	0
Common Scoter	3	0	0	0	8	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0
Goosander	3	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0
Great Crested Grebe	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cormorant	1	2	2	2	0	4	4	2	0	0	0	1	1	1	0	3	2	1	0	0	0
Cormorant	2	0	0	0	1	2	2	0	1	0	0	0	0	0	0	1	1	0	1	0	0
Cormorant	4	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Little Egret	1	3	5	4	5	8	5	6	1	0	0	2	3	4	3	6	4	5	1	0	0
Little Egret	2	19	16	33	25	15	12	16	2	0	2	11	13	24	19	8	9	9	2	0	0
Little Egret	3	18	20	38	32	23	21	14	1	0	0	16	12	28	20	15	15	8	1	0	0
Little Egret	4	17	11	31	13	44	21	28	0	0	0	12	9	23	7	17	15	11	0	0	0
Grey Heron	1	1	0	2	5	2	1	2	3	2	3	0	0	1	1	1	1	1	1	1	1
Grey Heron	2	4	2	1	2	0	3	4	3	2	1	1	1	1	1	0	1	1	2	0	0
Grey Heron	3	1	0	2	2	1	2	3	1	1	0	0	0	1	1	0	1	1	0	0	0
Grey Heron	4	0	1	2	2	1	3	1	3	0	0	0	0	0	0	0	1	0	1	0	0
Oystercatcher	1	44	140	10	8	506	52	20	5	15	26	23	43	7	6	136	25	11	3	7	19

Species	Obs Pt	Peak Monthly Counts (April 2010 to January 2011 inclusive) Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Mean Monthly Counts (April 2010 to January 2011 inclusive)[8] Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Oystercatcher	2	48	40	69	29	199	131	85	70	71	71	39	35	40	14	162	85	58	52	40	51
Oystercatcher	3	58	24	12	27	223	96	75	62	30	12	34	11	6	10	136	63	45	23	20	5
Oystercatcher	4	3	4	4	3	33	11	15	6	6	2	2	2	3	1	12	3	5	2	3	1
Ringed Plover	1	12	10	0	0	8	0	0	0	8	0	3	3	0	0	2	0	0	0	3	0
Ringed Plover	2	64	14	39	0	37	9	27	44	11	8	33	3	10	0	24	2	8	25	3	3
Ringed Plover	3	70	40	71	11	76	0	5	2	6	1	33	17	26	3	43	0	1	0	1	0
Ringed Plover	4	32	63	65	7	702	8	2	0	0	1	18	40	26	3	243	3	1	0	0	0
Golden Plover	1	0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0	1	1	0
Golden Plover	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Golden Plover	4	0	0	0	1	0	2	500	400	0	0	0	0	0	0	0	0	125	91	0	0
Grey Plover	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Grey Plover	2	0	0	0	0	2	0	7	12	3	60	0	0	0	0	1	0	2	5	1	36
Grey Plover	3	0	2	0	0	1	5	79	975	80	83	0	0	0	0	0	2	33	444	37	56
Grey Plover	4	1	7	1	1	10	16	630	144	113	127	1	2	0	0	4	11	226	123	98	78
Lapwing	1	0	0	0	0	0	0	8	17	18	17	0	0	0	0	0	0	3	7	10	6
Lapwing	2	0	0	0	0	0	0	0	52	4	2	0	0	0	0	0	0	0	11	1	0
Lapwing	3	0	0	0	0	0	2	18	30	412	0	0	0	0	0	0	1	4	8	124	0
Lapwing	4	0	0	0	0	0	0	45	51	0	0	0	0	0	0	0	0	15	12	0	0
Knot	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
Knot	2	0	0	0	0	2	145	24	0	1,090	2,000	0	0	0	0	1	57	5	0	338	400
Knot	3	0	4	0	0	1	130	8	2,100	55	115	0	1	0	0	0	33	2	963	11	26

Species	Obs Pt	Peak Monthly Counts (April 2010 to January 2011 inclusive) Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Mean Monthly Counts (April 2010 to January 2011 inclusive)[8] Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Knot	4	0	1	0	0	33	97	600	3,575	1,860	215	0	0	0	0	7	43	393	1,896	887	104
Sanderling	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sanderling	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sanderling	4	0	5	0	3	1	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0
Little Stint	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dunlin	1	72	13	0	0	3	0	8	156	82	0	30	3	0	0	1	0	2	49	27	0
Dunlin	2	408	4	27	100	22	10	1,000	1,060	1,600	3,250	209	2	7	33	9	3	291	755	603	2,655
Dunlin	3	320	67	45	235	329	183	3,210	7,350	2,120	4,880	186	37	22	75	196	71	1,976	3,221	1,388	3,220
Dunlin	4	367	330	72	75	462	68	5,400	6,812	12,590	2,700	147	200	26	17	113	31	2,803	4,546	6,548	2,104
Ruff	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Snipe	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Snipe	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Black-tailed Godwit	1	0	9	0	0	7	0	5	0	0	0	0	2	0	0	1	0	1	0	0	0
Black-tailed Godwit	2	0	0	0	2	0	0	26	0	2	0	0	0	0	0	0	0	5	0	0	0
Black-tailed Godwit	3	0	0	0	0	21	160	33	0	1	0	0	0	0	0	5	51	7	0	0	0
Black-tailed Godwit	4	0	0	0	0	19	140	42	14	3	0	0	0	0	0	5	61	14	4	1	0
Bar-tailed Godwit	1	6	13	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0
Bar-tailed Godwit	2	34	2	1	0	0	65	0	0	7	0	14	0	1	0	0	34	0	0	2	0
Bar-tailed Godwit	3	0	18	3	0	0	36	65	0	0	0	0	7	1	0	0	9	14	0	0	0
Bar-tailed Godwit	4	12	0	1	0	1	175	60	0	10	0	4	0	0	0	0	95	15	0	2	0
Whimbrel	1	43	17	0	3	3	0	0	0	0	0	28	10	0	2	1	0	0	0	0	0

Species	Obs Pt	Peak Monthly Counts (April 2010 to January 2011 inclusive) Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Mean Monthly Counts (April 2010 to January 2011 inclusive)[8] Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Whimbrel	2	134	15	13	5	0	1	0	0	0	0	52	8	5	1	0	0	0	0	0	0
Whimbrel	3	36	13	9	4	0	0	0	0	0	0	13	7	6	2	0	0	0	0	0	0
Whimbrel	4	71	42	6	4	5	0	0	0	0	0	39	14	2	1	1	0	0	0	0	0
Curlew	1	2	1	2	8	13	19	14	10	16	9	1	0	1	6	9	8	8	5	12	6
Curlew	2	100	9	16	126	71	101	270	72	66	163	50	6	11	71	55	61	131	61	41	92
Curlew	3	27	7	22	107	150	400	195	526	270	237	21	4	19	76	89	148	128	194	214	178
Curlew	4	11	5	29	109	172	143	166	510	739	395	5	3	11	67	83	99	135	313	366	268
Common Sandpiper	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greenshank	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greenshank	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greenshank	4	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Redshank	1	0	0	1	5	0	0	3	0	13	2	0	0	0	2	0	0	1	0	6	0
Redshank	2	4	0	0	2	0	0	0	8	20	4	1	0	0	0	0	0	0	4	9	1
Redshank	3	0	0	0	0	1	0	6	159	15	59	0	0	0	0	0	0	1	64	5	17
Redshank	4	1	0	0	2	4	1	355	162	145	110	0	0	0	0	1	0	89	61	59	58
Turnstone	1	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	2	0
Turnstone	2	30	0	0	0	5	12	33	80	50	95	17	0	0	0	3	5	17	55	30	47
Turnstone	3	36	0	1	0	2	2	66	57	26	4	11	0	0	0	1	1	22	27	16	2
Turnstone	4	0	1	0	2	2	1	62	44	8	47	0	0	0	0	0	0	28	10	4	21
Little Tern	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX 20D: BADGER SURVEY RESULTS

POTENTIALLY EXCEPTED INFORMATION:

The information contained in this report is potentially excluded from disclosure under Regulation 12(5)(g) of the Environmental Information Regulations 2004 as such disclosure could adversely affect the protection of the environment to which the information relates.

APPENDIX 20E: HINKLEY BAT SURVEY REPORT

EDF Energy
Hinkley Bat Survey Report

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as ‘Hinkley C’) on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, excluding coastal/marine biodiversity other than birds.

This report details the work completed in respect to bats in 2009, comprising activity surveys, static Anabat monitoring and a building and tree assessment. It provides a description of the survey methodologies used and the results obtained. These results are used to draw conclusions regarding how the site is used for foraging, commuting and roosting. Relevant previous survey work for bats undertaken in 2007 and 2008 is also summarised.

1.2 Background Information

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. At the time of the bat surveys that were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1.1). The boundary of the SSA was therefore used to define the area for the 2009 bat surveys (which effectively updated and superseded the 2008 surveys). The SSA boundary includes all of the land within the final ‘Construction Boundary’.

1.2.2 Site Description

The majority of the land within the SSA is agricultural; comprising 16 arable fields and 16 grassland fields with various levels of agricultural improvement. The fields are primarily bordered by mature hedgerows. Six small, rectangular broad-leaved woodlands are located within the northern part of the SSA and a square block of young broad-leaved plantation has been created in the central part of the area, with smaller areas of isolated scrub scattered along the northern boundary and in the eastern parts of the SSA. Two watercourses flow west to east through the SSA (further seasonal ditches also occur) and a further watercourse is present on its southern boundary. Three ponds occur within the SSA. In addition, there are three derelict stone barns.

The northern boundary of the SSA is adjacent to the Bristol Channel. A low cliff, between 0.2m and 10m in height, forms an escarpment between the land and sea.

The land immediately adjacent to the west of the SSA is similar in character to that within the western part of the SSA, i.e. it comprises agricultural fields (both arable and improved pasture), which are separated by intact species-poor and species-rich hedgerows. A small number of ponds occur and the upper reaches of the Bum Brook flow through the area.

The land east of the SSA is different in character to that within the SSA. It forms part of Bridgwater Bay SSSI and comprises large open fields separated by drains, with very few hedgerows present. The fields immediately adjacent to the SSA have been agriculturally improved and are relatively species-poor. However, those fields to the south and east are less intensively grazed, support a more varied sward and have a greater diversity of plant species.

The proposed development falls into the Vale of Taunton and Quantock Fringes Natural Area[1] (English Nature, 1998), which describes the lowland landscape around the major towns of Taunton, Wellington and Minehead between the Quantock Hills, Brendon Hills, Exmoor and the Blackdown Hills. The Natural Area is characterised by a wide variety of habitats and species, including hedgerow and hedgebanks, calcareous grassland, streams, woodland and scrub, nightingale, otter and bats, all of which occur or could occur within the site.

The Natural Area immediately to the east of the site is the Somerset Levels and Moors Natural Area (English Nature, 1997).

2. Methodology

2.1 Desk Study

Existing information regarding bats within the SSA and surrounding land was obtained from the following sources:

- EDF Energy (and British Energy, which became part of EDF Energy in 2009) which has conducted a wide range of ecological surveys of its land holding and employs a conservation warden at Hinkley to help manage its land and undertake biological recording;
- Somerset Environmental Records Centre (SERC), which also hold all the records from the Somerset Bat Group;
- The Environmental Statement (ES) for the Decommissioning of Hinkley A (Magnox, 2006);
- the ES and supporting information (including from the SEI) for the proposed West Hinkley Wind Farm (Dulas, 2006);

[1] The classification of areas of the country into distinct Natural Areas (NAs) was undertaken by English Nature (now Natural England) in order that areas of the countryside identified by unique combinations of physical attributes, wildlife, land use and culture could be grouped together. Overall, 143 NAs, including 24 Coastal NAs have been identified.

- communication with the Somerset Bat Group; and
- communication with the Bat Conservation Trust (Philip Briggs, National Bat Monitoring Programme Team Co-ordinator).

Data relating to bat sightings and roosts from SERC was requested in May 2009 (following an initial request in 2007) for 10km from the SSA boundary to ensure that any additional new records submitted in the intervening period were captured.

2.2 Field Surveys

The methodology for undertaking all the bat survey work followed that advised by Natural England (The Bat Mitigation Guidelines, English Nature, 2004) and Bat Conservation Trust Good Practice Survey Guidelines (2007). Sunset times for all the surveys were taken from Metcheck (www.metcheck.com).

2.2.1 Habitat Suitability

Habitat suitability for bats was considered during the extended Phase 1 habitat assessments in 2007, 2008 and 2009 (detailed in Entec report reference 19801cb304), whilst undertaking bat activity surveys (see below), the building and tree roost assessment and from aerial images of the site. This identified features that offer potential for:

- roosting e.g. trees, buildings, other built structures;
- commuting e.g. provided by structural features such as woodland edge); and
- foraging (e.g. over areas of grassland or adjacent to woodland).

Features that reduce the value of a feature or habitat for commuting or foraging were also noted. This element of work was used to help design activity survey transects and to determine locations for static monitoring points.

2.2.2 Buildings Assessment

Five buildings (Buildings 2, 3, 4, 5a and 5b) are located either within or immediately adjacent to the SSA. A further building (Building 1) is located approximately 220m to the west of the SSA boundary. Building 1 has been surveyed in relation to previous development proposals (e.g. the wind farm), but was screened out of detailed assessment due to the distance from the SSA. A small number of other buildings associated with the existing Power Station are present within the SSA boundary. These relatively new buildings offer very little roosting potential for bats and were screened out of the detailed assessment. The locations of Buildings 2-5b[2] is shown in Figure 2.1.

[2] Buildings 5a and 5b are adjacent to each other and have been shown on the figure as Building 5. Where this building is referenced as Building 5 within this document it refers to both buildings. Building 5a is the smaller building, whilst Building 5b is a larger derelict farm house.

Screening

Buildings 2-5b were inspected externally on the 15 June 2009 to determine their suitability for bat roosts and to decide on further survey requirements. Due to poor structural integrity of the buildings, and the associated health and safety risk, access was only available at this time into Building 3. Further inspection of Buildings 2, 4, 5a and 5b was completed on the 16 September 2009. All inspections were carried out by a Natural England licensed bat ecologist (Lynn Whitfield, NE licence no. 20084000 and Katheryn Leggat, licence no. 20093209). The methodology included:

- close inspection to determine whether the external surfaces provide roosting opportunities (e.g. gaps in stone wall) or the building provided opportunity for bats to access potential roost spaces (e.g. gaps or cracks in stone or mortar work, loose tiles, open windows and doors);
- search for bat droppings (e.g. in cobwebs or below potential roost access points); and
- description of structure (only brief if considered not suitable).

For Buildings 4, 5a and 5b, a pole-mounted camera was used to inspect the interiors and, although the resolution of the images was not high enough to search for details such as droppings, it did enable the general internal structure to be examined. Building 2 was not inspected internally with the camera as it was possible to see much of the inside through the numerous open doorways and windows using binoculars.

Detailed notes on all buildings were taken.

Emergence/Re-Entry Surveys

Following the screening survey it was determined that an emergence (dusk) and re-entry (dawn) survey was required for Buildings 2-5b[3]. Due to the relatively small size and simple shape of the buildings each survey required only two people, stationed at opposite corners. The emergence surveys started just prior to dusk and lasted between 1.5 and 2 hours. The re-entry surveys started 2 hours before dawn and finished at dawn. During each survey the buildings were watched for bats entering or exiting. Due to the derelict nature of the buildings, this focused primarily on open doors, windows and roofs. Bat calls were recorded using bat detectors (e.g. Batbox duet or Pettersson D-230) and recording devices (e.g. an Edirol R09), which were subsequently analysed using BatSound.

The dates of the surveys and weather conditions are provided in Table 2.1.

[3] Due to the close proximately of Buildings 5a and 5b, these were surveyed at the same time.

Table 2.1 Building Emergence/Re-entry Survey Dates and Weather Conditions

Building Number	Date	Emergence or Re-entry	Weather Conditions
2	02 June 2009	Emergence	Dry, calm and clear (0% cloud cover). Temp 23ºC - 15ºC.
4 and 5	15 June 2009	Emergence	Dry, light winds and clear (20% cloud cover). Temp 17ºC - 13ºC.
3	18 June 2009	Emergence	Dry, moderate winds and scattered cloud (60-90% cloud cover). Temp 17ºC - 15ºC.
2	10 July 2009	Re-entry	Very light drizzle, light wind and cloudy (95%). Temp 17ºC - 19ºC. RH 71% - 64%
4 and 5	31 July 2009	Re-entry	Dry, calm and clear (20% cloud cover). Temp 15ºC - 14ºC. RH 74% - 75%
3	04 August 2009	Re-entry	Very light drizzle, light wind and cloudy (100%). Temp 18ºCºC - 17ºC. RH 87% - 93%

Although the primary aim of the survey was to investigate roosting in the buildings, all bat activity at the time of the emergence and re entry surveys was recorded. Therefore, information collected on these dates has also been used to form a picture of bat activity across the SSA.

2.2.3 Tree Assessment for Roost Sites

There are nine woodland blocks within the SSA. The locations and references for these are shown in Figure 2.2.

Screening

An initial inspection of the semi-mature and mature trees (scrub or very young trees were screened out without assessment due to their very low potential to support bat roosts) within the woodlands in the SSA, specifically to identify potential for roosting bats, was completed on 16th and 18 March 2009. This is an appropriate time of year to complete this type of survey as there are no leaves on the trees, which if present could obscure features on the trunk and branches. The survey comprised:

- detailed inspection, using close focus binoculars to identify features that might offer roosting potential (e.g. including holes, cavities, splits, exfoliating bark and dense or woody ivy cover); and
- recording the location of the tree using GPS, and features of interest, if the tree offered potential for roosting bats.

Detailed notes were made and features with a medium to high potential to support bats were recorded.

Detailed Inspection

A detailed inspection of those trees supporting medium-high and high potential features (as identified during the screening survey) within woodlands A, C, D and G was completed on the

25 November 2009 by Greena Ecological Consultancy (GEC). A total of 22 trees supporting 47 features were subject to this inspection. Two features could not be assessed in detail as they could not be safely accessed. Dense ivy was not inspected as in most cases this cannot be fully assessed without removing the ivy, which could harm bats present and/or remove roosting sites.

Each feature was accessed using ladder and tree climbing techniques and then examined for evidence of use by bats (e.g. droppings or roosting individuals) using a combination of hand held bright torches (0.5-2M candle power), high power mini torches and a 90cm long 5mm diameter fiberoptic viewing probe. As a result of the detailed inspection, the potential for each feature to support bats was refined based on the following criteria:

- no potential - feature provides no potential to support bats because it is superficial;
- low potential - feature unlikely to be used by bats as it is too shallow, wet or light;
- medium potential - feature offers some suitable conditions for roosting and could possibly be used by small numbers of bats;
- high potential - feature offers ideal conditions for roosting e.g. deep cracks with stable temperatures and relatively dry; and
- confirmed - evidence of bat roosting found e.g. droppings.

Information about the trees surveyed was also recorded including approximate age, height, diameter, root/loss damage, fungal infection, dead sections, open/closed habitat location and soil type.

Emergence/Re-Entry Surveys

Following the screening survey it was determined that a number of trees within the woodlands had medium to high or high potential to support bat roosts and that emergence (dusk) and re-entry (dawn) surveys were required. Due to the number and locations of the trees highlighted (i.e. within several scrub woodlands) it was not practical to survey every tree individually. Instead, surveyors were stationed at strategic points at the edges of the woodlands, chosen on the basis of visual coverage (i.e. being to see a lot of the woodland edge) and likely commuting routes between the woodlands and the surrounding landscape (e.g. connecting hedgerows). The survey points for the re-entry survey were altered slightly in response to the results of the emergence survey. The locations of the survey points are shown in Figure 2.2.

The emergence surveys started around dusk and lasted between 1.5 and 2 hours. The re-entry surveys started 2 hours before dawn and finished at dawn. During each survey the woodlands were watched for bats entering or exiting. Bat calls were recorded using bat detectors (e.g. Batbox duet or Pettersson D-230) and recording devices (e.g. an Edirol R09), which were subsequently analysed using BatSound.

The dates of the surveys and weather conditions are provided in Table 2.2.

Table 2.2 Tree/Woodland Emergence/Re-Entry Survey Dates and Weather Conditions

Survey Points	Date	Emergence or Re-entry	Weather Conditions
1-5	23 June 2009	Emergence	Dry, light winds and clear (0% cloud cover). Temp 22ºC - 16ºC.
6-10	29 June 2009	Emergence	Dry, light winds and clear (5% cloud cover). Temp 18ºC - 18ºC.
1-5	29 July 2009	Re-entry	Dry, light winds and cloudy (95% cloud cover). Temp 17ºC - 15ºC.
6-10	11 August 2009	Re-entry	Dry, light winds and cloudy (80% cloud cover). Temp 21ºC - 17ºC. RH 75% - 83%

Although the primary aim of the survey was to investigate roosting within the woodlands, all bat activity was recorded. Therefore, information collected on these dates has also been used to form a picture of bat activity across the SSA.

2.2.4 Walked Activity Surveys

General Method

Surveys to sample the distribution of and usage by foraging and commuting bats in the SSA were completed in 2007, 2008 and 2009. The methodologies for each of the surveys are broadly similar, having followed guidance provided in the Bat Conservation Trust Good Survey Guidelines (2007).

In all years the bat activity has been sampled by following transect routes around various parts of the SSA (depending on access availability). During each survey the transect was walked at a steady pace and bat calls were recorded using bat detectors (e.g. Batbox duet, Pettersson D-230 or Anabat SD1) and recording devices (e.g. an Edirol R09), which were subsequently analysed using BatSound or Analook, depending on the method of recording. A number of indistinct calls were verified by Philip Briggs from the BCT.

During each activity survey, a note was made of the likely bat species, the location of the registration and other detail (where discernable) such as direction of flight, activity (e.g. foraging or commuting), number of passes and number of bats.

All surveys commenced around sunset and lasted between 2 and 3 hours to coincide with the time when bats are most active during the night, as this is widely recognised as an optimal time to survey for bat activity. At least one circuit of each transect was completed within this time on each survey visit.

Survey Locations

Each activity survey transect has followed a different route. This is in part due to the site boundary changes and associated access restrictions (section 1.2.1), which required part of the transect routes in 2007 to follow footpaths, but the transect routes have also varied with the aim of sampling as much of the site as possible and to vary the time different locations within the SSA were sampled. Figures 2.3a-2.3c illustrate the transect routes taken in 2007, 2008 and 2009 respectively. This figure shows that despite the varied transect routes, the entire site has been well sampled for bat activity. Note that on most of the survey dates (see below) two different transect routes were surveyed.

Timing

The survey dates and weather conditions of each transect completed are provided in Table 2.3. A total of 18 transect routes across the SSA has been completed between 2007 and 2009.

Table 2.3 Activity Survey Dates and Weather Conditions

Date	Number of Transects	Weather Conditions
2007		
26 May 2007	One	14ºC, 50% cloud cover, wind 4-5: light to moderate
23 July 2007	One	14ºC, light rain, wind 2-3: light. (NB Heavy rain during preceding 24 hours)
22 August 2007	One	15.5ºC, 10% cloud cover, wind 2-3 light wind
26 September 2007	One	10.5ºC, 60% cloud cover, wind 4-5: moderate with gusts
2008		
10 September 2008	Two	17.4ºC (start), 15.1ºC (end), 100% cloud cover, light drizzle at start of survey and very windy especially in exposed areas.
24 September 2008	Two	16.1ºC (start), 14.6ºC (end), 100% cloud cover, with a light breeze.
2009		
19 May 2009	Two	Dry, light winds and scattered cloud (10-50% cloud cover). Temp 16ºC - 14ºC.
18 June 2009	Two	Dry, moderate winds and scattered cloud (60-90% cloud cover). Temp 17ºC - 15ºC.
13 July 2009	Two	Dry, light winds and cloudy (80% cloud cover). Temp 23ºC - 18ºC. RH 58% - 73%. (heavy rain prior to survey)
17 August 2009	Two	Dry, calm and scattered cloud (50% cloud cover). Temp 24ºC - 20ºC. RH 57% - 68%
03 September 2009	Two	Dry, moderate winds and cloudy (60-100% cloud cover). Temp 18ºC - 15ºC.

Note that the results described in section 3.2.4 also take into account activity of bats recorded during the building and tree emergence/re-entry surveys.

2.2.5 Driven Activity Surveys

Two driven transects were undertaken in 2007 to sample bat activity within a 2km zone around the SSA. The transect routes are shown in Figure 2.3a. An Anabat detector was fixed to a car with the microphone pointing out of the rear passenger window. The speed of the driven transect was between 10mph and 20mph, with two-minute listening stops. An amber flashing beacon and warning sign on the car warned other drivers of the slow moving vehicle. This is a recognised method for sampling bat activity (Bat Conservation Trust, 2007) and allows a wide area to be covered (for contextual purposes) within the period of peak bat activity after dusk.

The dates the driven activity transect routes were completed and the weather conditions are provided in Table 2.4.

Table 2.4 Dusk Driven Transect Survey Dates and Weather Conditions

Date	Weather Conditions
18 July 2007	16.5ºC, clear conditions and a light southwest wind (3-4)
22 August 2007	16ºC, fine, dry conditions with a moderate northerly wind 4-5.

2.2.6 Static Bat Detectors (Anabat)

Two Anabat SD1s units were deployed as static recorders from June until September. The units were hidden at locations along prominent linear features such as hedgerows. The positions were regularly altered to sample different locations within the SSA (Figure 2.1). Each Anabat was set twice in each location (apart from location 5), with the memory cards and batteries changed prior to re-setting the unit the second time. This ensured that should the Anabat fail during either the first or second recording period at each location data would still be collected. The duration each Anabat sampled was dependant on the battery life. Hi-mics were used so that the microphones could be placed between 1m and 2m above the ground and sensitivity levels were maintained at around 5 to filter out disturbance, for example from rustling leaves, but to ensure fainter calls would triggered the unit to record. Table 2.5 shows when the units were deployed at each location.

Table 2.5 Anabat Locations, Deployment Dates and Rationale for Site Selection

Location Reference and Grid Reference	Dates	Number of Days Sampled in each Location	Reason for Location
Anabat A - always located on the ‘green lane’ in response to the Barbastelle records collected in 2007			
1 ST205 454	05/06/09 - 18/06/09	13	At this location there is a dense tall hedgerow on both sides of the track (‘green lane’) creating a dark and sheltered corridor.
2 ST201 453	18/06/09 - 01/07/09 and 10/07/09 - 20/07/09	23	Located at the junction of the ‘green lane’ with a dense north-south hedgerow that connects to woodlands to the north.
3 ST198 454	20/07/09 - 02/08/09	13	Located near the junction of the ‘green lane’ with a dense north-south hedgerow that connects to the valley to the south.

Table 2.5 (continued) Anabat Locations, Deployment Dates and Rationale for Site Selection

Location Reference and Grid Reference	Dates	Number of Days Sampled in each Location	Reason for Location
Anabat A - always located on the 'green lane' in response to the Barbastelle records collected in 2007			
4 ST207 454	14/08/09 - 31/08/09	17	Located to sample the eastern end of the 'green lane' to determine whether Barbastelle travel the entire length of this feature. At this location there is also a junction with a north-south hedgerow leading to further hedgerows to the south, east and west.
5 ST207 453	09/09/09 - 23/09/09	14	Located within a hedgerow immediately east of the access road. At the western end of the hedgerow sampled in Location 4.
Anabat B			
1 ST197 454	05/06/09 - 18/06/09	13	Located at the crossroads of Benhole Lane and the 'green lane' which are both tall mature and established landscape features.
2 ST197 456	18/06/09 - 01/07/09 and 10/07/09 - 20/07/09	23	Located on the northern part of Benhole Lane in a sheltered valley.
3 ST203 456	20/07/09 - 03/08/09	14	Located at the SW corner of Woodland C with the aim of sampling a dark corridor formed by the wood and adjacent hedgerow.
Anabat B			
4 ST209 454	14/08/09 - 31/08/09	17	Located at the juncture of hedgerows which could be used for commuting to the mosaic of habitats south of the existing Power Station.
5 ST207453	09/09/09 - 23/09/09	14	Located on a prominent hedgerow and ditch immediately west of the access road and opposite the location for Anabat A.

The Anabat recordings were analysed to identify the species present using Analook software. Due to the extremely large number of bat registrations recorded by both Anabats, the analysis has been restricted to identifying calls from key species, namely those listed under Annex II of the Habitat Regulations, which are Barbastelle, lesser horseshoe and greater horseshoe.

2.2.7 Survey Limitations

All the surveys (excluding the static Anabat monitoring) were completed in suitable weather conditions (as set out in EN, 2004). However in order to achieve this, one building and one tree re-entry survey were postponed by approximately one week to avoid heavy rain. This resulted in these surveys being completed in early August rather than in the optimum month of July. However, this delay is not considered to have significantly altered the conclusions resulting from these surveys, as the results achieved in August are consistent with all the other surveys completed.

Due to the derelict nature of the buildings, the surveys of these features were constrained on the basis of the health and safety risk, namely entry into all but one of the buildings was prohibited. This may have resulted in a lack of finer detail regarding depth and size of some features that could not be accessed to allow a detailed assessment using an endoscope. However, every building was subject to external and internal inspection and two surveys (one emergence and one re-entry). Therefore, it is considered that a reasonable and sufficient level of effort and assessment has been completed to determine the value of the buildings to roosting bats and it is unlikely internal inspection would alter the conclusions reached.

One of the inherent difficulties in using Anabat detectors is the balance between placing the microphone in a prominent place, so that bat calls are recorded, whilst also sheltering the microphone from wind and leaves (that will trigger the recording device) and ensuring the unit is hidden to avoid theft. For the majority of the survey period this was achieved. However, on very windy nights, and in certain static locations, interference increased and consequently the quality of the bat calls recorded was reduced. Equally, very high levels of cricket calls (which are at a similar frequency to bats) also affected the quality of the results on a small number of nights. It is considered unlikely that reduced quality of data on a limited number of nights would significantly affect the conclusions drawn, due to the large quantity of data collected.

3. Results

3.1 Desk Study

3.1.1 Desk Study Records

Regular bat surveys have not been undertaken by the BE Site Warden, although common species such as pipistrelle (species does not appear to have been determined[4]) and noctule are known to occur through *ad hoc* surveys using bat detectors (Burrell, 2006).

SERC records were analysed following the receipt of an updated search (for 10km around the SSA boundary) in May 2009. The more notable records in the immediate area around the SSA are as follows:

- There are four reports of grey long-eared bat listed between 1996 and 1998 all from grid reference ST207458 (near or in the plant training building);
- There is one record of lesser horseshoe bat. The species was recorded in flight at ST206 455 on 28 September 2006. This is within the SSA boundary close to the east-west green lane. The origin of this record is unknown;
- Brown long-eared bat, noctule and serotine are listed as being occasional, frequent and rare respectively at ST200456 between 28 June and 28 September 2006 (as

[4] These records may have been made before the split of the two commoner pipistrelle species (*Pipistrellus pipistrellus* and *Pipistrellus pygmaeus*)

part of survey work for the West Hinkley Wind Farm). This location is within the coastal part of the SSA boundary.

A 10km search for bat records was conducted to gain insight into bat activity in the wider area, particularly roost locations and records of nationally rare species/those with a restricted range known to occur in Somerset. The most notable results were as follows:

- There are no known barbastelle roosts and no records of the species within 10km of the SSA boundary;
- There are five lesser horseshoe bat roosts (both summer and hibernation) between 7.5km and 10.2km of the SSA. These roosts are all in the Quantock Hills;
- The furthest of these lesser horseshoe bat roosts from the site (10.2km south south-east) also supports greater horseshoe bat;
- The closest brown long-eared bat roost is approximately 2.8km to the south-east of the SSA at ST237 428. There are two further roosts between 8 and 10km of the SSA.

Additional information was sought from Mr Edward Wells (Somerset Bat Group) with regard to the records of grey long-eared bat, as SERC were unable to obtain further details with regard to authenticity or origin. Mr Wells has stated that in his opinion there is one confirmed record of a grey long-eared bat from Hinkley. This animal was found in the administration block of the operational plant and taken into care. All relevant biometrics were taken to confirm a positive identification of the species, and the bat was released in the same area.

3.1.2 Previous Survey Information

Bat surveys were conducted for West Hinkley Wind Farm (WHWF) during 2005 and 2006 (Dulas Ltd, 2006). Roost surveys were undertaken of 3 of the 4 buildings and all suitable mature trees within the SSA boundary, and transect surveys were completed to record bat activity within the site.

Bat droppings (no species specified) were found in one of the four buildings surveyed in 2005 but no evidence of bats was found during repeat surveys in 2006. The ES concluded that none of the buildings were used as maternity roosts, but that small numbers of bats could use the buildings occasionally for shelter or hibernation. Limited numbers of mature trees were found to be present within the WHWF survey area. No tree roosts were found. A number of transect routes were walked on several occasions during 2006 (between the 28 June and 03 August). The presence of the following species was recorded: common and soprano pipistrelle, noctule, serotine and bat species in the genus *Myotis*. Common pipistrelle was the commonest species and was recorded on all survey dates. Bat activity appears to have been spread throughout the WHWF survey area with most of the records concentrated along the hedgerows, woodland edges and along the coastal strip.

Supplementary post-submission information for the wind farm application was collected in April and May 2007 by Michael Woods Associates, to a survey protocol agreed with West Somerset Council. This involved two April and two May survey visits, during which three surveyors walked separate transects, all of which overlapped the SSA boundary, and one of which was entirely within it (the entire east-west green lane was covered during each survey). Each survey resulted in 10.5 hours of data being collected from areas within and adjacent to the

SSA boundary. The buildings on site were also visited and assessed for their potential to support roosting bats. Static Anabats were deployed at three locations within the SSA to collect complementary data.

These 2007 surveys concluded that the coastal fields had relatively little bat activity and that there was no evidence of roosting within the buildings. Five bat species were recorded during the work: common and soprano pipistrelle, noctule, lesser horseshoe bat and at least one *Myotis* species. *Pipistrelle* sp. bats were recorded on all surveys, with other bat species being far less frequent (only a small number of records and not recorded during all surveys)[5]. The report identified that several localised sections of hedgerow, including two along the east-west green lane appeared to be of local importance to bats.

Barbastelle is listed in the Vale of Taunton and Quantocks Fringes Natural Area Profile (English Nature, 1998) as a species that has been recorded several times in recent years. This Natural Area occupies the low ground between the Quantock Hills, the Brendon Hills and Exmoor and the Blackdown Hills and extends east of the Quantocks to meet the Somerset Levels. It is bordered to the north by the Bristol Channel Coast. As such, it encompasses the SSA.

A breeding colony of Barbastelle is known to occur at Horner Woods, near Minehead, approximately 30km to the west of the SSA. These bats have been reasonably well studied and in a study in 2000 (Natural England, 2009), they travelled up to 10km from the roosts (which changed regularly) and used a total area of $180km^2$. The BCT also provided a bat detector (not roost) record of Barbastelle from Combe Sydenham, approximately 14km south-west of the SSA. Barbastelle have also been recorded around Old Cleeve, approximately 16km to the west of the SSA (Geoff Billington, *Pers comm*.).

3.2 Field Study

3.2.1 Habitat Suitability

The most suitable areas of bat habitat provide good roosting locations, an abundance of prey items and well connected links between the roosts and foraging sites, as demonstrated by the features identified as being of high value to bats within Bat Surveys - Good Practice Guidelines (BCT, 2007) are:

- buildings, trees or other structures with features of particular significance for roosting bats;
- habitat of high quality for foraging bats e.g. broad-leaved woodland, tree-lined watercourses and grazed parkland; and
- site connected to the wider landscape by strong linear features that would be used by commuting bats e.g. river/stream valleys or hedgerows.

[5] There were two records of lesser horseshoe bat: one on 04 April 2007 and one on 18 May 2007. One of the encounters was on the east-west green lane with the other near the footpath west of Pixies Mound field.

Roosting Opportunities
Within the SSA there are four buildings (excluding those buildings associated with the Power Station). These are all built from stone and are considered to provide relatively limited roosting opportunities due to their derelict condition (see section 3.2.2 for more detail). There are few mature trees within the SSA and only a small number are likely to offer features suitable for roosting bats (see section 3.2.3). There are no other features within the SSA that could be used by roosting bats (e.g. mines or caves). Therefore, the SSA provides limited opportunities for roosting bats and is unlikely to support any large hibernation or maternity roosts.

Foraging Opportunities
A mixture of habitats occurs within and adjacent to the SSA, ranging from large arable fields to broad-leaved woodland and mosaics of scrub and grassland. The large arable fields are unlikely to provide good foraging habitat as the crop monocultures will support few invertebrates. The woodlands, hedgerows and areas of scrub are likely to support a wider range of invertebrates and therefore are relatively more valuable foraging locations. The water features within the site comprise minor watercourses and small ponds, which are unlikely to be large enough to support sustained productive foraging locations, but which do provide a diversity of invertebrates within the SSA. Therefore, it is considered the SSA contains pockets of suitable foraging habitat for bats, but much of the SSA is largely unsuitable.

Commuting Opportunities
As indicated above, the watercourses that are present within the SSA are minor and are poorly connected to the wider landscape. In many locations they also do not have adjacent hedgerows or tree-lines that would shelter commuting bats (particularly those species that do not readily fly away from cover). However, all the fields are bounded by hedgerows, which although managed, are mature and dense and are likely to form strong landscape features. Further, the hedgerow network within the SSA is well connected to hedgerows present within fields to the west and south. The hedgerows will also shelter commuting bats from the prevailing winds. Therefore, it is considered the SSA provides good connectivity for commuting bats, both within the SSA and into the wider landscape.

Overall Suitability
It is clear that the habitats within the SSA provide a varying degree of suitable habitats for bats. Therefore, it is concluded that overall, the habitats within the SSA are of moderate value to bats.

3.2.2 Building Assessment

Screening Surveys (Internal and External)

Building 2
Building 2 is a tall two-storey building with an approximate footprint of 10m x 20m, with thick stone walls and a pitched roof made from corrugated material (likely asbestos). In the past, this building was a farmhouse. Internally, the original structure would have supported two levels, although the floor has now largely collapsed with the upper floor being open to the rafters (i.e. no separate roof void). Large sections of the walls are missing, with one long side almost completely open.

As the interior of this building is exposed to the elements it is unlikely to support a maternity roost because bats require a dry, warm, stable and sheltered space for this type of roost.

However, cracks and crevices between the stones may lead to substantial spaces within the walls, and may provide both hibernation and cool summer roosts for a low number of crevice-roosting species.

Building 3

Building 3 is a small, open-fronted stone barn with a fairly new sloping roof constructed of corrugated asbestos. Due to its construction, the interior of the building is exposed and unlikely to create a stable or warm environment for roosting. However, the building is likely to remain largely dry and the thickness of the walls may create more stable conditions inside the wall. Therefore, the crevices in the stonework of the walls, both internally and externally, have the potential to lead to cavities within the wall, which could support roosting bats. Most of these cavities could be examined and were full of cobwebs. The exception to this was a crevice in the internal back wall, close to the west wall and about 1.8m from the floor, which was free of cobwebs. Two bat droppings were found on a ledge a few centimetres below this crevice which would suggest that it is used as a roost site and, from the size and shape of the droppings, by a pipistrelle species. Hay bales were stacked against most of the back wall at the time of survey, which could conceal further suitable crevices. Given the likely environmental conditions provided by the building, it is unlikely to support a maternity roost.

Building 4

Building 4 is a single-storey barn with an approximate footprint of 13m x 7m. The barn has a double hipped[6] roof structure with wooden trusses and pegged beams, in an 'A' frame design supporting a pitched, clay tiled roof over stone walls. Internally, the ground is open to the rafters, hence no roof void is present, and the tiles are laid directly onto battens with no lining. There may be gaps between the beams and rafters of this traditional roof structure, which could offer roosting opportunities, as do gaps under the barge boards on the exterior of the barn.

Generally the barn is in a good state of repair. However, the walls do support at least 25 gaps between stones and there are openings around the lintel and wooden beams which frame the door. These gaps could lead to cavities inside the walls. Although the roof is largely in place, several tiles are missing which is likely to render the roof space draughty. As such, although the cracks and crevices which this building supports may provide summer and winter roosts for a low number of crevice-roosting bat species the building is unlikely to be warm enough or provide stable environmental conditions for a maternity roost.

Building 5a [Smaller of buildings at site 5]

Building 5 is single-storey building with a footprint of approximately 10m x 6m. It has thick stone walls on three sides and is open along its east facing aspect. The pitched roof is supported by trusses of king post construction[7] and is tiled. Tiles are laid directly onto wooden battens with no lining. Between 7 and 8 tiles are missing but the roof is otherwise in comparatively good condition. In the stonework, there are over 40 gaps, all of which may provide access to cavities inside the walls. Cracks and crevices may provide summer or winter roosts for a low number of crevice dwelling bat species, but the building is unlikely to be warm or dry enough to

[6] The hip is the term given to the inclined line formed where two sloping roof surfaces turn an outside corner of a building. 'Double hipped' refers to a roof with two hips.

[7] King post truss has wooden trusses on a central vertical post.

provide a stable environment for a maternity roost. There are some wooden beams against the inside of the stone gable ends, the gaps behind which may also support roosting bats. The southern side of the structure (external) is completely overgrown and therefore not visible.

Building 5b
Building 5b is a single-storey barn with a footprint of approximately 15m x10m. It has thick stone walls which support a wooden 'A' frame roof, which is tiled. Tiles are laid directly onto battens, with no lining, and no roof void is present. The roof is in a poor state of repair, half of it having collapsed, which means that the inside of the building is very open and exposed, reducing favourability to bats. However, in the remaining section of roof there are 4-5 gaps in joints between beams and the walls support large, apparently deep gaps, around the window and door frames, which could offer potential roost opportunities. Dense ivy covers the north east corner of the barn and may conceal further crevices. Again, cracks and crevices may provide summer roosts for a low number of bats, but the building is probably not warm or dry enough to provide a stable environment for a maternity roost. The walls may provide an important hibernation resource for bats.

All Buildings
As the barns are in close proximity to habitats which offer foraging potential, and because they are connected to these features by hedgerows and ditches, Buildings 2, 4, 5a and 5b could be used by bats as night roosts/feeding perches; the latter would be indicated by collections of bat droppings or insect wings (prey remains) on the floor. Such evidence would not have been visible during the internal inspection using a remote camera as it did not give sufficient detail to distinguish this form of evidence from other debris on the ground. Although Building 3 offers similar potential for feeding perches it was inspected and no evidence was found to support this.

Emergence/Re-Entry Surveys

Building 2
During the emergence survey in June 2009, the first bat recorded (21 minutes after sunset) was a soprano pipistrelle, which appeared to emerge from the apex of the north-west corner of the building and then fly into the building through an open doorway on the north side. A limited number of further bats were seen on the north and west sides of the building (which are the most exposed) restricted to two common pipistrelle and one further soprano pipistrelle. Activity was much higher around the south and east sides of the buildings (which are nearer to hedgerows and are more sheltered). A common pipistrelle was observed 31 minutes after sunset repeatedly flying in and out of the building through a large south facing doorway. During the remainder of the survey common pipistrelle bats were seen on six occasions to enter or exit the building through the open east facing window.

The re-entry survey recorded a moderate number of common pipistrelle bats, although most appeared to be commuting and foraging along the nearby hedgerows. A single common pipistrelle appeared to enter the building through the east facing window from the north 41 minutes prior to sunrise, with another common pipistrelle appearing to the enter the building through the south facing doorway 32 minutes before sunrise.

Building 3
No bats were observed either leaving or entering Building 3 during the emergence and re-entry surveys. During the June visit the first bats observed were commuting common pipistrelle and

were recorded 30 minutes after sunset. Similarly, the last common pipistrelle heard during the re-entry survey was approximately 30 minutes before sunrise, suggesting this bat was not roosting in Building 3.

The building was filled with bales of hay for the majority of the survey period. However, during the re-entry survey at the beginning of August, when there was light rain and the building was empty, at least one *Myotis* sp bat was recorded circling and foraging within the barn for most of the survey period. This indicates the building may occasionally used for shelter and foraging by *Myotis* sp.

Building 4
A single common pipistrelle was observed leaving the building through a north facing doorway approximately 37 minutes after sunset during the emergence survey in June. A single common pipistrelle was also observed during the re-entry survey in July foraging around the building, then flying in and out of the south facing doorway a number of times before finally entering the building approximately 22 minutes before sunrise. No other bats were seen to enter or exit the building, although a reasonable number of common pipistrelle was recorded commuting and foraging in this location.

Building 5
No bats were observed entering or exiting the building during the surveys. Limited bat activity was recorded during the emergence survey in June, restricted to commuting common pipistrelle, noctule and serotine.

More bat registrations were recorded during the re-entry survey, including a *Myotis* sp. flying around the building and along the wall connecting the building to a hedgerow to the north over 90 minutes before sunrise. The last bat recorded during the re-entry survey was a common pipistrelle clearly commuting west to east around the building approximately 42 minutes before sunrise.

3.2.3 Tree Assessment for Roost Sites

Screening Surveys (Internal and External)
A total of 175 trees were assessed for their potential to support bat roosts. Of these, 43 trees (25%) were identified as having medium–high or high potential to support a bat roost due to the features present. Features that were considered to increase the likelihood of a roost a occurring (and therefore warrant a medium-high or high assessment) included woodpecker holes, rot holes, large cracks in limbs, dense ivy and flaking bark. Most of the tree species identified as having high potential are ash, pedunculate oak and field maple. No evidence of bats was found during the external screening surveys.

It was determined that further (internal) assessment of trees would concentrate on those identified as having medium-high or high potential, excluding those within Woodlands H and I (which will not be significantly affected by the development). Therefore, an initial 19 trees were subject to internal inspection. A further three trees were re-classified during the scoping visit prior to the internal inspection, such that a total of 22 trees were assessed internally.

A single confirmed bat roost was recorded during the internal inspection of the features surveyed. The feature supporting the roost is located within a field maple tree at the eastern edge of Woodland C and comprises a 25cm deep cavity approximately 7m above the ground.

Within the cavity a small number of bat droppings were found. Due to their location the droppings could not be accessed and were identified using the probe as either *Myotis* sp or Barbastelle.

Of the remaining trees, 11 are considered to have features with high potential to support a bat roost, with 17 high potential features identified in total, and three trees support features considered to have medium potential to support roosts. The high potential features comprise rot and woodpecker holes, dense mat ivy, flaking bark and rotten branches.

Woodland A supports one tree with a high potential tree, Woodlands C and D support three trees each with high potential features and Woodland G has four trees with high potential features.

Emergence/Re-Entry Surveys

Bats were only observed entering or exiting the woodlands on one occasion. This was during the emergence survey at position 4 (south of Woodland D) when two common pipistrelles were seen separately to leave the woodland and fly south then east, approximately 65 minutes after sunset. No bats were seen entering or exiting the woodlands on any other occasion.

The woodlands are well connected to the wider landscape via a network of hedgerows and many of the survey points recorded a moderate level commuting and foraging behaviour from a wide range of species.

3.2.4 Activity Surveys

Strategic Siting Area

Seven species of bat (or group of species in the case of *Myotis*) have been recorded during the activity surveys completed during 2007, 2008 and 2009 within the SSA. These are:

- Common pipistrelle;
- Soprano pipistrelle;
- Noctule;
- Serotine;
- Long-eared (likely to be brown long-eared);
- *Myotis* sp.; and
- Barbastelle.

It is not possible to separate the *Myotis* species based on the calls recorded. However, the characteristics of a number of very clear calls suggest that both Natterer's and Daubenton's are probably present.

Bats have been recorded throughout the SSA (Figure 3.1), although fewer bats were recorded in the southern part of the SSA, probably due to the poorer habitat (large arable fields dominate this area). Both Benhole Lane and the 'green lane' through the centre of the site appear to be well used commuting and foraging corridors. The enclosed footpaths around Woodlands C, D and G are also well used, as are the hedgerow south of Building 5 and the northern watercourse.

Common Pipistrelle

Common pipistrelle was the most frequently encountered bat species, has been shown to occur throughout the SSA and was recorded at least once on every survey visit. The earliest a common pipistrelle was observed was during the June activity survey, when a bat was recorded 24 minutes after sunset along the southern part of Benhole Lane (although an earlier bat was recorded exiting Building 2). During a number of the other surveys the first common pipistrelle heard was also in the western part of the site and often near to Benhole Lane. It has been shown that a small number of bats appear to be roosting in the buildings surveyed and this is reflected by the times common pipistrelle have been recorded prior to sunrise, many of which are within 60 minutes of sunrise.

Soprano Pipistrelle

One soprano pipistrelle was recorded in the SSA in 2007 (around the sewage treatment works in the eastern part of the SSA) and none in 2008.

In 2009, soprano pipistrelle was recorded at 20 locations, scattered fairly evenly throughout the SSA. This species was also recorded in every month between May and September, with a slightly greater number of registrations in June and July. Soprano pipistrelle bats were recorded 29 minutes after sunset on two occasions. The first was during the August activity survey adjacent to the Bum brook along the southern boundary of the SSA and the second was along the footpath east of Woodland D.

Noctule

In 2007, three registrations of noctule were recorded; two near the existing Power Station access road and one along the boundary of the SSA with Wick Moor.

Noctule bats were recorded in 23 locations during the 2009 surveys, concentrated around the woodlands in the centre of the SSA and the existing access road. The earliest a noctule was recorded within the SSA was during the July activity survey 35 minutes after sunset along the southern part of Benhole Lane. This is one of a small number of the registrations from Benhole Lane, with bats also recorded in the valley in the centre of the SSA and along the coast. Most of the remaining records are likely to comprise several passes of the same bat due to the timing of the calls. A noctule was also recorded 24 minutes prior to sunrise near Building 3 in July.

During the July visits up to two noctule bats were recorded foraging around the lights along the access road. The locations of the records also indicate that the hedgerow network around the woodlands is well used.

Serotine

One serotine was recorded along the SSA boundary with Wick Moor in 2007 (actually during the driving transect). None were recorded in 2008.

In 2009, serotine bats were recorded in 21 locations, all in the central and northern parts of the SSA. Serotine bats were particularly well recorded during the static surveys in June and July (i.e. for the buildings and woodlands) when many registrations (over 16 in one location) were recorded around all the woodland blocks. On one occasion in June, two bats were recorded foraging together along the south edge of Woodland C. All the serotine bats encountered during the surveys were recorded over an hour after sunset, with the earliest 61 minutes after sunset adjacent to Woodland C.

Long-Eared
In 2007, two long-eared bats were observed foraging along the ‘green lane’ during the June transect visit. No long-eared bats were recorded in 2008 and long-eared were only recorded in four locations during the 2009 surveys.

Three of the registrations are from the same static survey visit in June, where is appears a single bat may have travelled west to east across the SSA via the dense hedgerows connecting the woodlands. A further long-eared was recorded in July near to the existing Power Station gates.

Long-eared bats produce very quite calls and are therefore difficult to record using bat detectors. It is therefore likely that the distribution and abundance of long-eared bats across the SSA is wider and higher (respectively) than is indicated by the surveys.

Myotis sp.
Myotis sp. was recorded in four locations during the 2007 surveys and once during 2008. All the records are from the central part of the SSA. One of the 2007 records is around the sewage treatment works in the eastern part of the SSA. This is also where a Daubenton bat was recorded.

In 2009, *Myotis* sp. bats were recorded in 29 locations within the SSA. The locations of the registrations are spread throughout the site, although a slight concentration of calls occurs along the western SSA boundary. *Myotis* sp. were generally recorded at least an hour after sunset apart from the August activity survey when a *Myotis* sp. (probably a Daubenton’s[8]) was recorded 34 minutes after sunset by the ford on Benhole Lane adjacent to the south-west corner of the SSA.

Myotis sp. bat were frequently recorded foraging, particularly in association with buildings during the dawn surveys (e.g. Building 3 and 5). The latest a *Myotis* sp. bat was recorded within the SSA was 47 minutes before sunrise near to Building 4.

Barbastelle
Two Barbastelle bats were recorded during the 2007 July survey in the centre of the ‘green lane’ in the centre of the SSA. None were recorded in 2008.

Barbastelle were recorded in seven locations during the 2009 surveys, the details of which are set out in Table 3.1.

[8] This is based on the sound analysis and the location of the call, as Daubenton bats are frequently recorded foraging over water

Table 3.1 Records of Barbastelle (excluding Anabat Records)

Date	Time after Sunset (mins)	Time before Sunrise (mins)	Location	Number of Registrations/Activity
19 May 2009	108	-	East edge of Woodland F	1 pass
13 July 2009	72	-	Benhole Lane, near Building 3	1 pass
13 July 2009	103	-	Along ‘green lane’ - a section that has tall elms on the south side.	15 passes over 15 minute duration (not constant, three phases of activity). Probably foraging due to the pattern of activity but no feeding buzzes recorded.
29 July 2009	-	66	Adjacent to western edge of Woodland B of possible within woodland	1 pass
11 August 2009	-	69 (last call)	Eastern edge of Woodland E and B	Approximately 41 passes over 38 minutes. Probably foraging due to the pattern of activity but no feeding buzzes recorded.
17 August 2009	124	-	Along tall hedgerow in valley	2 passes
03 September 2009	86	-	Northern section of Benhole Lane	11 passes over 5 minute duration. Probably foraging due to the pattern of activity but no feeding buzzes recorded.

The records collected during the activity and emergence/re-entry surveys are concentrated in the western part of the SSA, primarily along the ‘green lane’, Benhole Lane and Woodlands B, E and F. On a number of occasions, data collected also suggest that barbastelle use the SSA for foraging (as well as commuting), as shown by the repeated passes, particularly on the 11 August 2009.

Wider Area

Driven transects in the area around the SSA recorded seven species of bat (or species group in the case of *Myotis* sp.). These were:

- Barbastelle;
- Long-eared;
- Serotine;
- Noctule;
- *Myotis* sp.;
- Common pipistrelle; and
- Soprano pipistrelle.

With the exception of common pipistrelle, the majority of bat activity recorded along the driven transect was concentrated in discrete areas. The greatest diversity of species was recorded in locations where there were areas of semi-natural habitats, such as woodland copses and open water. Bats were also recorded around the villages of Stogursey, Shurton and Knighton.

Five species of bat, including barbastelle, were recorded at Cross Elms Copse, to the west of the SSA. Hedgerows connect this copse to a number of small woodlands and plantations, including Horibere Woods, Martin's Wood and Great Plantation.

Serotine and noctule bats were recorded around the village of Wick, Upper Cock Farm, Brown's Cottage (to the east of Hinkley Point power station) and close to the power station on Wick Moor Drove. However, the level of bat activity in this area was generally lower than in areas to the west.

3.2.5 Static Bat Detectors (Anabat)

Both units recorded extremely large numbers of bat calls, particularly unit A (along the 'green lane'). Although not currently analysed in detail, some general conclusions drawn during the analysis are:

- Common pipistrelle is the most frequently recorded species. Although this may in part be due to their foraging habit of moving along features many times, it is considered likely this is a good reflection of common pipistrelle abundance within the SSA;
- Long-eared bat was recorded much more frequently than during the other bat surveys.

Barbastelle

Anabat A

Barbastelles were recorded on a total of 27 nights during the monitoring period (33% of the time). They were recorded at all the locations the Anabat was positioned along the 'green lane' and by the access road, although most registrations were at locations 2 (where a north-south hedgerow meets the 'green lane' from Building 5) and 4 (at the eastern end of the 'green lane'). The time that barbastelle were recorded by the Anabats varies considerably. The earliest recorded registration was 64 minutes after sunset on the 16 July, where-as the latest time barbastelle were recorded within the SSA was 122 minutes before sunrise on the 24 August. A summary of the records is provided in Table 3.2.

Table 3.2 Records of Barbastelle (Anabat A)

Location	Date	Time after Sunset (mins) or Time	Number of Registrations
1	05/06/2009	114	1
	19/06/2009	123	1

Table 3.2 (continued) Records of Barbastelle (Anabat A)

Location	Date	Time after Sunset (mins) or Time	Number of Registrations
2	10/07/2009	68	15
	11/07/2009	77	2
	12/07/2009	91	6
	13/07/2009	92	7
	14/07/2009	269	1
	15/07/2009	96	2
	16/07/2009	64	2
	18/07/2009	89	2
	20/07/2009	186	1
3	21/07/2009	192	1
	22/07/2009	80	2
	27/07/2009	100	1
	31/07/2009	261	1
4	14/08/2009	73	5
	15/08/2009	146	1
	16/08/2009	213	2
	17/08/2009	162	5
	18/08/2009	122	2
	19/08/2009	149	1
	20/08/2009	132	4
	21/08/2009	85	3
	22/08/2009	89	4
	23/08/2009	151	4
	24/08/2009	139	2
5	10/09/2009	03.04	1
	13/09/2009	02.17	1

Anabat B

Barbastelles were recorded by Anabat B on 14 nights during the monitoring period (17% of the time) and were recorded from all five static positions, confirming use of Benhole Lane by this species. The results also show that barbastelle occur around Woodland C and also the southern edge of the SSA boundary, to the south of Pixies Mound. The earliest registration was 71 minutes after sunset on the 16 June, whilst the latest was 132 minutes before sunrise on the 27 July. A summary of the records is provided in Table 3.3.

Table 3.3 Records of Barbastelle (Anabat B)

Location	Date	Time after Sunset (mins)	Time before Sunrise (mins)	Number of Registrations
1	13/06/2009	109	-	3
	16/06/2009	71	-	1
2	24/06/2009	180	-	1
	16/07/2009	109	-	2
3	21/07/2009	-	151	1
	22/07/2009	-	184	1
	24/07/2009	-	158	1
	26/07/2009	232	-	2
	27/07/2009	-	132	1
	28/07/2009	135	-	4
	30/07/2009	102	-	3
4	15/08/2009	257	-	1
	19/08/2009	-	187	1
	20/08/2009	-	156	1

Lesser Horseshoe

Five lesser horseshoe calls were recorded on the Anabats during the survey (7% of the nights sampled). These were all recorded on Anabat A, located at various positions along the 'green lane'. Each registration occurred on a different day, although in late August a lesser horseshoe was recorded on three days out of four. The earliest a lesser horseshoe was recorded was 80 minutes after sunset. A summary of the records is provided in Table 3.4.

Table 3.4 Records of Lesser Horseshoe

Location (Anabat A)	Date	Time after Sunset (mins)	Number of Registrations
2	11/07/2009	154	1
3	22/07/2009	80	1
4	21/08/2009	96	1
	22/08/2009	89	1
	24/08/2009	257	1

Greater Horseshoe
Four greater horseshoe calls were recorded on the Anabats during the survey (5% of the nights sampled). These were all recorded on Anabat A, located at various locations along the ‘green lane’ and adjacent to the access road. A summary of the records is provided in Table 3.5.

Table 3.5 Records of Greater Horseshoe

Location (Anabat A)	Date	Time (24hour clock)	Number of Registrations
1	11/06/2009	01.33	1
2	13/07/2009	02.15	1
	14/07/2009	03.28	1
5	14/09/2009	01.54	1

4. Conclusions

4.1 Species Assemblage

Following extensive survey of the SSA it has been shown that the following species occur:

- Common pipistrelle;
- Soprano pipistrelle;
- Noctule;
- Serotine;
- Long-eared (likely to be brown long-eared);
- *Myotis* sp (likely to be at least Natterer’s and Daubenton’s);
- Barbastelle;
- Lesser horseshoe; and
- Greater horseshoe.

4.2 Roosting

4.2.1 Buildings

The four buildings assessed within and adjacent to the SSA are all very similar in construction and current condition. Hence, they all offer comparable potential roosting opportunities.

Due to the derelict condition of the buildings and their fairly exposed locations along the coast, they are all considered to have low potential for and are unlikely to support large maternity colonies of any species. However, there are cracks within the stone-work of every building that could be used for roosting by a small number of non-breeding bats (such as males or pre-pubescent females) and the surveys have shown that three of the four buildings do support very small pipistrelle roosts (likely to comprise one or two bats only). Despite the lack of evidence of roosting bats in either Building 5a or 5b, it is considered highly likely that these buildings will also be used by small numbers of roosting bats due to its similarity to the other buildings. The surveys indicated that only pipistrelle sp. bat was roosting in the buildings, however, there is also potential for *Myotis* sp. and long-eared bats to use them.

The cracks identified in the stone-work of the buildings could also lead to cavities within the walls, which could be sufficiently insulated (due to the thickness) to allow hibernation. It is considered unlikely that a large hibernation roost would occur, but small numbers of pipistrelle sp., *Myotis* sp. and long-eared bats could use the buildings during the winter, particularly if suitable hibernation sites are infrequent in the surrounding area.

4.2.2 Trees

Of the 74 trees assessed (excluding the trees in Woodland H and I), 22 trees (30%) have been identified as having medium-high and high potential to support bat roosts.

Of these, one tree has been found to support a confirmed bat roost. Due to the speed with which evidence of bat presence can degrade in the damp conditions within crevices, it is likely this feature had been used during 2009. The species of bat using this roost could not be determined, but is likely to be either *Myotis* sp. or barbastelle due to the size of the droppings found. However, based on the limited extent of the crevice it is highly unlikely to support a maternity roost of either of these species. Instead, the feature is likely to support an occasional low status roost only, used by individual or small numbers of bats. The feature could be used at any time of the year, including the winter, but only during milder periods of weather.

A further 11 trees also support features with high potential to support bat roosts and three trees support features with medium potential. Again, due to the decomposition of evidence of bat presence, it is possible these features have been used by bats previously. Further it is considered that these features could be used by bats throughout the year, except it very cold weather (e.g. $<5^{o}C$).

4.3 Activity (Foraging and Commuting)

The majority of the bat activity recorded during the surveys occurred in the sheltered parts of the SSA such as Benhole Lane, the woodland edges, along hedgerows and through the valley in the centre of the SSA. This can probably be attributed to general bat behaviour (using features for shelter and to avoid predators) in combination with the character of the landscape, which is exposed and largely influenced by intensive farming practices. The SSA is also adjacent to the Severn Estuary in a fairly exposed location, and is therefore prone to frequent windy conditions. This is likely to influence the number and distribution of aerial insect prey, as lower numbers of insects are found in more exposed areas[9].

Both commuting and foraging behaviour was recorded within the SSA. For example, many of the bat records comprise only a single brief pass, which indicates commuting behaviour. Every species recorded within the SSA exhibited this behaviour and this suggests that the extensive hedgerow network through the site is used by bats travelling between roosts and foraging locations. Feeding buzzes from both pipistrelle and *Myotis* species were also recorded and foraging can be inferred from the behaviour seen relating to noctule, serotine and barbastelle (i.e. a number of passes in quick succession along a feature).

The number of registrations and the location of these throughout the survey area indicate that all of the species recorded, apart from the horseshoe and long-eared bats, occur frequently throughout the SSA. Further, it is considered likely that the long-eared bats have been under-recorded (due to their quiet call) and are also considered to occur frequently. Whilst it is possible both horseshoe species may have been under-recorded during the activity and emergence/re-entry surveys, particularly lesser horseshoe bats which have quiet and very directional calls, the limited results from the Anabats suggest that the horseshoe species only use the SSA infrequently.

Based on the earliest encounters of the species using the SSA and the moderate numbers of each species present, it is considered highly unlikely that a large bat roost is present within the SSA or immediately adjacent to it. However, for some species, the earliest encounters are not long after the typical emergence time, suggesting that off-site roosts may be located in the nearby surrounding area. This is particularly evident in relation to common and soprano pipistrelle, *Myotis* sp. and barbastelle. In addition, the earliest encounters for the common and soprano pipistrelle and *Myotis* sp. are from the southern part of Benhole Lane, which may indicate roosts for these species are located in the villages of Shurton, Burton or Stogursey.

The number of barbastelle records within the SSA was much greater in 2009 than in previous survey years. The most likely explanation for this is not that usage of the site has increased, but rather that the extensive survey effort and presence of recording devices within the SSA during 2009 provided more opportunity to encounter this species. Whilst even with more records it is difficult to fully determine how barbastelle use the SSA, some broad observations can be drawn:

- Whilst barbastelle have not been recorded throughout the SSA, the distribution of records indicates usage of the woodlands and taller hedgerows. It also appears that barbastelle are likely to commute along a short stretch of the minor watercourse in the northern part of the SSA (which provides no tree or hedge cover) to reach the woodland blocks;
- The ‘green lane’ through the centre of the SSA is clearly an important commuting (and possibly foraging) route for this species based on the number of registrations in this location and because barbastelle were often recorded soon after sunset, when most bat species commute to favoured foraging areas;

[9] Distribution patterns of aerial insect accumulations over pasture on the leeward side of hedges has been demonstrated by Rothamsted Experimental Station (Lewis, 1969) and habitat use by foraging and commuting bats is described in British Bats (Altringham, 2003).

- Similarly, the number of records spread throughout the survey period suggests that Benhole Lane is also an important feature for barbastelle;
- The records of barbastelle south and west of Pixies' Mound in combination with the other records within the SSA and from the driving transects suggests that barbastelle may be crossing the existing Power Station access road and travelling east. It is therefore possible that barbastelle are foraging in the mosaic of habitats south of the existing Power Station or commuting to foraging areas further east;
- There is evidence that barbastelle utilise the SSA throughout the night, based on both the early evening and late morning records.

Whilst lesser horseshoe bats have previously been recorded within the SSA (from the desk study information), there are no previous records of greater horseshoe. Nonetheless, the occurrence of both species is no more than occasional and appears to be largely restricted to the 'green lane'. All the greater horseshoe records are also a significant time after sunset and before sunrise and, given that greater horseshoe bats can travel up to 12km from the roost (when habitat is poor in its locality), the roost could be some distance from the site. A number of the lesser horseshoe records are closer to the average emergence time of this species (31 minutes, Altringham, 2003) and lesser horseshoe bats are known to forage primarily within 2km of their roost, but will travel up to 4km (VWT, 2008). Therefore, it seems reasonable to conclude that there is likely to be a roost in reasonable proximity to the SSA, but that the SSA does not form the primary foraging resource for lesser horseshoe bats, as evidenced by the infrequent records.

4.4 Summary Description of the Bat Populations in the SSA

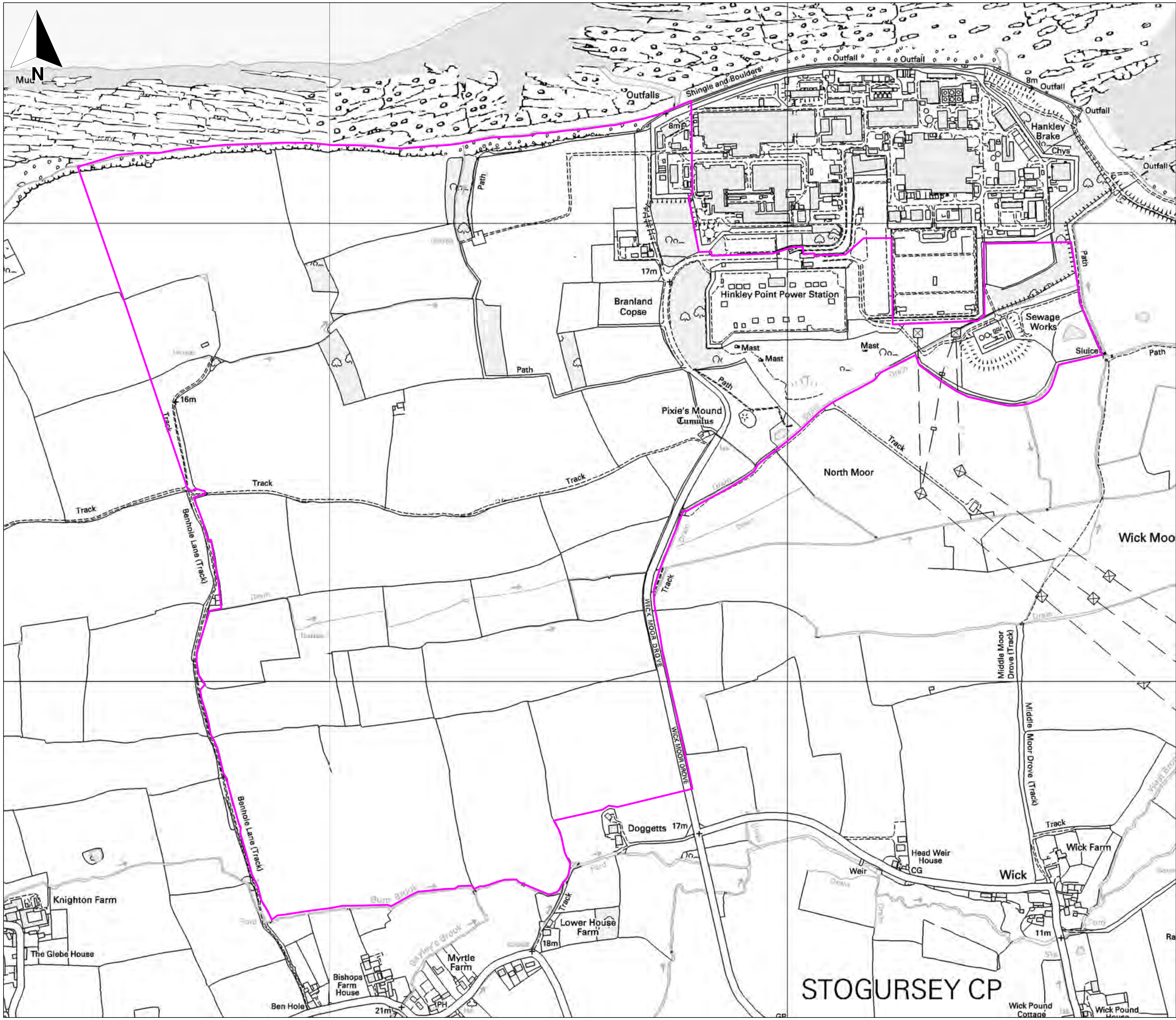
The surveys have shown that the SSA supports at least nine species of bat (when the *Myotis* group is considered as a single species, but this could be as high as 11 if all three suspected species were present) and that the habitats are reasonably well used for roosting, foraging and commuting. The county of Somerset supports a wide range of bat species (15 out of the 16 British bat species are known to regularly occur) and there is a species action plan for 'bats' within the Somerset Biodiversity Strategy.

Within the bat assemblage in the SSA are three species listed on Annex II of the Habitats Directive, namely lesser and greater horseshoe, and barbastelle. Horseshoe species were recorded infrequently within the SSA and it is unlikely that the SSA forms part of the key foraging area or an important commuting route for either species. Also no horseshoe bat roosts were located within the area surveyed. In contrast, the SSA is clearly used on a regular basis (i.e. several times a week) by barbastelle, both commuting and foraging, although, there is only one possible, occasionally used barbastelle roost present. This level of regular activity indicates that the SSA forms a part of a larger territory used by barbastelle.

In addition to the Annex II bat species, the SSA supports a further three species listed on both Section 41 of the NERC Act and as priority species within the UKBAP, namely soprano pipistrelle, noctule and brown long-eared. All these species were recorded frequently within the SSA and it is likely the habitats are used regularly for foraging and commuting. However, there is no evidence of a noctule roost within the SSA and only small roosts of soprano pipistrelle or brown long-eared are likely to occur.

None of the habitat types within the SSA are considered to be of high value to bats because the site is very typical of the surrounding landscape, where hedgerows, small woodlands and agricultural fields are common. However, all the results from the surveys that have been completed within the SSA (both for the new nuclear build and the wind farm) have indicated that the ‘green lane’ through the centre of the SSA is well used by a wide variety of species.

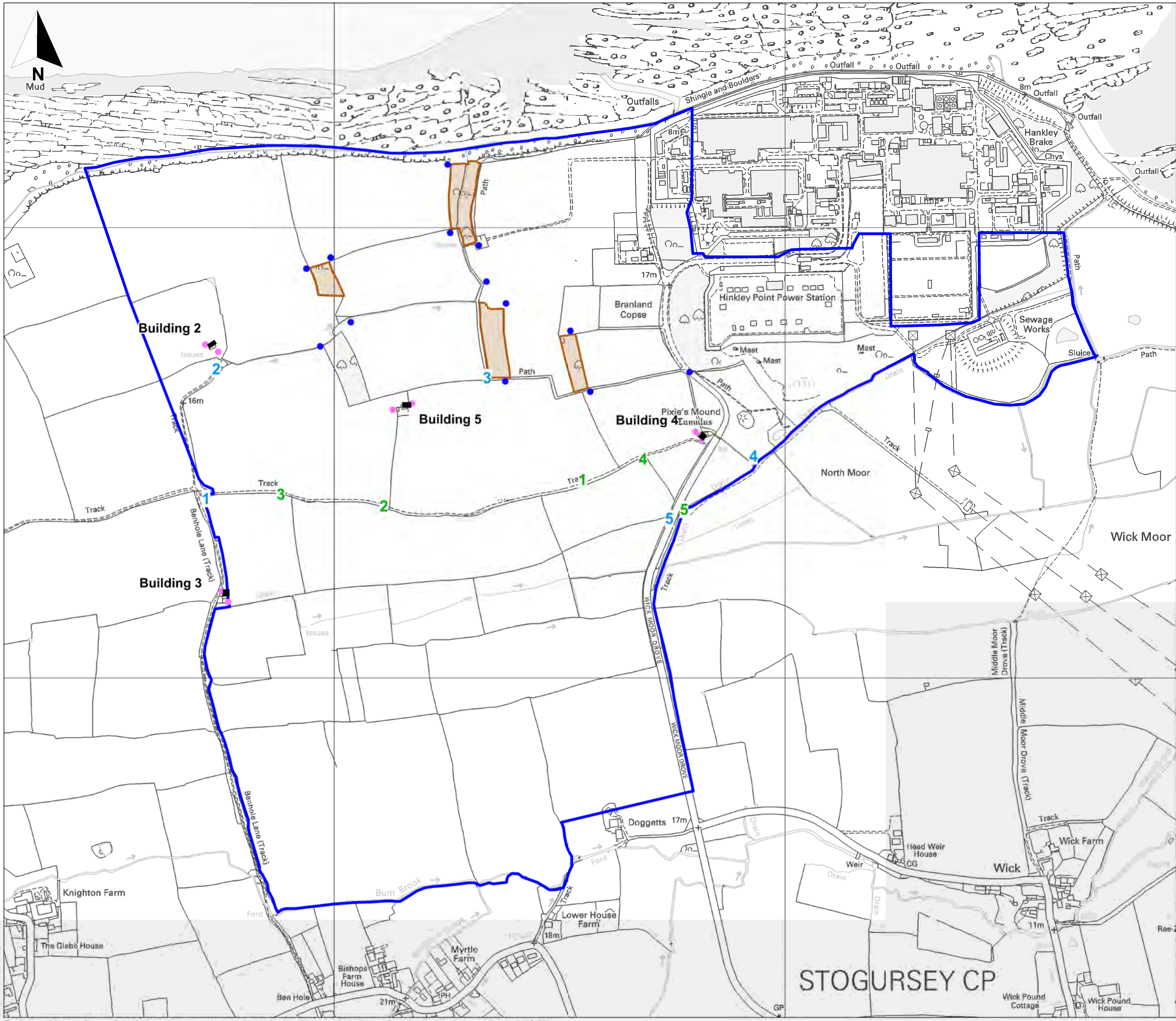
Report template changed for consistency reasons but no other changes have been made since the original issue date.



Hinkley Bat Survey Report

Figure 1.1
SSA boundary

October 2009
19801-R481b.wor adamk



Key

SSA Boundary

Tree climbing surveys completed

Buildings

Location of building emergence and re-entry surveys

Location of woodland emergence and re-entry surveys

Anabat A

1. 5th - 18th June 2009
2. 18th June - 20th July 2009
3. 20th July - 2nd August 2009
4. 14th August - 10th September 2009
5. 9th September - 23rd September 2009

Anabat B

1. 5th - 18th June 2009
2. 18th June - 20th July 2009
3. 20th July - 3rd August 2009
4. 14th August - 10th September 2009
5. 9th September - 23rd September 2009

0 m 500 m

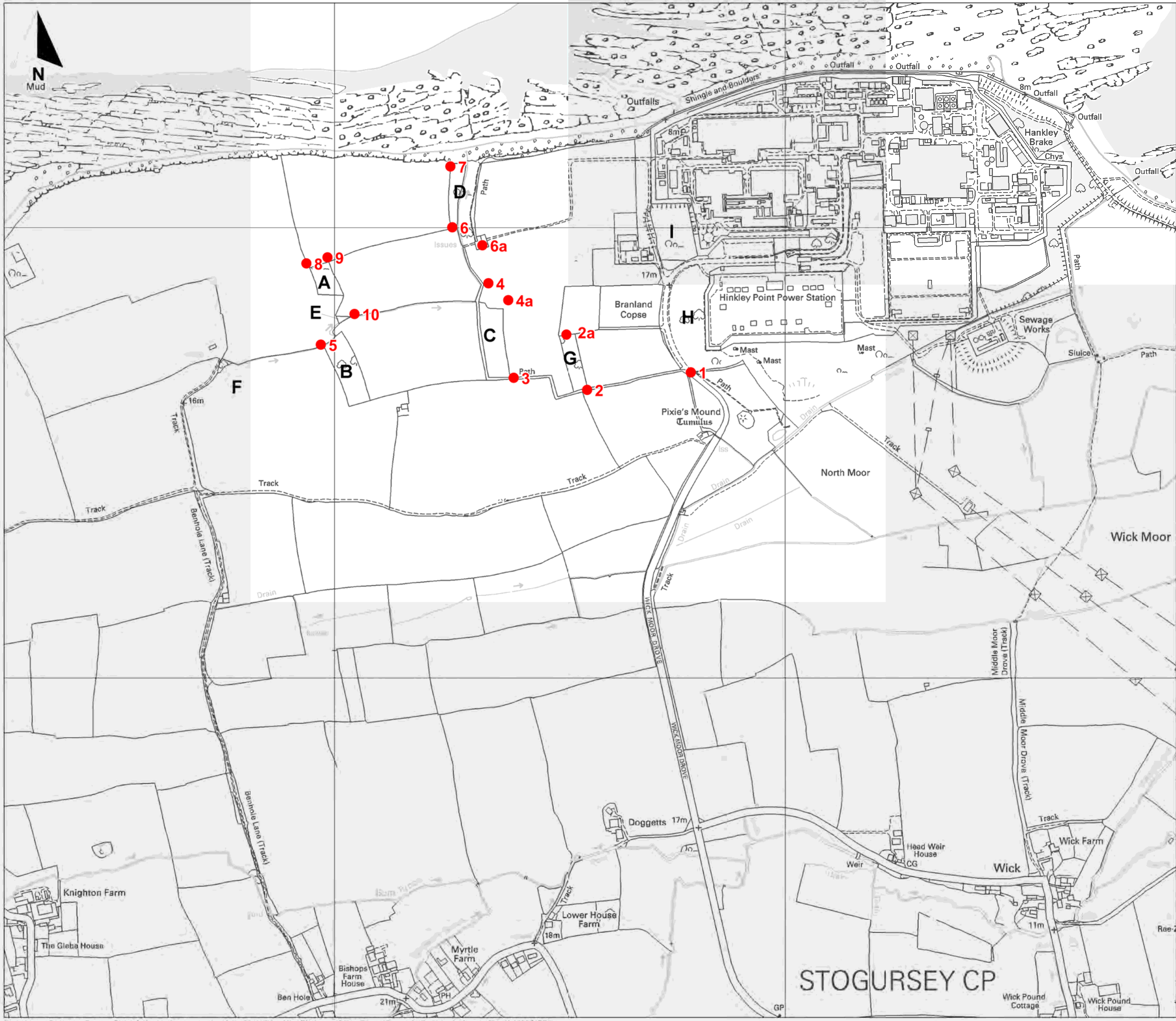
EDF

Hinkley Bat Survey Report

Figure 2.1
Locations of buildings surveyed (and survey points) and Anabat survey points

October 2009
19801-R482c.wor adamk

amec



Key

SSA Boundary

Tree Survey Emergence/Re-entry survey points

Woodland

A - Newclose Covert
B - Haysgrove Brake
C - Seaburton Brake
D - Whitewall Brake
E - Unnamed woodland
F - Unnamed woodland
G - Govetts Copse
H - Branland Copse
I - Unnamed woodland

0 m 500 m

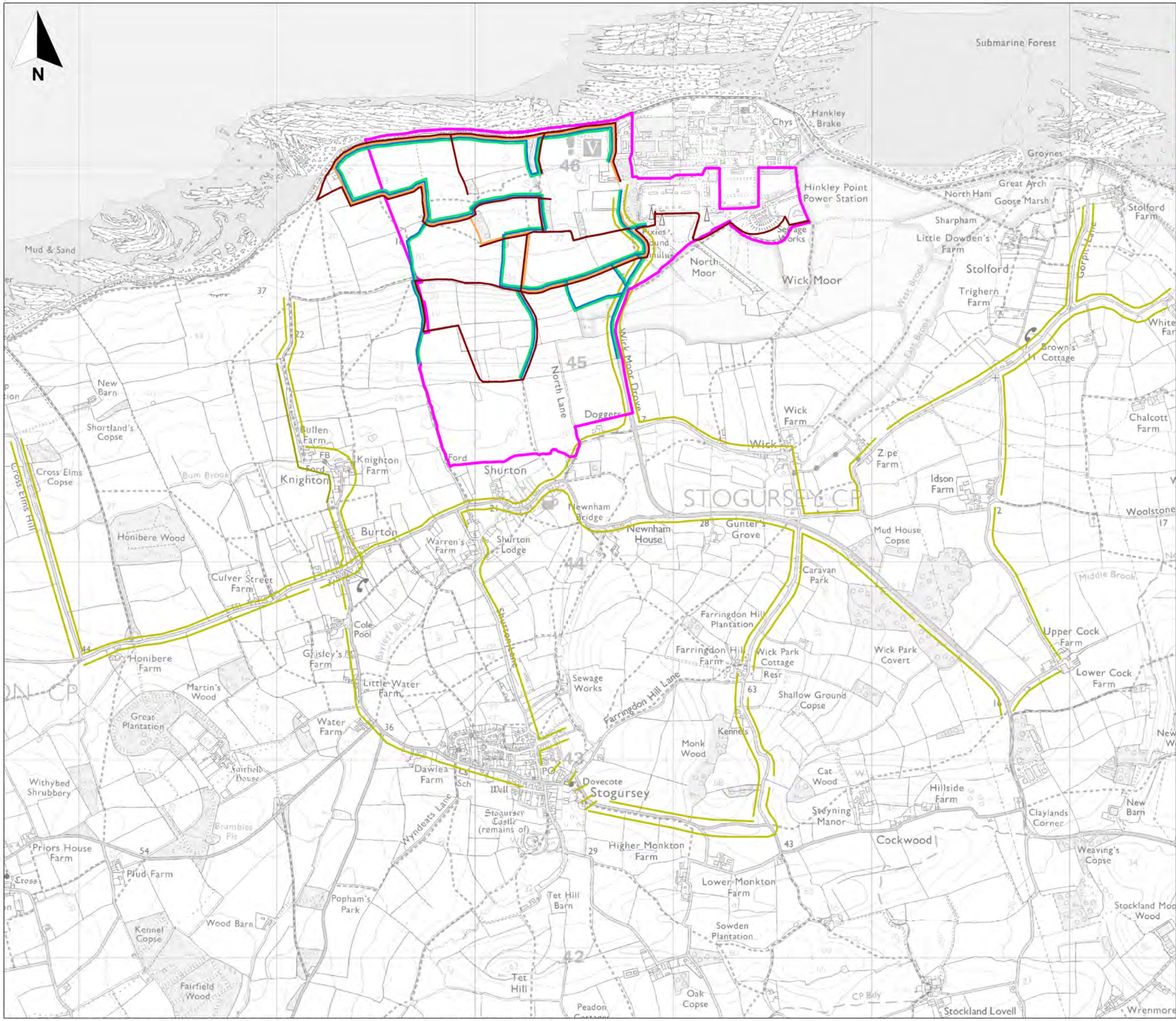
EDF

Hinkley Bat Survey Report

Figure 2.2
Location of woodland blocks and survey points

October 2009
19801-R483b.wor adamk

amec



Key

- SSA Boundary
- Walked transect June
- Walked transect July
- Walked transect August
- Walked transect September
- Driven transect July and August

0 m 500 m

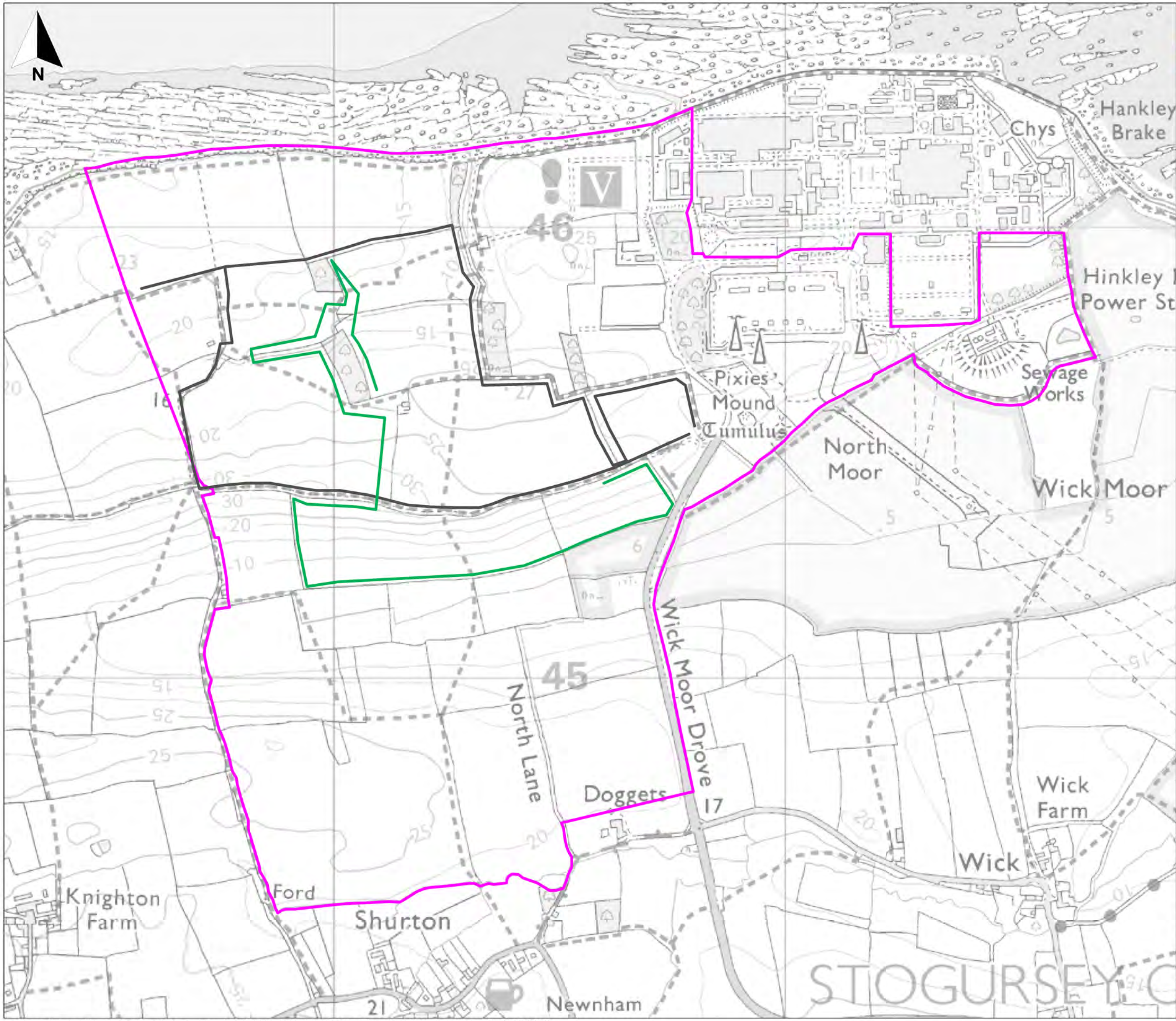
EDF

Hinkley Bat Survey Report

Figure 2.3a
Bat Survey Area
(walked and driven transects 2007)

October 2009
19801-R484b.wor adamk

amec



Key

SSA Boundary

Walked transect 1

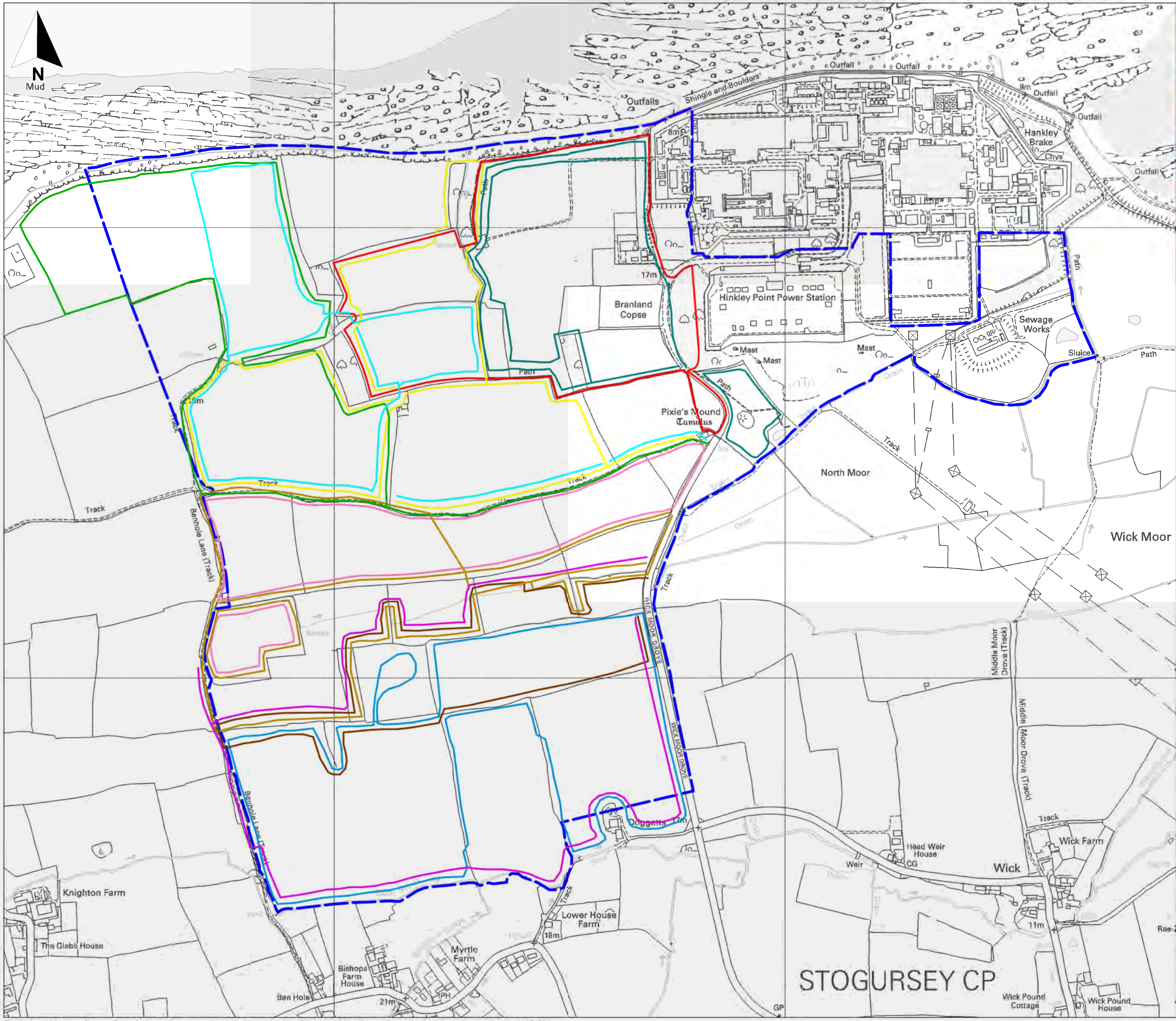
Walked transect 2

0 m 500 m

Hinkley Bat Survey Report

Figure 2.3b
Bat Survey Area 2008
(walked transects September only)

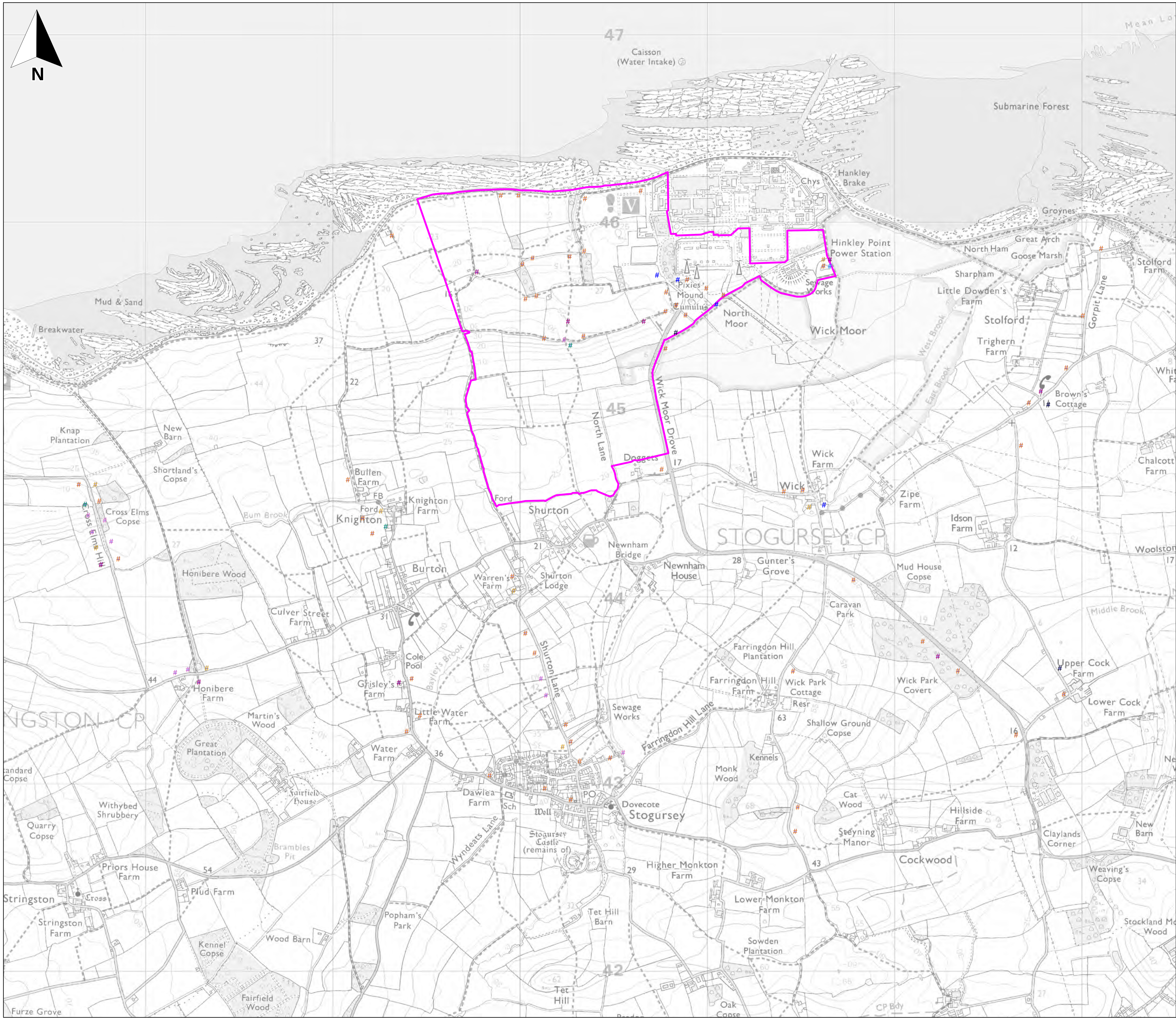
October 2009
19801-R485b.wor adamk



Hinkley Bat Survey Report

Figure 2.3c
Activity transect routes 2009

October 2009
19801-R486c.wor adamk



Key

SSA boundary

Location of Bat Foraging and Communiting Passes.

#	Barbastelle
#	Common Pipistrelle
#	Daubenton's bat
#	Myotis sp
#	Noctule
#	Plecotus sp (likely to be Brown Longeared Bat)
#	Serotine
#	Soprano Pipistrelle

0 m 1000 m

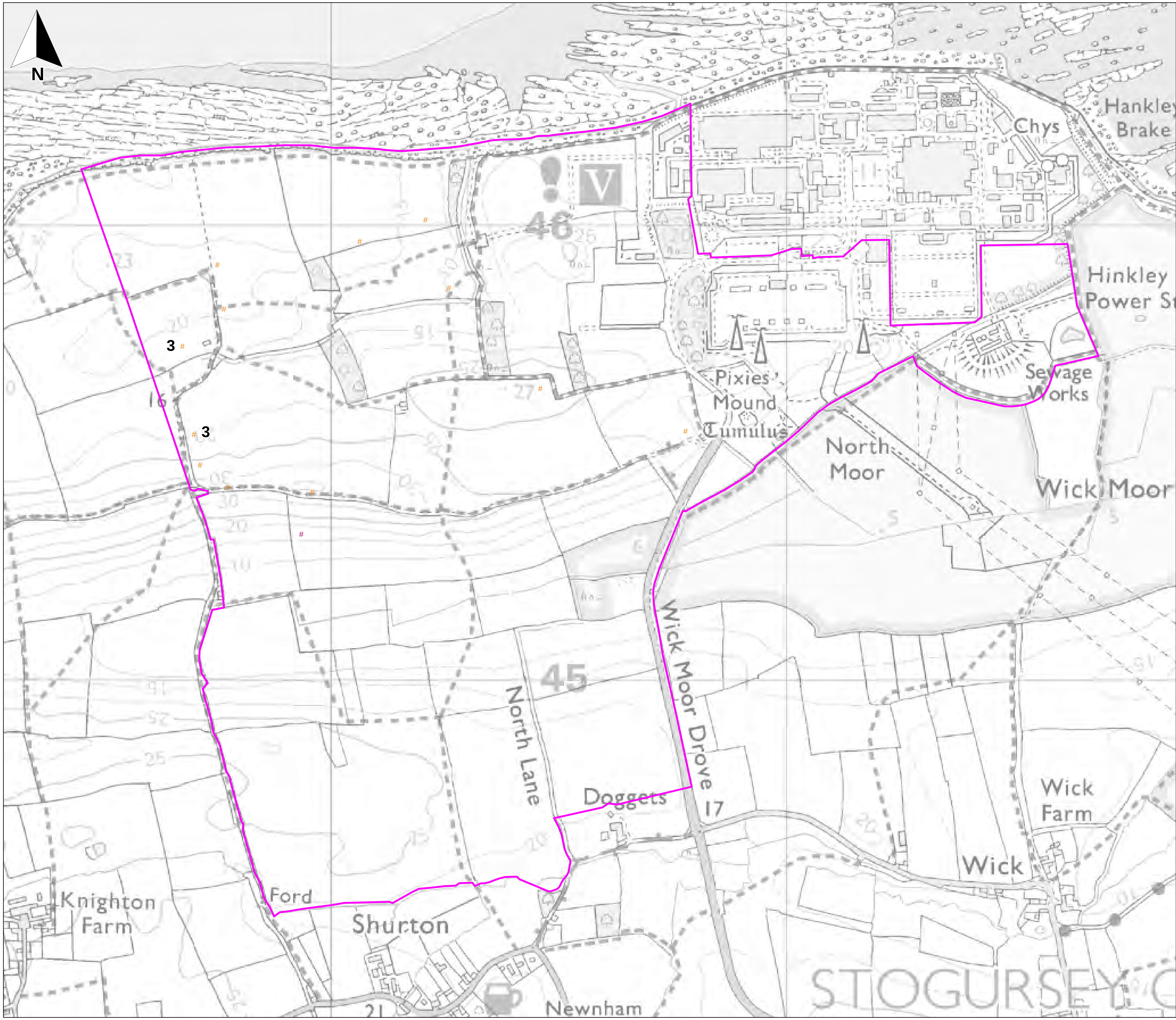
EDF

Hinkley Bat Survey Report

Figure 3.1a
Hinkley Bat Survey Results 2007 (location of bat passes)

October 2009
19801-R487b.wor adamk

amec



Key

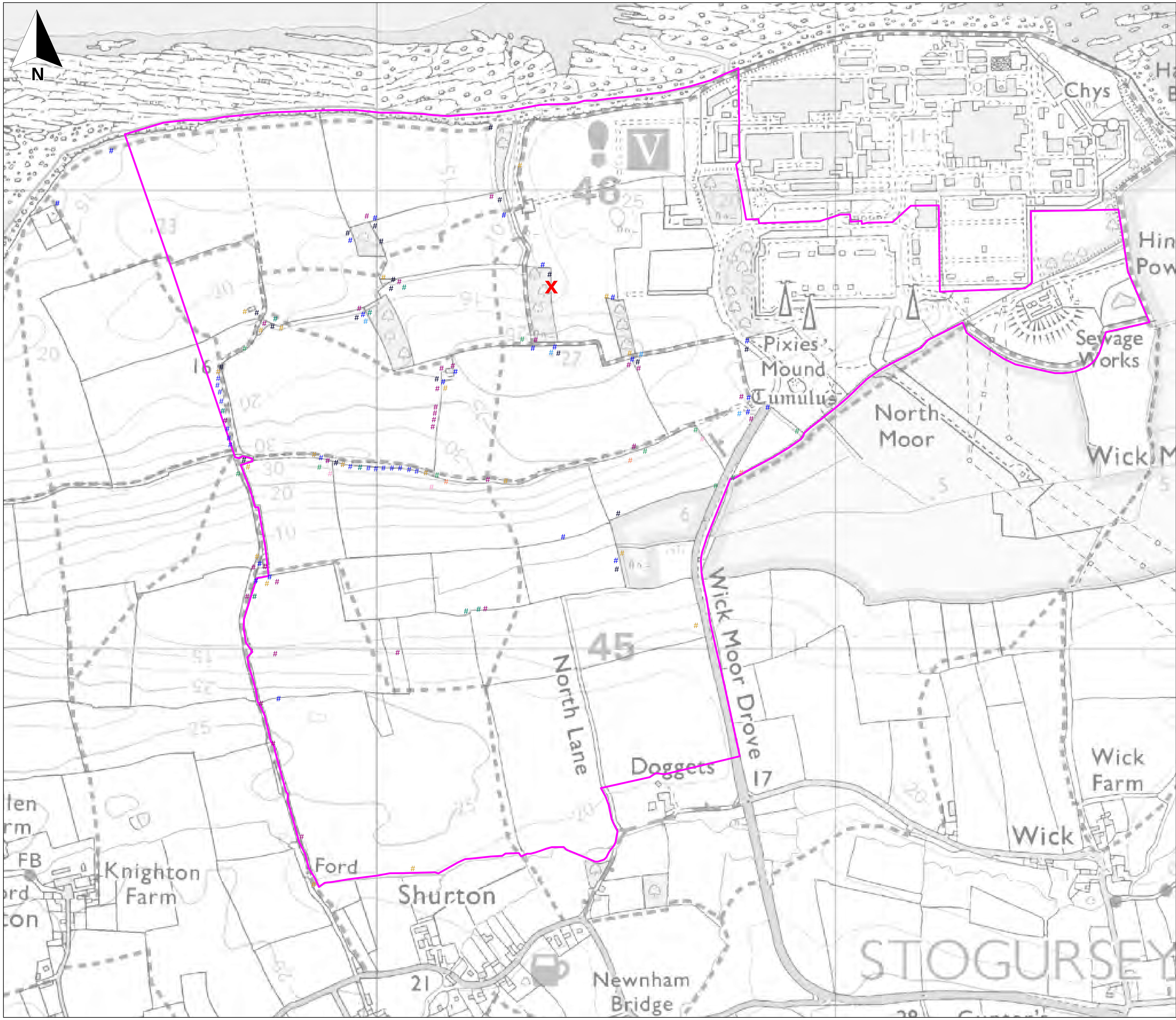
	SSA boundary
Location of Bat Foraging and Communiting Passes.	
#	Common Pipistrelle
#	Myotis sp
3	Number of individuals

0 m 500 m

Hinkley Bat Survey Report

Figure 3.1b
Hinkley Bat Survey Results
September 2008
(location of bat passes)

October 2009
19801-R488b.wor adamk



Key

SSA boundary

Location of Bat Foraging and Communiting Passes.

- Barbastelle
- Brown Long-eared
- Soprano Pipistrelle
- Myotis sp
- Noctule
- Serotine
- Lesser horseshoe
- Greater horseshoe

* Common Pipistrelle have not been mapped as they are present throughout the site

Location of known tree roosts

X Confirmed tree roost

0 m 250 m

Hinkley Bat Survey Report

Figure 3.1c
Hinkley Bat Survey Results 2009

October 2009
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APPENDIX 20F: HINKLEY 2010 BAT SURVEY REPORT

EDF Energy
Hinkley Point C Bat Survey Report 2010

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station on land to the west of the existing Hinkley Point Power Station complex. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) has been appointed as EDF's ecological consultants to undertake the terrestrial ecological survey and assessment work for the new development.

Extensive bat survey work was completed at the site during 2009 (following more limited surveys in 2007 and 2008), comprising activity surveys, static Anabat monitoring and building and tree assessments. These surveys recorded frequent use of the site by barbastelle and occasional use of the site by both lesser and greater horseshoe bats. There were also records of six other bat species: common and soprano pipistrelle, noctule, serotine, *Myotis* spp. and long-eared bats (the full results of these surveys are reported in the Hinkley 2009 Bat Report, Entec, 2009).

Due to the higher level of legal protection afforded to barbastelle and horseshoe bats (under the Habitat Regulations), their rarity and potential vulnerability to development, it was concluded that further surveys should be completed, targeted specifically at investigating how these species use the wider landscape.

The purpose of this report is to provide a description of the survey methodologies used and detail the results obtained, which are then used to draw conclusions regarding how barbastelle, lesser and greater horseshoe bats may be using the wider landscape.

2. Methodology

2.1 Study Area

A radius of 3km from the site (**Figure 1.1**) was chosen as the study area for the following reasons:

- a variety of habitat types occur, including several blocks of broad-leaved woodland which may provide roosting opportunities;
- surveys could be undertaken to both the east and west of the site to investigate usage in these areas and how bats may travel across the Hinkley Point C site; and
- the survey effort across this area of land could be fairly intensive and cover as much of the area as possible, potentially allowing a level of comparison within the data sets.

2.2 Desk Study

Further information relating to barbastelle in the local area was obtained from the Somerset Bat Group and from the Environment Agency in relation to the Steart Realignment Project.

2.3 Field Surveys

The methodology for undertaking all the bat survey work followed that advised by Natural England (The Bat Mitigation Guidelines, English Nature, 2004) and Bat Conservation Trust Good Practice Survey Guidelines (2007). Sunset times for all the surveys were taken from Metcheck (www.metcheck.com).

The surveys were tailored to investigate usage of the wider landscape around the proposed development site by barbastelle and horseshoe bats (referred to as the 'target species'). Therefore, whilst other species of bat were recorded during the transect and static surveys, these are treated as incidental survey results within this report and are only briefly summarised in the results section.

2.3.1 Static Emergent / Re-entry surveys

The results of the 2009 bat surveys indicated that barbastelle was unlikely to be roosting within the proposed development site due to the lack of suitable habitats and that the earliest times this species was recorded on site in the evening was at least 60 minutes after sunset. However, on a number of occasions barbastelle was recorded within the site reasonably soon after sunset (between 60 and 120 minutes after sunset) and, as there is potentially suitable habitat for roosting within 3km of the site, it is possible that a barbastelle roost could occur within this distance. Therefore, areas of potentially suitable roosting habitat within 3km were sampled using emergence / re-entry surveys.

One emergence / re-entry survey was completed each month between May and September 2010, with each survey focusing on a different woodland block(s). Each survey was completed by two surveyors stationed at two nearby static locations. **Figure 2.1** illustrates the locations of the survey points.

The emergence surveys started around dusk and lasted between 1.5 and 2 hours. The re-entry surveys started 2 hours before dawn and finished at dawn. During each survey the woodlands were watched for bats entering or exiting. Bat calls were recorded using frequency division bat detectors (e.g. Batbox duet or Pettersson D-230) and recording devices (e.g. an Edirol R09), with the recordings being subsequently analysed using BatSound.

The dates of the surveys and weather conditions are provided in **Table 2.1**.

Table 2.1 Emergence / Re-entry Survey Dates and Weather Conditions

Survey Location	Date	Weather Conditions
1 a & b	18th and 19th May 2010	Dry, light winds and cloudy (100% cloud cover). Temperature 12°C – 11°C.

Survey Location	Date	Weather Conditions
2 a & b	8th and 9th June 2010	Dry, light and cloudy (80% cloud cover). Temperature 15°C – 13°C.
3 a & b	13th and 14th July 2010	Dry, light winds and partly cloudy (50% cloud cover). Temperature 18°C – 16°C.
4 a & b	23rd and 24th August 2010	Dry, light to moderate winds and partly cloudy (30% cloud cover). Temperature 18°C – 12°C.
5 a & b	15th and 16th September	Dry, light to moderate winds and cloudy (80-100% cloud cover). Temperature 15°C – 14°C.

2.3.2 Walked Activity Surveys

Walked transect surveys aimed at sampling bat activity at a variety of habitats surrounding the site were completed during May and September 2010. Two transect surveys were completed each month; one route sampled land to the east of the site and the other route sampled land to the west of the site. **Figures 2.2a &b** shows the transect survey routes.

During each survey the transect was walked at a steady pace and bat calls were recorded using frequency bat detectors (e.g. Batbox duet or Pettersson D-230) and recording devices (e.g. an Edirol R09), with the recordings subsequently being analysed using BatSound. Notes were made of the likely bat species, the location of the registration and other details (where discernable) such as direction of flight, activity (e.g. foraging or commuting), number of passes and number of bats.

All surveys commenced around sunset and lasted between 2 and 3 hours to coincide with the time when bats are most active during the night, as this is widely recognised as an optimal time to survey for bat activity. At least one circuit of each transect was completed within this time on each survey visit.

The survey dates and weather conditions of each transect completed are provided in **Table 2.2**.

Table 2.2 Activity Survey Dates and Weather Conditions

Transect Route	Date	Weather Conditions
May		
East	20th May 2010	Dry, light winds and clear (0% cloud cover). Temperature 15°C – 14°C.
West	27th May 2010	Dry, moderate winds and clear (0% cloud cover). Temperature 13°C – 12°C.
June		
East	21st June 2010	Dry, light winds and partly cloudy (20% cloud cover). Temperature 15°C – 14°C.
West	22nd June 2010	Dry, light winds and partly cloudy (30% cloud cover). Temperature 17°C – 15°C.

Transect Route	Date	Weather Conditions
July		
East	6th July 2010	Dry, calm and cloudy (80% cloud cover). Temperature 17°C – 15°C.
West	19th July 2010	Dry/light rain, moderate winds and cloudy (100% cloud cover). Temperature 18°C – 17°C.
August		
East	2nd August 2010	Dry, light to moderate winds and partly cloudy (20% cloud cover). Temperature 17°C – 15°C.
West	9th August 2010	Light rain, calm and cloudy (80% cloud cover). Temperature 18°C – 17°C.
September		
West	1st September 2010	Dry, light to moderate winds and partly cloudy (20% cloud cover). Temperature 16°C – 15°C.
East	13th September 2010	Dry, moderate winds and cloudy (80% cloud cover). Temperature 17°C – 15°C.

2.3.3 Static Bat Detectors (Anabat)

Similar to the other surveys completed, the Anabat surveys were designed to sample barbastelle and horseshoe activity around the proposed development site (particularly to the east and west).

During each survey period between May and October 2010, the Anabats (model ref. SD1) were deployed in pairs at a designated location. The aim of using two Anabat in relatively close proximity to each other was to investigate whether it could be shown that bats were travelling along a habitat feature (e.g. a pass could be recorded by one Anabat and then shortly after by the second Anabat). Anabats were left in place for approximately one to two weeks; however the duration of recording was dependant on the battery life. Hi-mics were used so that the microphones could be placed between 1m and 2m above the ground and sensitivity levels were maintained at around 5 to filter out disturbance, for example from rustling leaves, but to ensure fainter calls would trigger the unit to record.

Whilst the intention was to survey areas east and west of the site equally, initial access restrictions to the west of the site prevented this from occurring. However, additional survey effort was instead employed at a number of locations along the proposed development site boundary, namely along the shore and the western site boundary (as this was the furthest west that access was permitted initially). Hence, the 2010 surveys focused on three main areas (**Figure 2.3**):

- On-site (Shore 1 and 2 and West 1 and 2);
- East of the site (East 1, 2, 5 and 6); and
- West of the site (West 4, 5, 6, 7 and 8).

Table 2.3 shows when the units were deployed at each location and why this location was chosen for the survey.

Table 2.3 Anabat Locations, Deployment Dates and Rationale for Site Selection

Location Reference	Dates (inclusive)	Number of Days Sampled in each Location	Reason for Location
On-site			
Shore 1	06.07.10 - 17.07.10	12	The Shore 1 and 2 Anabat locations were chosen to investigate barbastelle usage of the coastal grassland / cliff habitat, which this species is known to exploit in other areas of its range in the UK (e.g. Suffolk).
Shore 2	03.08.10 - 18.08.10	16	
West 1	26.05.10 - 06.06.10	27	West 1 and 2 are located on Benhole Lane, but were not surveyed in 2009. West 1 was located in a valley and at the junction of hedgerows near to a small stone barn known to be used by *Pipistrellus* and *Myotis* spp. West 2 was sited at the location that the Bum Brook crosses Benhole Lane.
	19.07.10 - 02.08.10		
West 2	26.05.10 - 09.06.10	43	
	26.06.10 - 09.07.10		
	18.08.10 - 31.08.10		
East of site			
East 1	11.05.10 - 22.05.10	24	East 1 and 2 were located near to the mosaic of semi-natural habitat to the south of the Hinkley Point B Station. East 1 was located in trees set back from the coast by 20m and East 2 was located in trees near to a large reed-dominated pond.
	08.07.10 - 20.07.10		
East 2	11.05.10 – 24.05.10	43	
	03.08.10 - 18.08.10		
	01.09.10 - 13.09.10		
East 5	09.06.10 - 21.06.10	28	East 5 and 6 were located at each end of a short north/south lane bounded on each site by a dense hedgerow (a ‘green lane’). East 5 was located at the junction of this lane with a prominent east/west hedgerow forming the boundary of Wick Moor; East 6 was located near to the village of Wick and the network of hedgerows present there.
	20.07.10 - 03.08.10		
East 6	22.06.10 - 03.07.10	14	
	18.08.10 (single night due to Anabat failure)		
West of site			
West 3	21.09.10 - 28.09.10	23	West 3 was sited at the junction of two prominent hedgerows, one of which is the western end of the same hedgerow forming the ‘green lane’ within the site.
	5.10.10 - 10.10.10		
	11.10.10 -19.10.10		
West 4	28.09.10 - 05.10.10	23	West 4 was located adjacent to the Bum Brook upstream from location West 2, in order to investigate whether barbastelle may be commuting and/or foraging along this feature.
	6.10.10 - 10.10.10		
	11.10.10 - 21.10.10		
West 5	14.09.10 - 21.09.10	23	West 5 and 6 were located on hedgerows that connect to the wider landscape via further hedgerows and small copses to the south and west of the site.
	28.09.10 - 04.10.10		

Location Reference	Dates (inclusive)	Number of Days Sampled in each Location	Reason for Location
	05.10.10 - 12.10.10		
West 6	21.09.10- 28.10.10	29	
	05.10.10 - 12.10.10		
	21.10.10 - 02.11.10		
West 7	27.09.10 - 01.10.10	23	West 7 was positioned adjacent to the Bum Brook, a possible commuting / foraging route, and Honibere Wood, a possible roost location.
	12.10.10 - 20.10.10		
	21.10.10 - 29.10.10		
West 8	27.09.10 - 05.10.10	25	West 8 was sited adjacent to Honibere Wood, at a location where it meets a minor road and hedgerows.
	12.10.10 - 17.10.10		
	18.10.10 - 27-10.10		

The Anabat recordings were analysed to identify the species present using Analook software. Due to the large number of bat registrations recorded by both Anabats, the analysis has been restricted to identifying calls from the target species (barbastelle, lesser horseshoe and greater horseshoe).

3. Results

3.1 Desk Study (target species only)

Prior to the 2007 bat surveys at the site there were no records of barbastelle bats from the proposed development site or the wider area, apart from the known maternity colony on Exmoor (~25km to the west). In 2009 the Somerset Bat Group undertook one evening survey at Hodder’s Combe (on the Quantocks) and recorded barbastelle (verified by the Bat Conservation Trust). In 2010 further surveys were completed in Hodder’s Combe and Holford Combe (also located on the Quantocks), which recorded 11 probable barbastelle passes over three visits to each combe during August and September (Pickersgill, 2010). No further detail in relation to the records is currently available (e.g. time after sunset).

During 2010 a range of bat surveys were also completed by Halcrow in support of the Environment Agency’s Steart Realignment Project (Halcrow, 2010). The surveys were predominantly walked transects, with Anabats left out for single nights during the dusk and/or dawn surveys. There were no records of barbastelle during the transect surveys. However, barbastelle activity was recorded on 7 of the 18 Anabat survey occasions (39% of survey time), with the greatest number of passes recorded on the 9 and 10 August 2010. During these peaks of activity, the passes are spread fairly evenly through the night, with short peaks of activity comprising a small number of calls close together, possibly suggesting foraging bouts. Most of the activity was recorded in the western part of the Steart survey area (nearest to the HPC proposed development site), with small numbers of passes along the River Parrett.

3.2 Field Study (target species only)

3.2.1 Emergence/Re-Entry Surveys

None of the target species (i.e. barbastelle or horseshoe bats) were observed entering or exiting the woodlands surveyed. However, during the June survey a barbastelle bat was recorded shortly after sunset (26 minutes). Although, it was still light at this time, the area under the trees was darker. Given that this species generally prefers dark commuting and foraging areas, it is likely that the barbastelle roosted in this woodland and was foraging under the canopy in order to maximise foraging time. This is typical behaviour of barbastelle during the summer when they leave roosts whilst it is still light (Greenaway, 2001).

Table 3.1 details the small number of target bat species registrations recorded.

Table 3.1 Target Species Records from the Emergence / Re-entry Surveys

Date	Location	Species	Minutes after Sunset or before Sunrise
May	1b	Greater horseshoe	71 minutes before sunrise
June	2b	Barbastelle	26 minutes after sunset
July	3a	Barbastelle	Two calls 84 minutes prior to sunrise
September	5a	Lesser horseshoe	93 minutes after sunset

3.2.2 Activity Surveys

Barbastelle was recorded on three occasions during the walking activity transect surveys (**Table 3.2**). All the registrations were recorded during the May transect routes, with one probable call (the call was indistinct but showed similarities to characteristic barbastelle calls) to the east of the site in Stolford and two definite calls near Honibere Wood to the west of the site. All the calls were at least one hour after sunset and the record to the east of the site was later than the calls to the west.

Neither species of horseshoe bat was recorded during these surveys.

Table 3.2 Target Species Records from the Transect Surveys

Date	Location (Figure 3.2a&b)	Species	Minutes after Sunset
May – East transect	Whitewick Lane, Stolford (ST 2338 4527)	Barbastelle (probable)	115 minutes
May – West transect	Honibere Farm Lane (ST 1848 4362)	Barbastelle	71 minutes
	Honibere Wood (ST 1814 4419)		87 minutes

3.2.3 Static Bat Detectors (Anabat)

A summary of the results from the Anabat surveys in relation to the target species is provided below, with more detailed baseline results provided in **Appendices A and B**.

Barbastelle

Barbastelle bats were recorded at all the Anabat monitoring locations in 2010, with the exception of East 1 and East 6. The number of passes recorded at each location, and during each survey month, varied greatly between 2 passes up to 305 passes per survey period. **Table 3.3** summarises the baseline data and draws broad conclusions based on the results.

Table 3.3 Barbastelle Records from Static Anabat Surveys

Location (Figure 2.3)	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
On-site				
Shore 1	July	2	Bats were present on only a single night in 12 days of survey (i.e. 8% of the nights). From the proximity to each other, both passes may have originated from the same bat.	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
Shore 2	August	20	Bats were present on 33% of the nights. Peak of activity was around 14th August (with 13 passes between 2.00-4.00am). All passes were in the AM period.	The cluster of calls on 14th August suggests foraging activity, although the other records are individual or small numbers of passes, more indicative of commuting.
West 1	May/June July/August	25	No bats were present in 13 days of survey in late May. Bats were present on 37% of the nights during the July survey and concentrated on 20-24th July, with some calls occurring together over a short space of time.	Data indicates both foraging and commuting activity at this location during July and August. The absence of calls in May/June may suggest seasonal usage of this area
West 2	May/June June/July	11	Bats were present during 25% of the nights during the late May / early June survey. Passes were spread throughout the survey period with small clusters of calls on certain nights (e.g. five calls between 1-4am on the 27th May). No bats were recorded in 15 days of survey in late June/July.	Data indicates commuting and probable foraging activity at this location (or in the nearby area), as indicated by regular calls over a single night. The absence of calls in late June and July and the large increase in calls during August may suggest seasonal usage of this area, potentially associated with a seasonal food resource.
	August	160	Very active period of 160 passes in 14 nights of survey in August. Bats were present on 71% of the nights. Activity concentrated on 19th and 23rd to 27th August. Clusters of calls during a	

Location (Figure 2.3)	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
			number of nights, e.g. 21 passes between 12.30 and 5.00am.	
East of site				
East 1	May July	0	No bats were present in 12 days of survey carried out in May and 13 days in July (25 days in total).	The data suggest this location does not form part of a core foraging territory but, as barbastelle occur in the area, the location may be used on an infrequent basis.
East 2	May	305	Very active period; 305 passes in 14 days. Bats were present on 78% of the survey nights. Peak of activity concentrated between 14th and 20th between 22.00pm and around 01.00-03.00am each night Clusters of calls during a number of nights, e.g. 62 passes between 10pm and 2.30pm on 17th May. Number of passes in quick succession may suggest multiple bats.	The high level of activity recorded during May and limited activity recorded later in the year, suggests this location is used seasonally, possibly in response to a seasonally available food source (which may be associated with a large reed - dominated pond adjacent to the Anabat location). Due to an abundance of food, the area may be visited by multiple bats early in the active season. For the remainder of the year, this location appears to be used infrequently and probably only by commuting bats.
	August September	4	Bats were present on 23% of the nights during the August survey. The activity was spread over the survey period, with single calls on four nights. No bats were present in 15 days of survey during September.	
East 5	June July/August	37	No bats were present in 13 days of survey during June. Bats were present on 50% of the nights during the July/August survey period and the majority of these passes were concentrated between 27th and 29th July (11 passes on the 28th July).	The cluster of calls recorded in late July suggests this location is occasionally used by foraging or commuting bats.
East 6	June/July August	0	No bats were present in 14 days of survey carried out in late June/early July or in August.	The data suggest that this location does not form part of a core foraging territory or commuting route but, as barbastelle occur frequently in the area, the location may be used on an infrequent basis.
West of site				
West 3	September	39	Bats were present on 62% of the nights during September of which the majority of passes (86%) were concentrated on the 21st and 22nd September.	Data from September suggests foraging activity on two nights, with the area more regularly used by commuting bats.
	October	5	All calls were recorded in a single night (8th October), between 9pm and 12.30am.	

Location (Figure 2.3)	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
West 4	September/ October	148	Very active period, with bats present on 72% of the survey days, with 111 passes in 6 days between 28th September and 6th October. Only single passes recorded in mid-October.	Data indicates commuting and probable foraging activity at this location (or in the nearby area), as indicated by regular calls over consecutive nights, possibly in response to a seasonally available food source.
West 5	September/ October	55	Bats were present on 44% of the nights surveyed (none were recorded during eight days of survey in mid-September). Passes were spread through the survey period but peak on the 7th (10 passes between 1am and 6am) and 8th October.	Data indicates commuting and probable foraging activity at this location (or in the nearby area), as indicated by regular calls over a single night.
West 6	September/ October	11	Bats were present on 20% of the nights surveyed. Small numbers (three or less) of calls recorded on each night.	The low number of calls suggests this location is used primarily for commuting during the survey period.
West 7	September/ October	6	Bats were present on 13% of the nights surveyed. Small numbers (three or less) of calls were recorded on each night.	The low number of calls suggests this location is used infrequently for commuting during the survey period.
West 8	September/ October	2	Bats were present on 10% of the nights surveyed. Single passes were recorded on each night.	The low number of calls suggests this location was used infrequently for commuting during the survey period.

* Full details in **Appendix A**

The results show that the area surveyed around the proposed development site is regularly used by barbastelle. However, the results indicate that the level of usage may vary throughout the year. For example, a large number of passes was recorded at East 2 in May, with a very small number recorded later in the year; a similar pattern was recorded at West 2. The differences in usage are likely to be in response to food availability at certain locations at certain times of year.

The results also show that some landscape features are likely to be attractive to barbastelle throughout the year, for example because they provide a consistent foraging resource or because they offer a suitable linear corridor. One such feature is the Bum Brook, which had high levels of activity throughout late summer at West 2 (August) and West 4 (September/October). It is notable that the Anabats at West 7 (the highest upstream location on the Bum Brook, adjacent to Honibere Wood) recorded very little activity in September/October when West 4 was very active. This may suggest that barbastelle access the Bum Brook corridor at a location between West 7 and West 4.

The vast majority of the passes were recorded at least 60 minutes after sunset or before sunrise (**Appendix A**), which means that primary roosting sites (such as maternity roosts) are not likely to be in close proximity to the survey locations and that bats are travelling from a roost site to the survey area. However, the data provides no indication of the likely direction from which barbastelle are travelling to reach the survey area, as many of the survey points that were furthest from the site recorded little activity, with the exception of survey location West 5, which had moderate levels of activity during the same period of high activity at West 4.

Greater Horseshoe

Greater horseshoe bats were recorded from 9 of the 14 survey locations, with the greatest number of passes recorded at West 6 during the survey in September/October. **Table 3.4** summarises the baseline data and draws broad conclusions based on the results.

Table 3.4 Greater Horseshoe Records from Static Anabat Surveys

Location	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
On-site				
Shore 1	July	3	All calls were recorded around midnight; two calls three minutes apart on a single night and a third call eight days later	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
Shore 2	August	0	No greater horseshoe (GHS) calls recorded	The data suggest this location does not form part of a core territory or commuting route but, as greater horseshoe occur in the area, the location may be used on an infrequent basis.
West 1	July	3	Single passes on three nights in late July. Earliest pass 89 minutes after sunset on 24th July	Limited use of this location during the survey, restricted to commuting
West 2	May	7	Three passes over three minutes on 25th May and four passes over eight minutes on 31st May	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
East of site				
East 1	July	1	One pass 82 minutes after sunset	Very occasional use of this area, restricted to commuting by single bats
East 2	August	1	One pass around midnight in mid August	Very occasional use of this area, restricted to commuting by single bats
East 5	July	1	One pass 109 minutes after sunset	Very occasional use of this area, restricted to commuting by single bats
East 6	June/July August	0	No GHS calls recorded	The data suggest this location does not form part of a core territory or commuting route but, as greater horseshoe occur in the area, the location may be used on an infrequent basis.

Location	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
West of site				
West 3	September / October	0	No GHS calls recorded	The data suggest this location does not form part of a core territory or commuting route but, as greater horseshoe occur in the area, the location may be used on an infrequent basis.
West 4	September / October	2	One pass each on two separate nights, 12 nights apart (earliest 86 minutes after sunset)	Limited use of this location during the survey, restricted to commuting
West 5	October	3	All calls on separate nights, over a period of eight days. Earliest pass 38 minutes after sunset on 3rd October	Limited use of this location during the survey, restricted to commuting
West 6	September / October	8	One or two passes on six nights in late September through to late October. All but one of the passes between 1am and 3am in the morning.	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
West 7	September / October	0	No GHS calls recorded	The data suggest these locations do not form part of a core territory or commuting route but, as greater horseshoe occur in the area, the locations may be used on an infrequent basis.
West 8	September / October	0	No GHS calls recorded	

Greater horseshoe bats were recorded on 21 nights, equal to 6% of the nights that were surveyed, suggesting the use of the area by this species is infrequent The majority of the records comprised single registrations which were likely to be associated with either commuting or very short foraging activity. The greatest levels of activity were recorded from the southern static survey locations (e.g. West 2 and West 6), with only single or no passes from the eastern and western survey locations.

Lesser Horseshoe

Lesser horseshoe bats were recorded from 8 of the 14 survey locations, with the greatest number of passes recorded at West 5 during the survey in September/October. **Table 3.5** summarises the baseline data and draws broad conclusions based on the results.

Table 3.5 Lesser Horseshoe Records from Static Anabat Surveys

Location	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
On-site				
Shore 1	July	0	No lesser horseshoe (LHS) calls recorded	The data suggest these locations do not form part of a core territory or commuting route but, as lesser horseshoe occur in the area, the locations may be used on an infrequent basis.
Shore 2	August	0	No LHS calls recorded	
West 1	July	0	No LHS calls recorded	
West 2	June August	2	One pass in early June and one in late August. Both calls around 2am.	Limited use of this location during the survey, restricted to commuting
East of site				
East 1	May	1	Single pass recorded 172 minutes after sunset	Limited use of this location during the survey, restricted to commuting
East 2	August	0	No LHS calls recorded	The data suggest these locations do not form part of a core territory or commuting route but, as lesser horseshoe occur in the area, the locations may be used on an infrequent basis.
East 5	July	0	No LHS calls recorded	
East 6	June/July August	0	No LHS calls recorded	
West of site				
West 3	September	3	Single passes over three consecutive nights in late August, earliest 153 minutes after sunset	Limited use of this location during the survey, restricted to commuting
West 4	October	8	One or two passes during seven nights in early-mid October. Earliest pass 35 minutes after sunset on 3rd October.	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
West 5	September / October	20	Recorded over five nights in early-mid October, with the maximum number of passes being seven over a duration of 45 minutes on the 5th October. The first pass on each night ranged from 23 to 190 minutes after sunset.	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
West 6	September / October	12	One or two passes during nine nights between late September and late October (final pass on 1st November). Earliest pass 66 minutes after sunset on 6th October. Latest pass on following night at 46 minutes before sunrise.	Limited use of this location during the survey, restricted to commuting or opportunistic foraging

Location	Month	Total Number of Passes	Summary of Baseline Data*	Interpretation of Baseline Data
West 7	October	4	Two passes in close proximity on two nights in late October	Limited use of this location during the survey, restricted to commuting or opportunistic foraging
West 8	October	4	Single passes during October, with the earliest registration 88 minutes after sunset.	Limited use of this location during the survey, restricted to commuting

Lesser horseshoe bats were recorded on 33 nights, equal to 9% of the survey nights, suggesting the use of the area by this species is infrequent. All but three of these registrations were from the ‘west of site’ survey points, with the greatest number of passes recorded at West 5 and West 6. Given the low number of registrations per night, activity in this area is likely to be primarily commuting, with infrequent foraging.

3.3 Field Study (non-target species)

The locations that the following species have been recorded are shown on **Figures 3.1a&b** and **3.2a&b**.

Common Pipistrelle
Common pipistrelle was the most frequently encountered bat species within the site during the surveys and was recorded on all of the transect and static emergence / re-entry surveys. Although the registrations were recorded fairly evenly throughout the survey area, higher concentrations of occurrences were recorded around Stolford to the east of the site, with a lower number of registrations to the west, although passes were frequent on the track from Honibere Farm north towards Knap Plantation Woodland.

Soprano Pipistrelle
Soprano pipistrelle was the second most frequently encountered bat species within the site during the surveys. The registrations of this species were also fairly evenly spread throughout the survey area, with slightly more passes recorded near to villages and farms, such as Stolford.

Nathusius’ Pipistrelle
Nathusius’ pipistrelle was recorded on only one survey occasion. A total of eight passes were recorded during the July transect survey to the east of the site. All the passes were recorded within a 10 minute period from the coastal path to the west of Stolford (around Great Arch).

Noctule
Noctule bats were recorded on over half of the survey occasions. A high number of registrations were recorded at Honibere Wood in May, between Wick and Stolford during the July transect survey, and west of Stogursey during August. Whilst many of the registrations are single passes, suggesting commuting activity, the number of passes close together during the May and July surveys indicates foraging activity.

Serotine
Serotine bats were recorded infrequently during the transect surveys, with a small number of registrations around Stolford and to the west of Stogursey (18 in total). A greater number of registrations was recorded during the static surveys, although on most occasions only one or two passes were recorded during each survey. The exception was the August survey at New Barn Wood when 20 serotine passes were recorded. Most of the activity recorded indicates commuting behaviour, although foraging took place on a small number of occasions.

Leisler's
Leisler's bats were recorded very rarely during the surveys, with the only confirmed occurrence of this species during a dawn survey in May at Honibere Wood. A total of five passes was recorded and the behaviour suggests it was a single bat foraging near to the woodland.

Long-eared
Long-eared bats were recorded infrequently during the surveys, which is not unusual due to their quiet echolocation call. The records were distributed across the survey area, with a small number of records at Chalcott Farm near Stolford, and Standard Copse north of Stringston. A slightly higher number of registrations were recorded during the static survey at Wick Park Covert (five passes in total).

***Myotis* spp.**
Myotis spp. were recorded regularly during the surveys, on almost every survey occasion and in a variety of habitat types. Peaks of activity (where more than one or two passes were recorded) were recorded near Honibere Farm, New Barn Wood (both to the west of the site) and Wick Park Covert (to the south east of the site). A total of 20 *Myotis* spp. passes was recorded during the June static survey at Wick Park Covert.

4. References

Bat Conservation Trust (2007). *Bat Surveys - Good Practice Guidelines*. Bat Conservation Trust, London.

English Nature (2004). *Bat Mitigation Guidelines*. English Nature, Peterborough.

Pickersgill, L (2010). Barbastelle Report for Summer 2010. Report for Somerset Bat Group

Entec (2009). Hinkley Bat Survey Report. Report for EDF Energy

Grennaway, F (2001). The Barbastelle in Britain. British Wildlife, June.

Halcrow (2010). Steart Penninsula Wetland Projects, Bat Activity Survey Report. Report for Environment Agency and The Bristol Port Company.

Report template changed for consistency reasons but no other changes have been made since the original issue date.

Appendix A
Barbastelle Anabat Survey Results

9 Pages

Tables A.1 to **A.17** detail the dates that barbastelle was recorded at each of the 2010 Anabat monitoring locations. Information regarding the number of passes and the time of these passes is also provided.

Table A.1 Shore 1- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
06.07.10 - 17.07.10	08.07.10	114	271	2
			Overall total	**2**

Table A.2 Shore 2- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
03.08.10 - 18.08.10	03.08.10		315	1
	08.08.10		245	1
	10.08.10		207	4
	14.08.10		120	13
	15.08.10		359	1
			Overall total	**20**

Table A.3 West 1- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
26.05.10 - 06.06.10				0
19.07.10 - 02.08.10	20.07.10	126	172	7
	21.07.10	149	188	3
	22.07.10	144	182	7
	23.07.10	151	224	2
	24.07.10	159	267	4
	29.07.10		228	2
			Overall total	**25**

Table A.4 West 2 - May / June Survey Only (June / July and August Surveys in Table 2.5)

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
26.05.10 - 09.06.10	26.05.10		68	5
	27.05.10	130	293	2
	01.06.10	120		3
	03.06.10	106		1
			Overall total	**11**

Table A.5 West 2 – June / July and August Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
26.06.10 - 09.07.10				0
18.08.10 - 31.08.10	18.08.10		176	4
	19.08.10	191	65	24
	20.08.10	152	94	8
	21.08.10		128	3
	23.08.10	103	129	27
	24.08.10	79	163	28
	25.08.10	101	135	21
	26.08.10	100	38	20
	27.08.10	137		6
	28.08.10		282	11
	28.08.10	137	286	8
			Overall total	**160**

Hinkley East

TableA.6 East 1- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
11.05.10 - 22.05.10				0
08.07.10 - 20.07.10				0
			Overall Total	**0**

Table A.7 East 2- May Survey Only (August and September results in Table 2.3)

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
11.05.10 – 24.05.10	12.05.10	65		9
	13.05.10	59	182	8
	14.05.10	65	56	50
	15.05.10	68	217	56
	16.05.10	68	195	33
	17.05.10	67	159	63
	18.05.10	58	122	28
	19.05.10	59	216	26
	20.05.10	71	216	20
	21.05.10	65	241	5
	23.05.10	52	67	7
			Overall Total	**305**

Table A.8 East 2- August and September Survey

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
03.08.10 - 18.08.10	05.08.10		249	1
	07.08.10		208	1
	08.08.10		121	1
	10.08.10		327	1
01.09.10 - 13.09.10				0
			Overall Total	**4**

Table A.9 East 5 - All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
09.06.10 - 21.06.10				0
20.07.10 - 03.08.10	20.07.10		132	3
	22.07.10		290	1
	23.07.10		187	1
	25.07.10	147	101	3
	28.07.10	86	108	12
	29.07.10	142	94	14
	30.07.10		129	3
			Overall Total	**37**

Table A.10 East 6 - All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
22.06.10 - 03.07.10				0
18.08.10 (single night due to Anabat failure)				0
			Overall Total	0

Hinkley West

Table A.11 West 3 - September Surveys Only (October results in Table 2.12)

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
21.09.10 - 28.09.10	21.09.10	85	229	19

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
	22.09.10	58	120	14
	23.09.10	259		1
	26.09.10	99		1
	27.09.10	83	415	4
			Overall total	**39**

Table A.12 West 3 - October Survey

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
5.10.10 - 10.10.10	08.10.10	140	410	5
11.10.10 -19.10.10				0
			Overall total	**5**

Table A.13 West 4- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
28.09.10 - 05.10.10	28.09.10	47	139	28
	29.09.10	42	100	8
	30.09.10	38	143	22
	01.10.10	49	320	13
	02.10.10	94	208	12
	03.10.10	35	185	10
	04.10.10	39	120	19
6.10.10- 10.10.10	06.10.10	42	257	16

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
	07.10.10	79	199	9
	08.10.10	130	193	2
	09.10.10		323	1
	10.10.10	133		1
11.10.10 21.10.10	11.10.10	44		1
	12.10.10	274		1
	14.10.10	53		1
	16.10.10	259		2
	17.10.10		409	1
	20.10.10	180		1
			Overall total	**148**

Table A.14 West 5- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
14.09.10 - 21.09.10				0
28.09.10 - 04.10.10	28.09.10	239	178	8
	29.09.10	43	267	2
	30.09.10	31	232	5
	01.10.10		300	2
	02.10.10		388	1
	04.10.10	133	196	4
05.10.10 - 12.10.10	05.10.10	39	301	7
	06.10.10	232		1
	07.10.10	130	103	11

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
	08.10.10	73	407	13
	09.10.10	248		1
			Overall total	**55**

TableA.15 West 6- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
21.09.10- 28.10.10	21.09.10	184	265	3
	22.09.10	40		1
	26.09.10	149		2
05.10.10 - 12.10.10	05.10.10	131		1
21.10.10 - 02.11.10	21.10.10		422	2
	01.11.10	174		2
			Overall total	**11**

Table A.16 West 7- All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
27.09.10 - 01.10.10	29.09.10	84		3
12.10.10 - 20.10.10	15.10.10		246	1
21.10.10 - 29.10.10	26.10.10	314		2
			Overall total	**6**

Table A.17 West 8 - All Surveys

Survey Period	Nights when Passes Recorded	Time of Closest Pass to Sunset where pm Passes Recorded (mins)	Time of Closest Pass to Sunrise where am Passes Recorded (mins)	Total No. of Passes
27.09.10 - 05.10.10				0
12.10.10 - 17.10.10	14.10.10		43	1
18.10.10 - 27-10.10	19.10.10	195		1
			Overall total	**2**

Appendix B
Horseshoe Anabat Survey Results

5 Pages

Greater Horseshoe

Location	Date Set	Registration Date	Time after Sunset (mins) and Actual Time of Record	Time before Sunrise (mins) and Actual Time of Record	Number of Registrations
East 1	08.07.2010	17.07.2010	82 mins		1
			22:43		
East 2		14.08.2010		318 mins	1
	03.08.2010			00:38	
Shore 1		09.07.2010		266 mins	2
	06.07.2010			00:46:00	
		17.07.2010		269 mins	1
				00:46	
West 2	26.05.2010	26.05.2010	118 mins		3
			23:11		
		31.05.2010		170 mins	4
				02:10	
East 5		30.07.2010	109 mins		1
	09.06.2010		22:53		
West 1	19.07.2010	21.07.2010		193 mins	1
				02:08	
		22.07.2010	97 mins		1
			22:53:00		
		24.07.2010	89 mins		1
			22:42		
West 4		30.09.2010		191 mins	1
	28.09.2010			03:43	
	11.10.2010	12.10.2010	86 mins		1
			19:53		

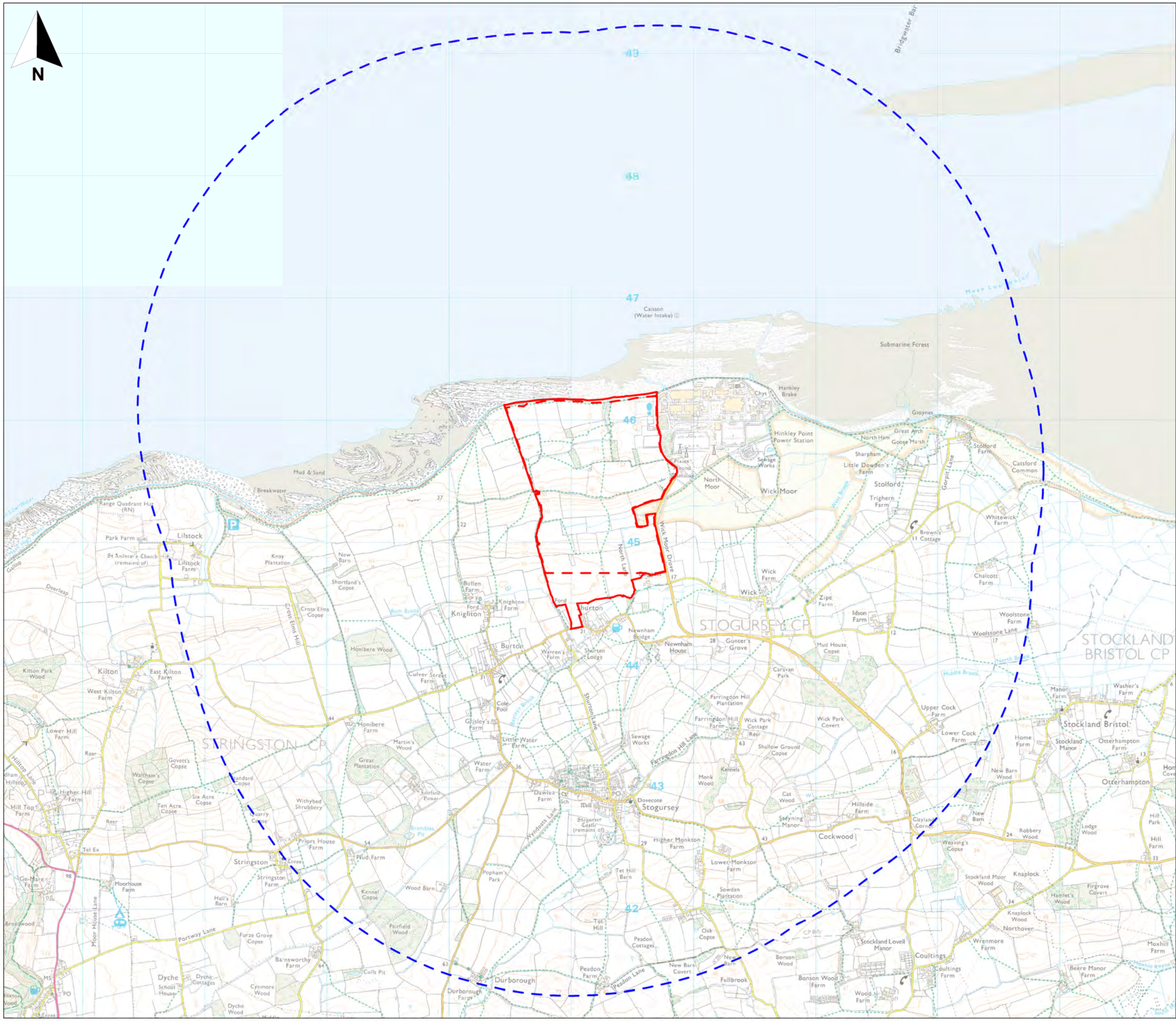
Location	Date Set	Registration Date	Time after Sunset (mins) and Actual Time of Record	Time before Sunrise (mins) and Actual Time of Record	Number of Registrations
West 5	28.09.2010	01.10.2010		338 mins 01:34	1
		03.10.2010	38 mins 19:25		1
	05.10.2010	09.10.2010		313 mins 02:12	1
West 6	 21.09.2010	28.09.2010		367 mins 01:00	1
	05.10.2010	05.10.2010	163 mins 21:26		2
		06.10.2010		359 mins 01:21	1
		09.10.2010		231 mins 03:34	1
	21.10.2010	27.10.2010		291 mins 03:04	2
		30.10.2010		264 mins 03:36	1

Lesser Horseshoe

Location	Date Set	Registration Date (night of)	Time after Sunset (mins)	Time before Sunrise (mins)	Number of Registrations
East 1	11.05.2010	17.05.2010	172 mins 23:53:00		1
West 2	26.05.2010	04.06.2010		179 mins 01:58	1
	18.08.2010	29.08.2010		254 mins 02:05	1
West 4	28.09.2010	03.10.2010	35 mins 19:22		1

Location	Date Set	Registration Date (night of)	Time after Sunset (mins)	Time before Sunrise (mins)	Number of Registrations
		05.10.2010		220 mins 03:38	1
	11.10.2010	09.10.2010		328 mins 01:57	1
		09.10.2010	249 mins 22:43		2
		12.10.2010	207 mins 21:54		1
		15.10.2010	197 mins 21:38		1
		18.10.2010		401 mins 00:59	1
West 3	21.09.2010	21.09.2010	153 mins 21:47		1
		20.09.2010		337 mins 01:19	1
		22.09.2010		195 mins 03:42	1
West 5	28.09.2010	28.09.2010	22 mins 19:20		1
		30.09.2010		382 mins 00:48	1
	05.10.2010	05.10.2010	36 mins 19:19		7
		07.10.2010	23 mins 19:01	419 mins 00:24	5
		09.10.2010	41 mins 19:15		3
		10.10.2010	71 mins 19:43		1
		11.10.2010	190 mins 21:39		2

Location	Date Set	Registration Date (night of)	Time after Sunset (mins)	Time before Sunrise (mins)	Number of Registrations
West 6	21.09.2010	27.09.2010	151 mins 21:32		1
	05.10.2010	05.10.2010	68 mins 19:51		1
		06.10.200	66 mins 19:46	64 mins 06:17	2
		10.10.2010		46 mins 06:42	2
		11.10.2010	164 mins 21:13		1
	21.10.2010	26.10.2010	337 mins 23:36		2
		27.10.2010		339 mins 01:18	1
		30.10.2010		252 mins 01:50	1
		01.11.2010	345 mins 22:32		1
West 7	21.10.2010	21.10.2010	338 mins 23:46	421 mins 00:46	2
		24.10.2010		397 mins 01:13	2
West 8	27.09.2010	01.10.2010	248 mins 22:59		1
	18.10.2010	18.10.2010	88 mins 20:13		1
		19.10.2010	157 mins 20:49		1



Key

Planning Application Site Boundary

Development Site - Indicative Boundary

Approximate survey area

0 km 1.5 km

Scale 1:30,000 @ A3

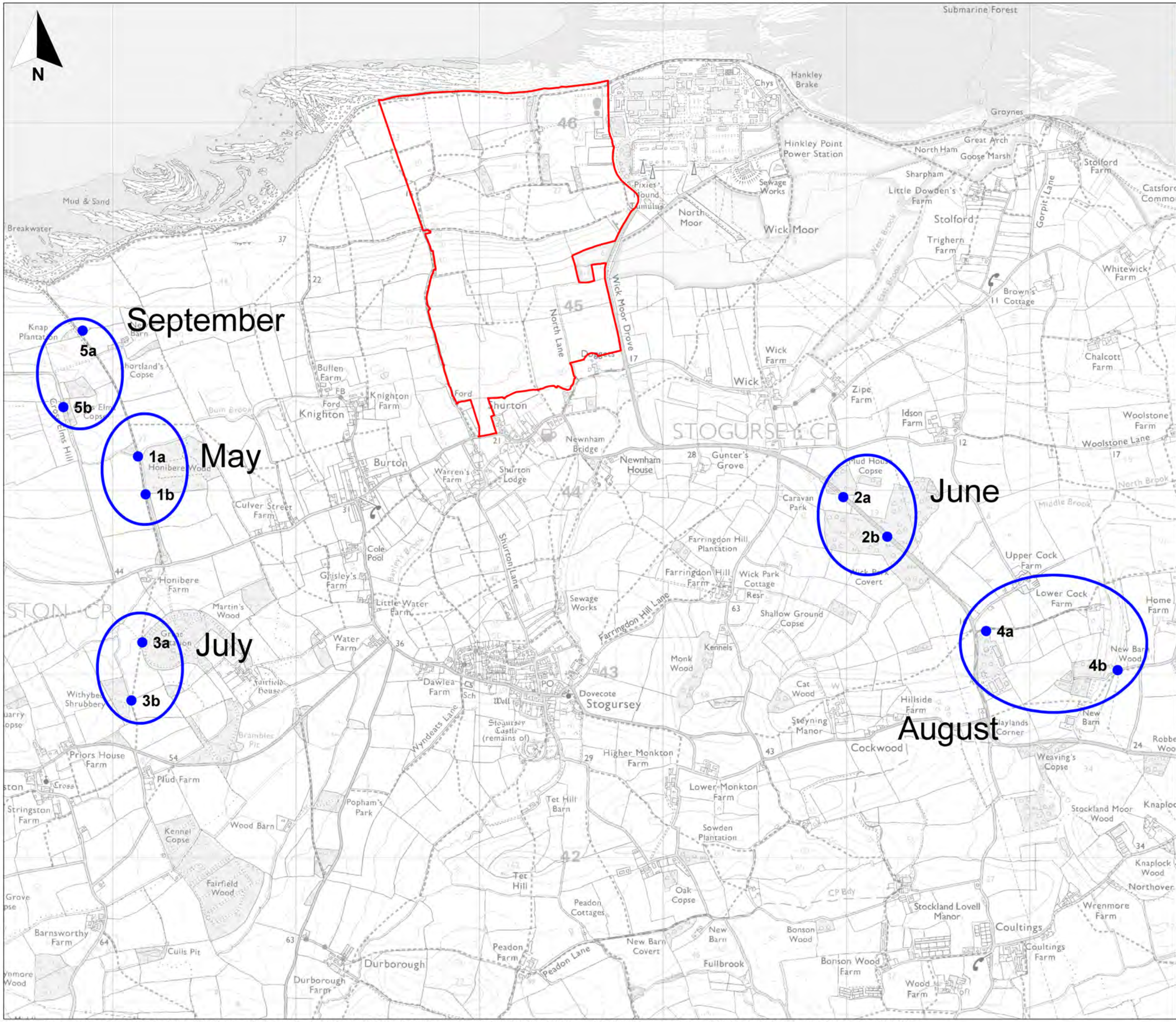
EDF

Hinkley Point C Baseline Bat Report 2010

Figure 1.1
Site boundary

March 2011
28132-L162a.wor adamk

amec



Key

- Planning Application Site Boundary
- Emergence / re-entry survey locations and dates

0 km — 1 km

Scale 1:20,000 @ A3

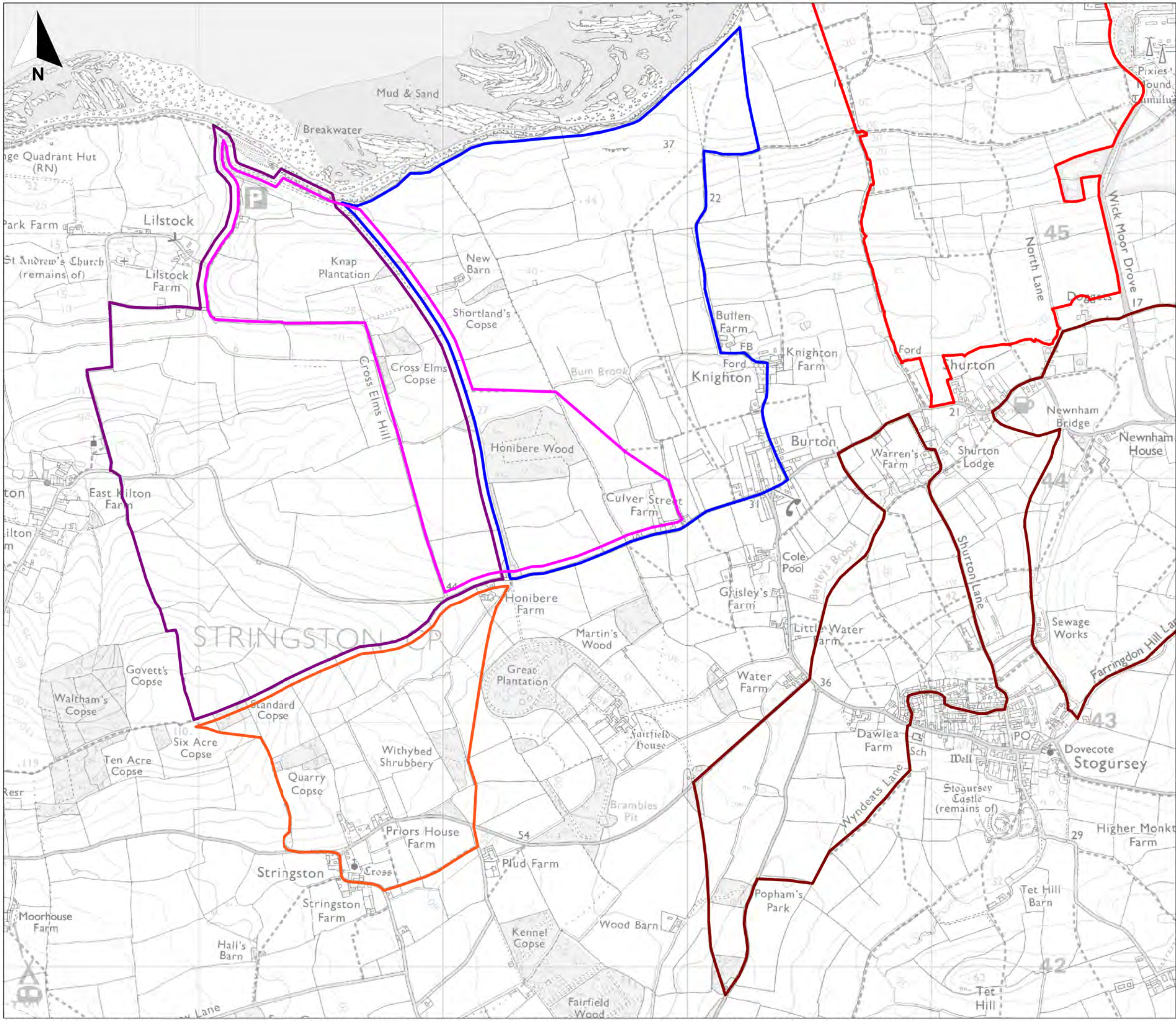
eDF

Hinkley Point C Baseline Bat Report 2010

Figure 2.1
Location of Static Survey Points

March 2011
28132-L163a.wor adamk

amec



Key

Planning Application Site Boundary

Date of transect route

May

June

July

August

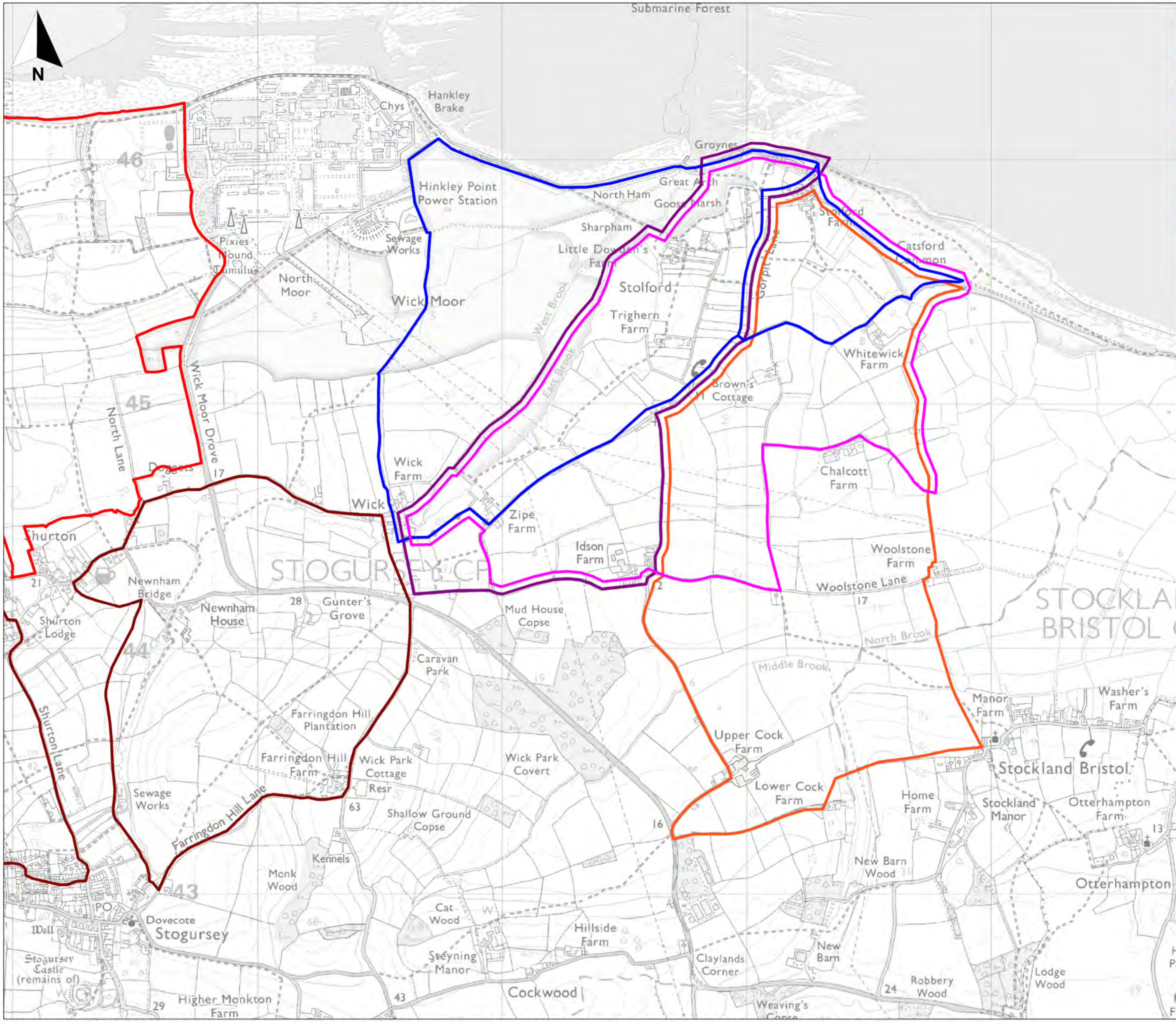
September

Hinkley Point C Baseline Bat Report 2010

Figure 2.2a
West transect routes

March 2011
28132-L164a.wor adamk

amec



Key

Planning Application Site Boundary

Date of transect route

May

June

July

August

September

0 m 500 m

Scale 1:15,000 @ A3

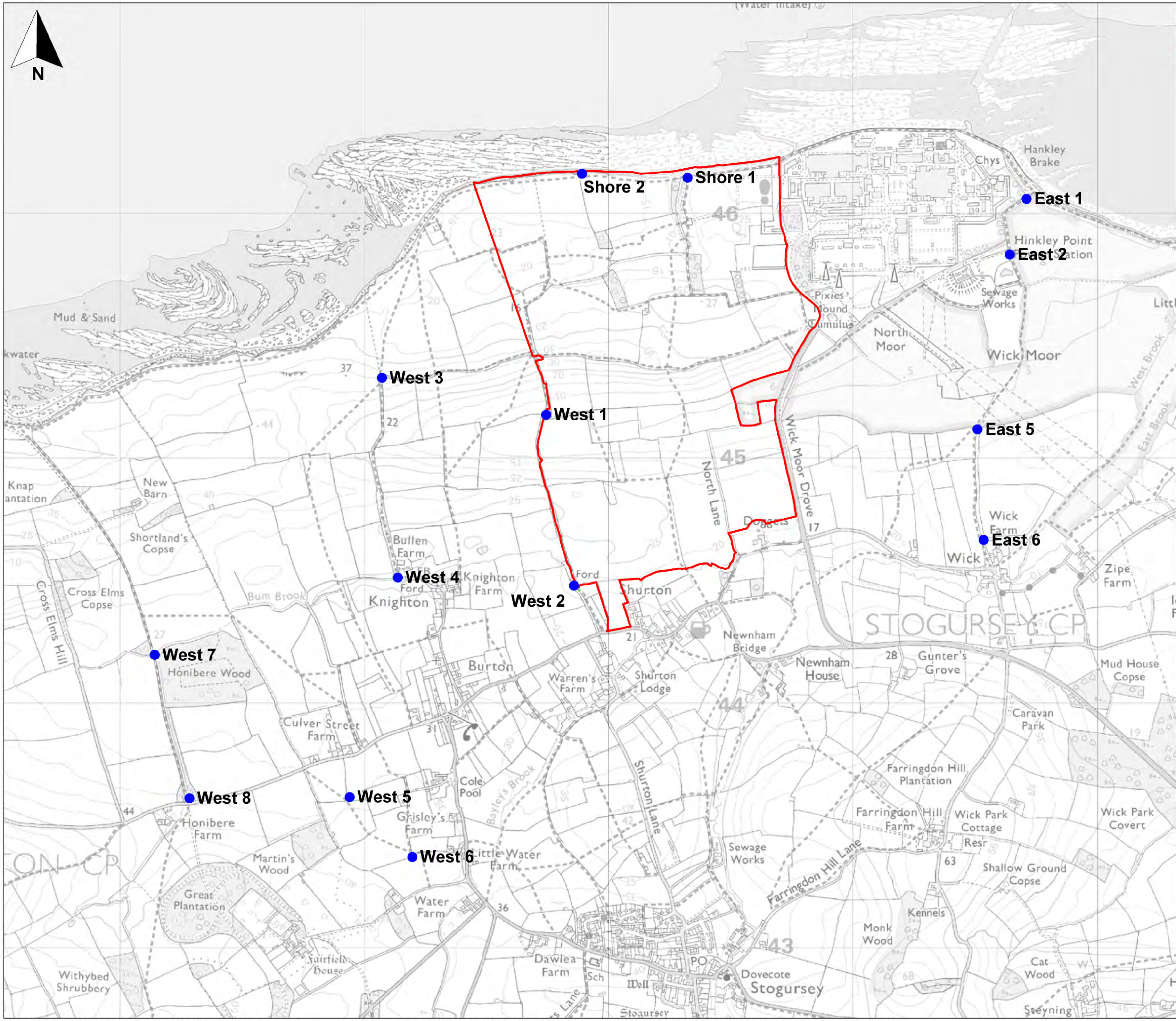
EDF

Hinkley Point C Baseline Bat Report 2010

Figure 2.2b
East transect routes

March 2011
28132-L183a.wor adamk

amec



Key

Planning Application Site Boundary

Anabat survey locations and reference

0 m — 750 m

Scale 1:15,000 @ A3

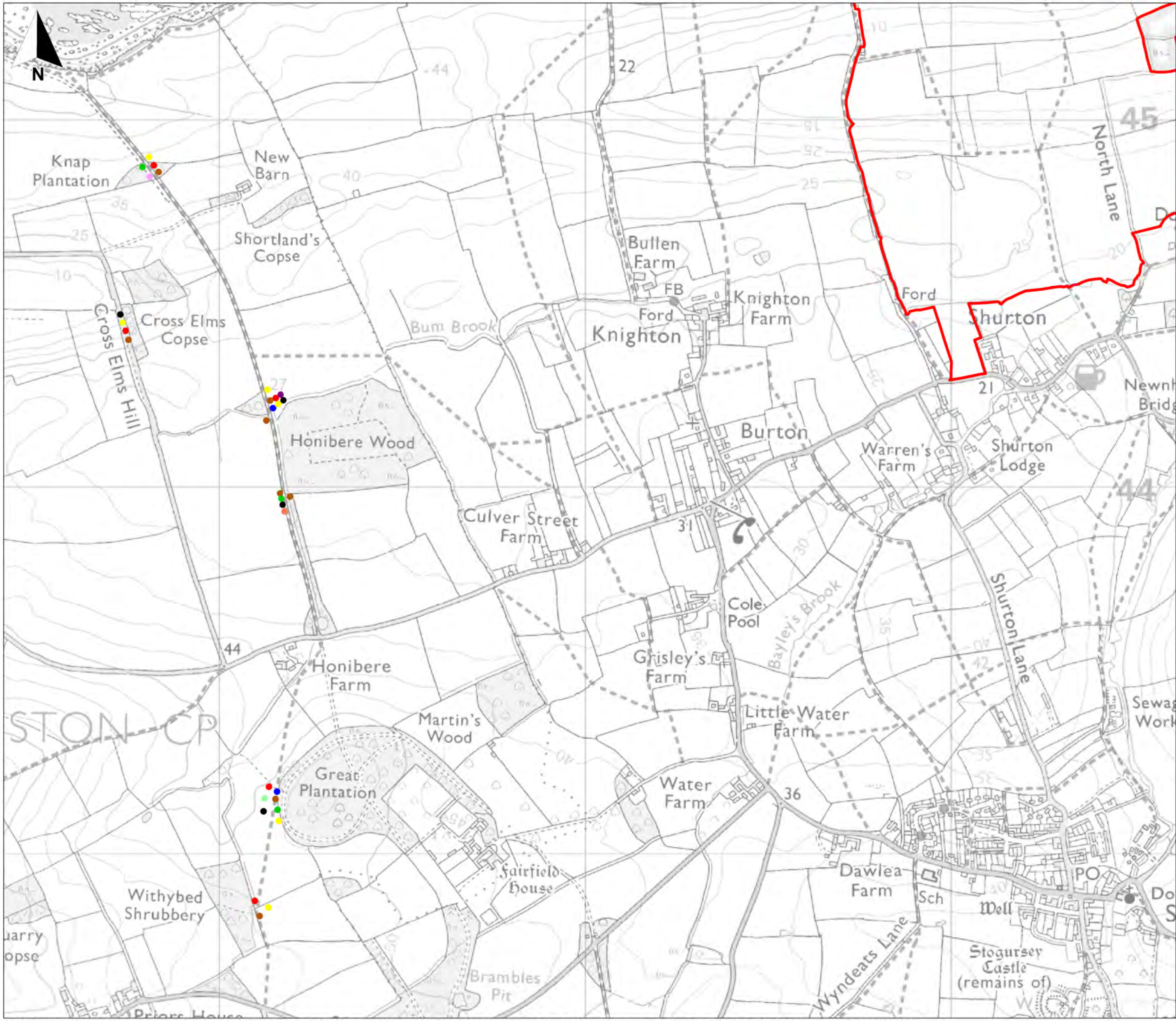
eDF

Hinkley Point C Baseline Bat Report 2010

Figure 2.3
Location of Static Bat Detectors

March 2011
28132-L165a.wor adamk

amec



Key

Planning Application Site Boundary

Location of Bat Foraging and Commuting Passes

- Soprano Pipistrelle
- Common Pipistrelle
- Noctule
- *Myotis* sp.
- Serotine
- Barbastelle
- Leisler's
- Greater Horseshoe
- Lesser Horseshoe
- Long-Eared Bat

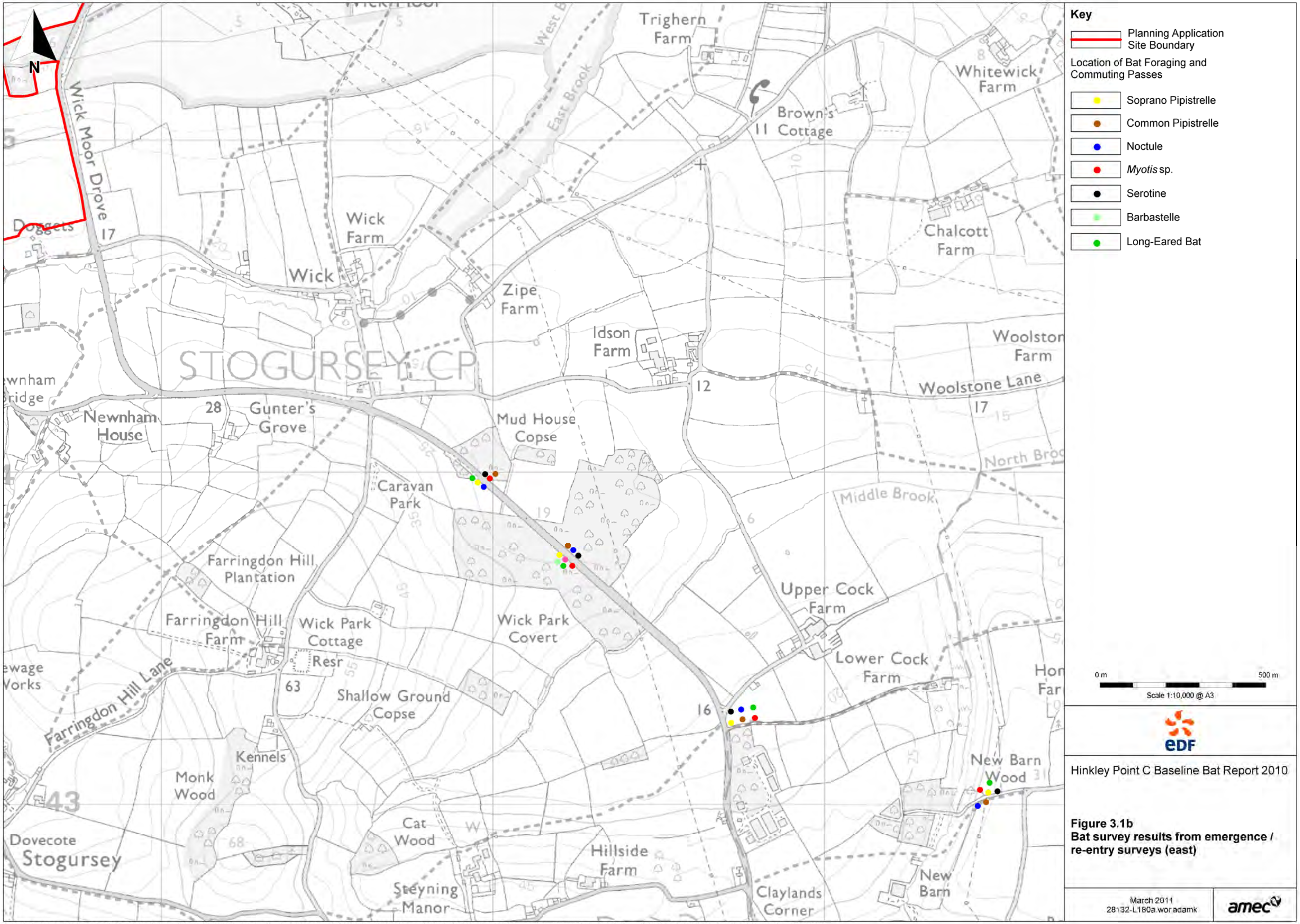
0 m 500 m

Scale 1:10,000 @ A3

Hinkley Point C Baseline Bat Report 2010

Figure 3.1a
Bat survey results from emergence / re-entry surveys (west)

March 2011
28132-L179a.wor adamk



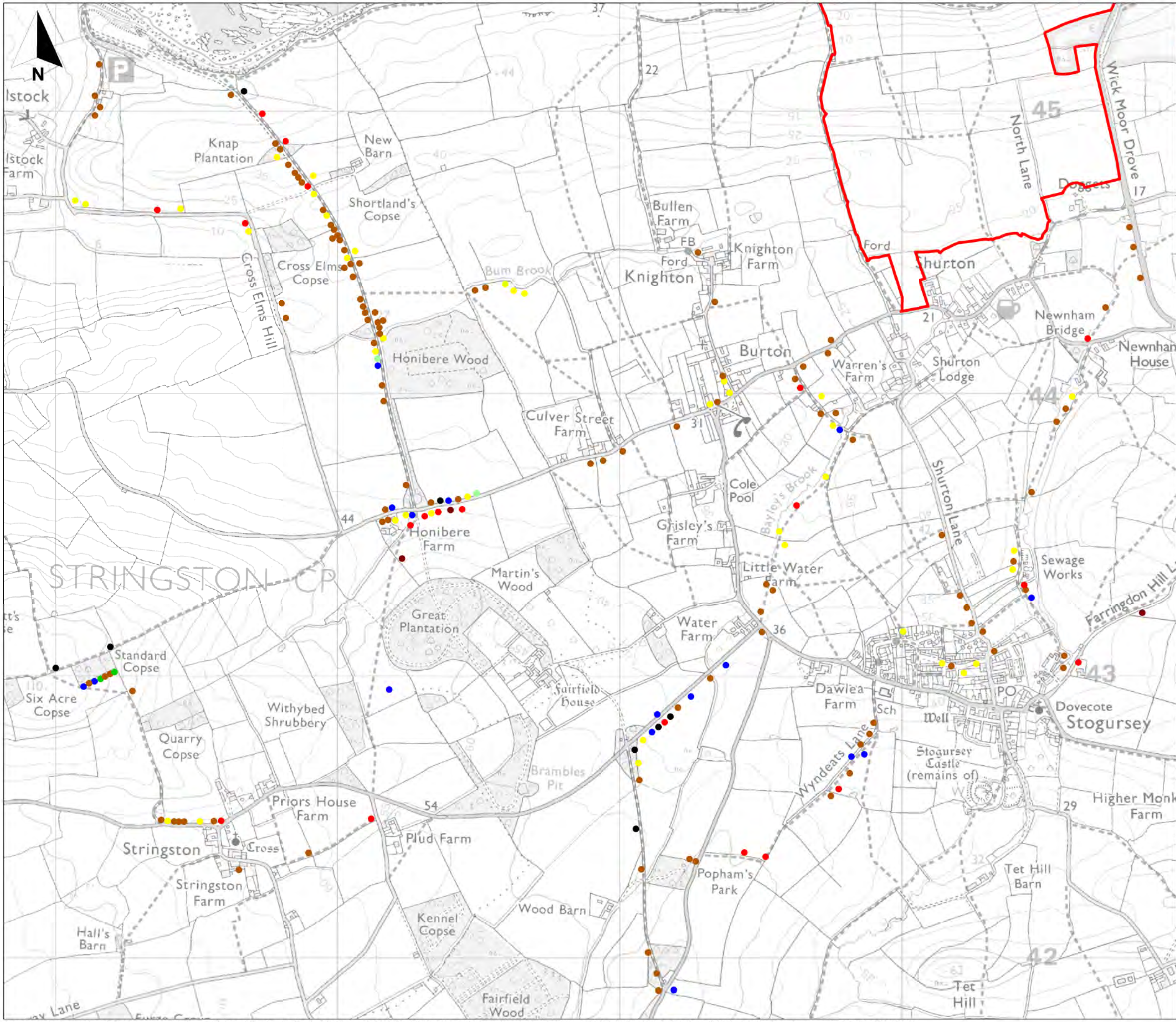
EDF

Hinkley Point C Baseline Bat Report 2010

Figure 3.1b
Bat survey results from emergence / re-entry surveys (east)

March 2011
28132-L180a.wor adamk

amec



Key

- Planning Application Site Boundary

Location of Bat Foraging and Commuting Passes

- Soprano Pipistrelle
- Common Pipistrelle
- Noctule
- *Myotis* sp.
- Serotine
- Barbastelle
- Long-Eared Bat

0 m — 500 m

Scale 1:13,000 @ A3

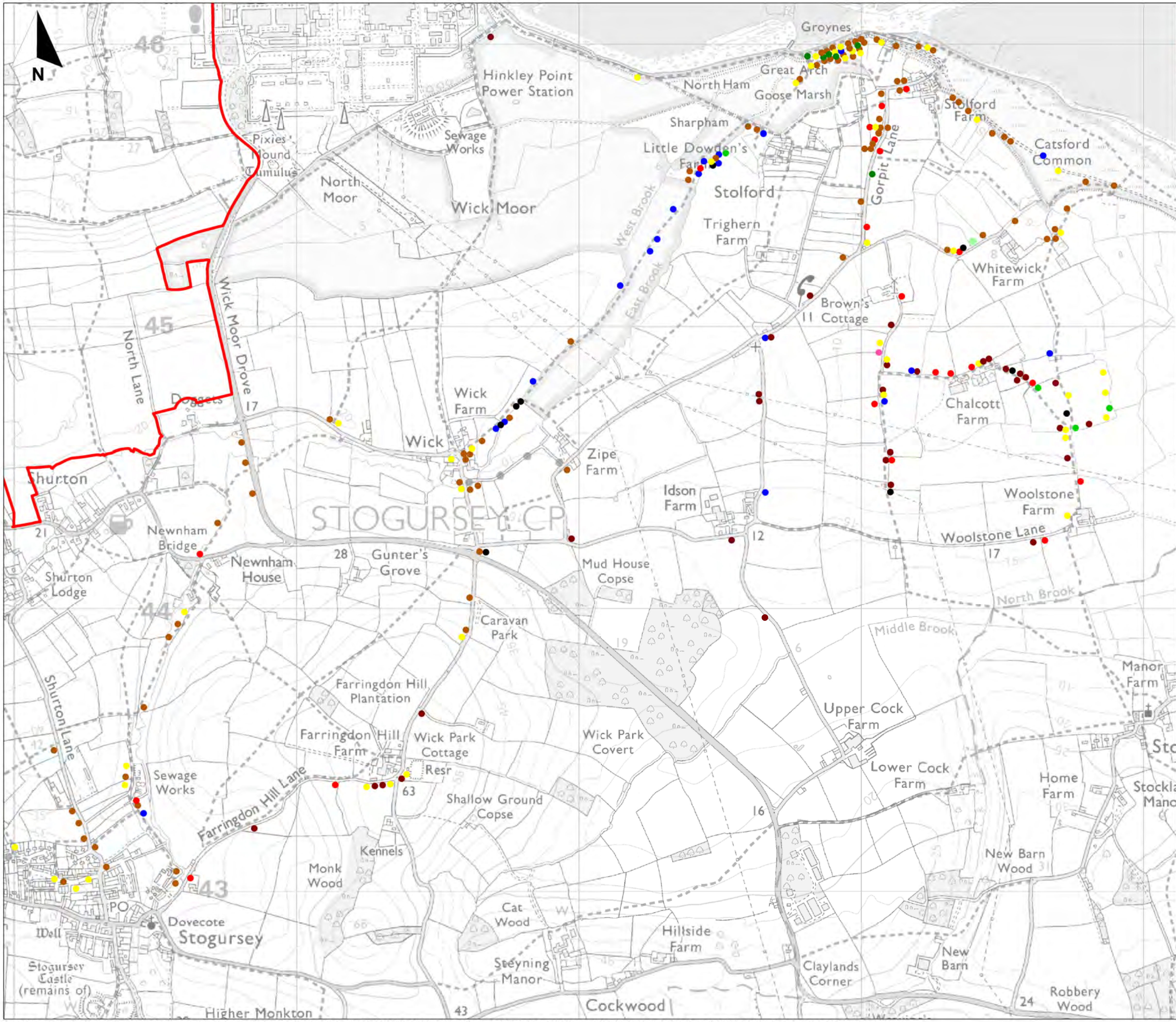
EDF

Hinkley Point C Baseline Bat Report 2010

Figure 3.2a
Bat survey results from transect surveys (west)

March 2011
28132-L166a.wor.adamk

amec



Key

Planning Application Site Boundary

Location of Bat Foraging and Commuting Passes

- Soprano Pipistrelle
- Common Pipistrelle
- Noctule
- *Myotis* sp.
- Serotine
- Barbastelle
- Nathusius's Pipistrelle
- Long-Eared Bat

0 m 500 m

Scale 1:13,000 @ A3

EDF

Hinkley Point C Baseline Bat Report 2010

Figure 3.2b
Bat survey results from transect surveys (east)

March 2011
28132-L181a.wor adamk

amec

APPENDIX 20G: HINKLEY DORMOUSE SURVEY REPORT

EDF Energy
Hinkley Dormouse Survey Report

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as 'Hinkley C') on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, excluding coastal/marine biodiversity other than birds. This report details the results of dormouse surveys that were completed between 2007 and 2009.

1.2 Background to Development

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. The 2007 survey was restricted to land owned or controlled by British Energy (which is now part of EDF Energy). When the dormouse surveys were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1). The boundary of the SSA was therefore used to define the area within which the 2009 dormouse survey was carried out. As a result of the 2007-2009 surveys, all habitat features within the SSA that were potentially suitable for dormouse were surveyed. The SSA includes all of the land within the final 'Construction Boundary'.

1.2.2 Site Description

The majority of the land within the SSA is agricultural; comprising 16 arable fields and 16 grassland fields with various levels of agricultural improvement. The fields are primarily bordered by mature hedgerows. Six small, rectangular broad-leaved woodlands are located within the northern part of the SSA and a square block of young broad-leaved plantation has been created in the central part of the area, with smaller areas of isolated scrub scattered along the northern boundary and in the eastern parts of the SSA. Two watercourses flow west to east through the SSA (further seasonal ditches also occur) and a further watercourse is present on the southern boundary of the SSA. Three ponds occur within the SSA.

The SSA is adjacent to the Bristol Channel. A low cliff, between 0.2m and 10m in height, forms an escarpment between the land and sea.

The land immediately adjacent to the west SSA is similar in character to that within the western part of the SSA, i.e. it comprises agricultural fields (both arable and improved pasture), which are separated by a mixture of intact species-poor and species-rich hedgerows. A small number of ponds occur and the upper reaches of the Bum Brook flow through the area.

The land east of the SSA is different in character to that within the SSA. It forms part of Bridgwater Bay SSSI and comprises large open fields separated by drains, with very few hedgerows present. The fields immediately adjacent to the SSA have been agriculturally improved and are relatively species-poor. However, those fields to the south and east are less intensively grazed and support a more varied sward and have a greater diversity of plant species.

The proposed development falls into the Vale of Taunton and Quantock Fringes Natural Area[1] (English Nature, 1998), which describes the lowland landscape around the major towns of Taunton, Wellington and Minehead between the Quantock Hills, Brendon Hills, Exmoor and the Blackdown Hills. The Natural Area is characterised by a wide variety of habitats and species, including hedgerow and hedgebanks, calcareous grassland, streams, woodland and scrub, nightingale, otter and bats.

The Natural Area immediately to the east of the SSA is the Somerset Levels and Moors Natural Area (English Nature, 1997).

2. Methods

2.1 Desk Study

Contextual information regarding dormouse within the preliminary works area and surrounding land was obtained from the following sources:

- EDF Energy (and British Energy), have conducted a wide range of ecological surveys of their land holding and employ a conservation warden at Hinkley to help manage their land and undertake biological recording);
- Somerset Environmental Records Centre (SERC);
- Somerset County Council (SCC);
- the Environmental Statement (ES) for the Decommissioning of Hinkley A (Magnox, 2006);

[1] The classification of areas of the country into distinct Natural Areas (NAs) was undertaken by English Nature (now Natural England) in order that areas of the countryside identified by unique combinations of physical attributes, wildlife, land use and culture could be grouped together. Overall, 143 NAs, including 24 Coastal NAs have been identified.

- the ES for the proposed West Hinkley Wind Farm (Dulas, 2006);
- the West Somerset Local Biodiversity Action Plan (LBAP); and
- the National Biodiversity Network (NBN) website.

Data from SERC was requested in May 2009 (following an initial request in 2007) to ensure that any additional new records submitted in the intervening period were captured. The 2009 data request included a search area of 3km[2] around the SSA boundary.

2.2 Field Surveys

The survey methodology followed guidance given in The Mammal Society's "Dormouse Nest Tubes" leaflet (no date), as well as general advice given in the Dormouse Conservation Handbook (English Nature, 2006), Dormice (The Mammal Society, 1992) and A Practical Guide to Dormouse Conservation (The Mammal Society, 1989).

2.2.1 Habitat Suitability

During the extended Phase 1 habitat survey (conducted in March 2007 and updated in 2009) it was concluded that the hedgerows and woodlands within the SSA supported a range of plant species and had fairly complex structural diversity. Also, although the woodland blocks are fairly isolated from each other, the network of hedgerows within and around the SSA offers suitable habitat corridors between the woods within the SSA and further areas of woodland outside it.

Further, the plants present within the hedgerows and woodlands include species that are noted as being of value to dormice (Bright *et al*, 2006) such as bramble, hazel, oak and honeysuckle, although only small amounts of the latter three species occur within the SSA.

The combination of these features suggested the woodland and hedgerow habitats could be suitable for dormouse.

2.2.2 Tube Checking

Dormice construct nests during the summer, usually made out of strips of honeysuckle bark woven with leaves. These can occur almost anywhere within a dense hedge or woodland but are usually off the ground in scrub or trees and can be within holes in trees. This habit of nest building can be used to survey for the presence of dormouse. This is achieved by providing suitable places for dormice to build their nests in the form of wooden boxes and/or plastic tubes, which are then checked at regular intervals. The wooden nest boxes are generally used for long-term monitoring as they are more durable and it usually takes longer for dormouse to use them. Tubes are best used to determine presence/absence over a relatively short period of time as they are readily used by dormouse and easy to set out at a site. Therefore, tubes were used at Hinkley.

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[2] Whilst a 2km radius around a site is the standard desk study area (IEA, 1995), due to the large scale of the proposed development this was extended to 3km with the aim of capturing more data to allow the results obtained to be put in the context of the wider area.

The Dormouse Conservation Handbook (English Nature, 2006) provides a recommended methodology for sampling a site for dormice using nest tubes. Within this method, an index of the probability of finding dormice in tubes in each month between April and November has been developed and the guidance recommends that dormouse absence should not be concluded from an index score of less than 20 (the maximum score is 25). The index is based on using 50 tubes at a site, but the guidance does not relate this number of tubes to the area of the development site. It is not stated in the guidance that a greater number of tubes increases the score obtained, although a paper within Mammal News (Michael Woods, summer 2008) does suggests that double the number of tubes, doubles the index score. The highest probability scores are obtained during May, August and September, relating to early nest building and dispersing sub-adults.

Based on this methodology, a total of 100 tubes were placed in hedgerows and woodlands during May and June 2007 and were checked on a monthly basis between June and November 2007. Due to access restrictions during 2007, only the land within Area A on Figure 2.1 was accessible for the survey. In November 2008 and April 2009, a further 270 tubes were installed in the hedgerows and woodlands within the remainder of the SSA. These were also checked monthly between May and September 2009. Therefore a total of 370 tubes were used within the SSA.

The hedgerows were sampled by placing tubes at 10-25m intervals, however, priority was given to placing tubes in optimal positions (e.g. in fruiting hazels or particularly dense areas of species-rich hedgerow) rather than sticking to this exact spacing in order to maximise the chances of detecting dormouse if present. In the woodlands the tubes were placed in rough grid layouts to sample both edge habitat and central habitat (English Nature, 2006). Figure 2.2 shows the locations of all the tubes located in both the hedgerows and woodlands surveyed in 2007 and 2009. Appendix A contains photographs showing representative locations of the tubes.

In order to effectively check each tube, a quiet and careful approach was made before the entrance was sealed with a cloth. The inside of the tube was then carefully inspected for the presence of nests or animals. Species other than dormouse, such as wood mouse (*Apodemus sylvaticus*), yellow-necked mouse (*Apodemus flavicollis*) and even birds, often use tubes. However, dormouse nests have characteristic features[3] and are relatively easy to identify.

2.2.3 Overall Survey Effort

Using the guidance provided by English Nature (2006) a survey effort score of 20 was achieved in 2007. In 2009, a score of 20 was also achieved. This analysis is based on using 50 tubes during a single survey season. As one hundred tubes were used in 2007 and 270 in 2009, the final effort score is considered to exceed 20. The surveys in both 2007 and 2009 sampled the key months (May, August and September) identified in the guidance as having the highest probability of finding dormice in tubes.

The English Nature guidance suggest that scores of under 20 should not be used to conclude dormice are absent from a site. The survey effort within the SSA is therefore equal to (and possibly exceeds) this threshold and it is therefore reasonable to conclude dormouse presence or absence can be confidently determined.

[3] Although nests in a tube will take on a more flattened appearance.

2.2.4 Other Signs

During each dormice survey visit, other signs of dormice were also searched for, e.g. nests and feeding remains comprising honeysuckle flowers and stripped honeysuckle bark, around the tube locations.

Hazel is very restricted within the woodlands across the SSA such that a nut search was not considered appropriate in the vast majority of locations. However, two areas of woodland within the SSA support a small number of hazel stools and the bases of these were searched for nuts opened by dormice in November 2008 (Figure 2.2). This survey was completed based on the method within the English Nature Guidance which requires 20 minutes of searching within five to ten 10x10m quadrats. Due to the lack of hazel within the woodland compartments, only two quadrats could be surveyed.

2.3 Constraints

The fact that only two quadrats within the SSA were surveyed for hazelnuts does not undermine the findings of the dormouse survey for the reason that the SSA was extensively surveyed using nesting tubes.

3. Results

3.1 Desk Study

Prior to this study, no formal dormouse surveys had been conducted within the SSA and no records were received during the data search (i.e. from SERC). Dormouse surveys were not completed as part of any of the previous ecological survey work undertaken for either the decommissioning of Hinkley A or the proposed West Hinkley Windfarm.

The nearest dormouse records listed on the NBN website to the SSA is 7km to the south-west at Holford on the edge of the Quantock Hills. The record is from 1994. There are three further dormouse records from the Quantock Hills with further records on Exmoor to the west and Taunton to the south.

3.2 Field Survey

The date of each survey event is provided in Table 3.1.

Table 3.1 Dormouse Survey Dates

2007	2009
22 June 2007	27 May 2009
20 July 2007	18 June 2009
16 August 2007	20 July 2009
19 September 2007	25 August 2009
26 October 2007	14 September 2009
29 November 2007	

No dormice were fond in any of the tubes in either 2007 or 2009. No signs of dormouse, such as feeding remains or nests were found.

A relatively high number of the tubes (~40) were utilised by wood mouse during the course of the surveys (often with more than one mouse in each tube). The wood mice constructed loose nests made predominantly of leaves and grass. During the autumn months the tubes were also used as feeding stations (most likely by wood mice again) and rosehips and blackberries were found in them.

4. Conclusions

No dormice or signs of dormice were observed during the course of the survey. Given the number of tubes used over the area available for survey and the number of visits made to the SSA during 2009 and in 2007 (to achieve the score of 20 in both years), it is considered reasonable to conclude that dormice are not present. As such, specific mitigation and enhancement measures for dormouse will not be required.

5. References

Bright, P. and Morris, P. (1989) *A Practical Guide to Dormouse Conservation*. The Mammal Society.

Bright, P. and Morris, P. (1992) *The Dormouse*. The Mammal Society.

Bright, P., Morris, P. and Mitchell-Jones, T. (1996) *The Dormouse Conservation Handbook*. English Nature, Peterborough.

Cresswell Associates (2005) *Hinkley A Power Station Decommissioning ES*. Section 12: Ecology. Magnox Electric.

Dulas (2006) *West Hinkley Wind Farm ES*.

The Mammal Society (no date) *Dormouse Nest Tubes.*

The Mammal Society (2008) *Mammal News.*

Report template changed for consistency reasons but no other changes have been made since the original issue date.

Appendix A
Selection of Relevant Photographs

Photo 1

Photo 2

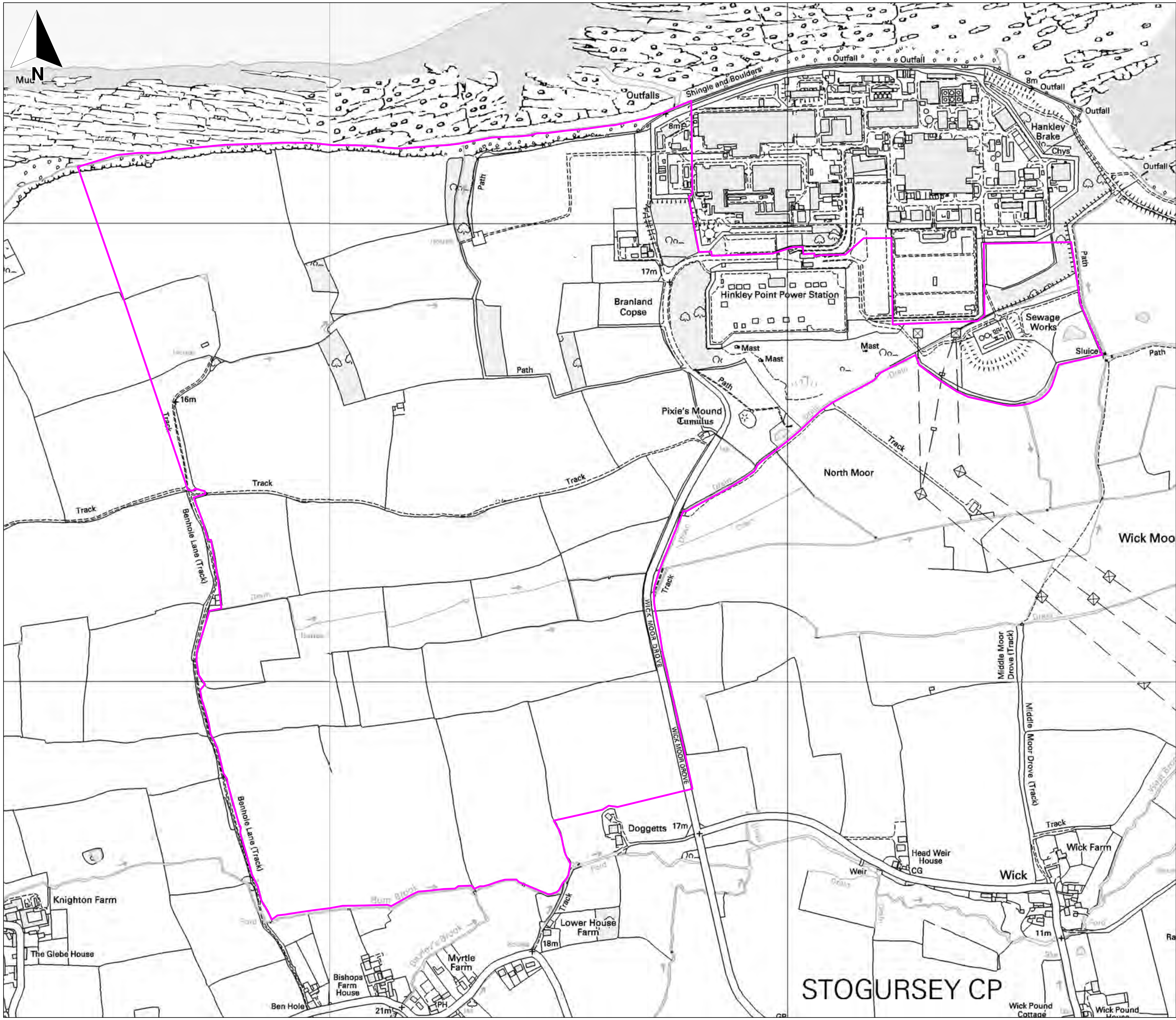
Photo 3

Photo 4

Photo 5 – Example of a wood mouse nest

Photo 6

Photo 7



Key

SSA boundary

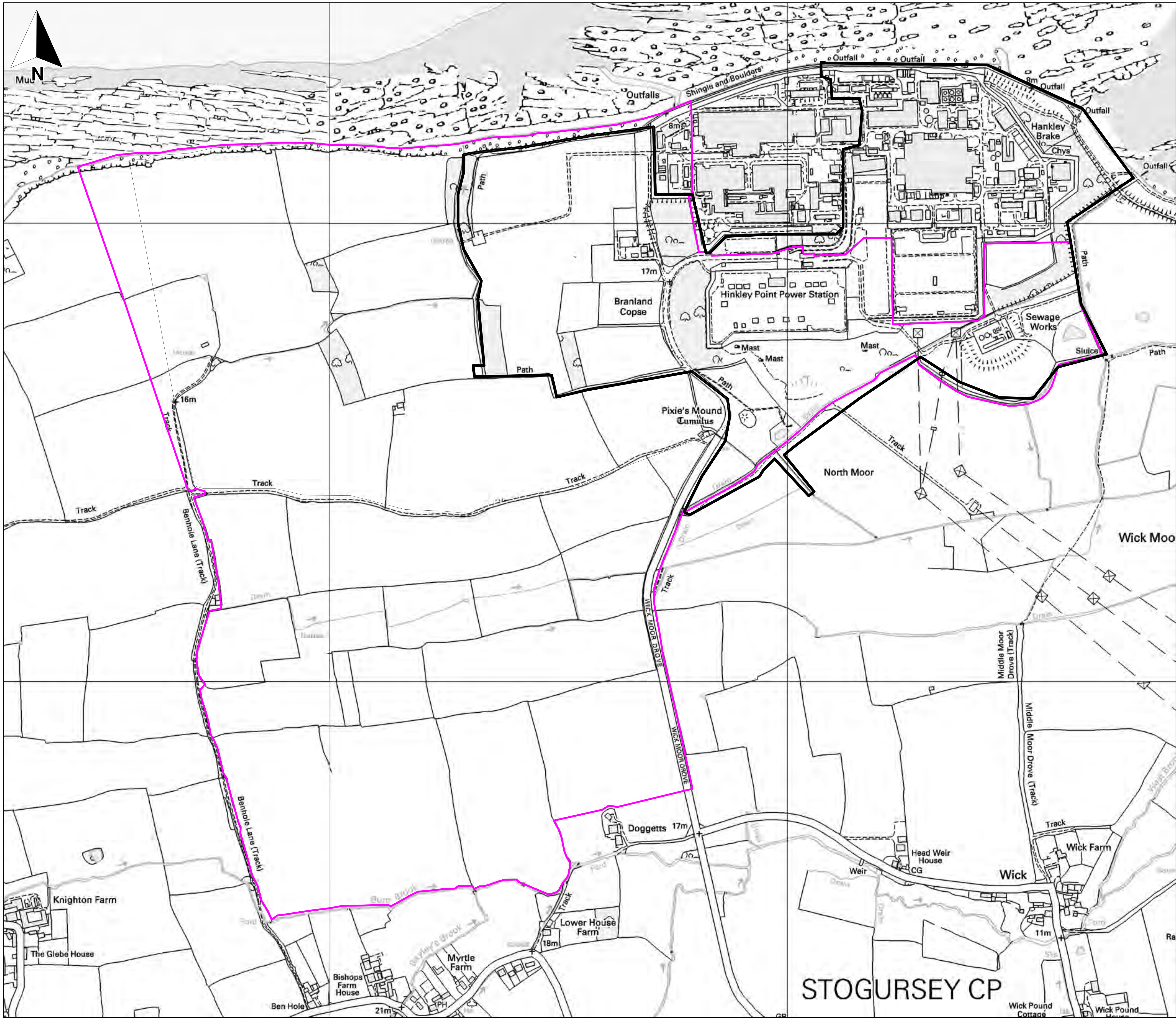
0 m 250 m

Scale 1:8000 @ A3

Hinkley Dormouse Survey Report

Figure 1.1
SSA boundary

September 2009
19801-R117b.wor adamk



Key

SSA boundary

Area 1

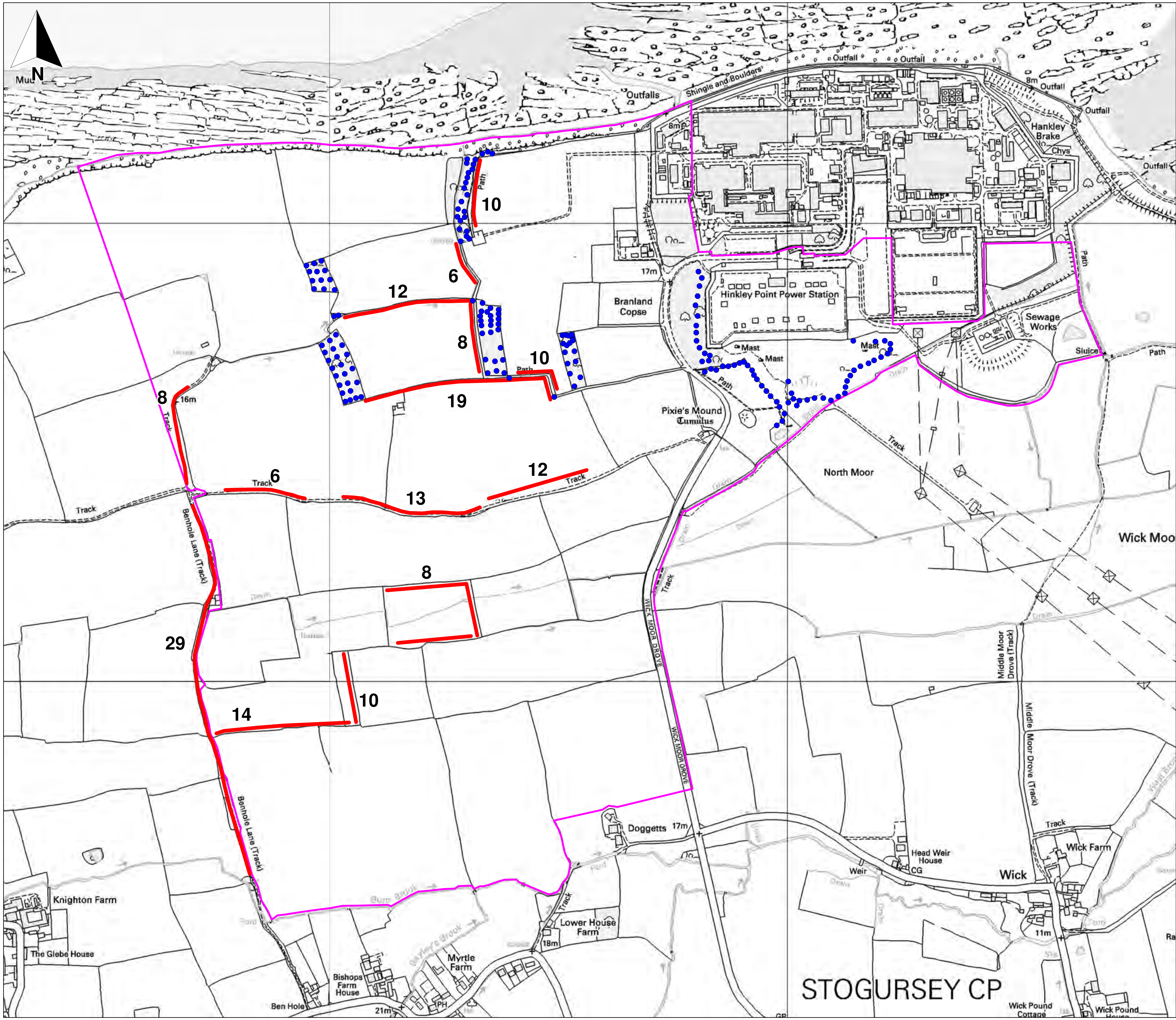
0 m 250 m

Scale 1:8000 @ A3

Hinkley Dormouse Survey Report

Figure 2.1
SSA boundary

September 2009
19801-R457b.wor adamk



Key

- SSA boundary
- Location of Dormouse Tubes
- Distributed dormouse tubes

0 m 250 m

Scale 1:8000 @ A3

EDF

Hinkley Dormouse Survey Report

Figure 2.2
Location of Dormouse Tubes

September 2009
19801-R118b.wor adamk

amec

APPENDIX 20H: HINKLEY OTTER AND WATER VOLE SURVEY REPORT

EDF Energy
Hinkley Water Vole and Otter Survey Report

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as 'Hinkley C') on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, excluding coastal/marine biodiversity other than birds. This report details the results of otter (*Lutra lutra*) and water vole (*Arvicola terrestris*) surveys that were undertaken in 2009. Relevant previous survey work for these species, undertaken in 2007 and 2008, is also summarised.

1.2 Background Information

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. At the time of the otter and water vole surveys that were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1). The boundary of the SSA was therefore used to define the main survey area for the 2009 otter and water vole survey work. In addition, however (as is explained in section 2.2.1), a number of 'off-site' watercourses (i.e. situated outwith the SSA) were surveyed for evidence of the use by otter. As such, the otter and water vole survey area referred to in Chapter 11 of the ES incorporates all water features within the SSA (even though the final 'Construction Boundary' covers a smaller area than the SSA) and, for otter, a number of 'off-site' watercourses.

1.2.2 Site Description

The majority of the land within the SSA is agricultural; comprising 16 arable fields and 16 grassland fields with various levels of agricultural improvement. The fields are primarily bordered by mature hedgerows. Six small broad-leaved woodlands are located within the northern part of the SSA and an area of young broad-leaved plantation has been created in the centre of the SSA, with smaller areas of isolated scrub scattered along the northern boundary and in the eastern parts of the SSA.

Two minor watercourses flow west to east through the SSA. The sources of both watercourses are located near to the western boundary of the SSA. One watercourse is contained entirely within the SSA as it discharges directly to the sea along the northern boundary, whilst the second watercourse joins to the ditches on Wick Moor to the east. Two further watercourses are present along the southern boundary of the SSA. The first is fast flowing (known as the Bum Brook/Bayley's Brook), whilst the second is a more slow flowing ditch along the north edge of Wick Moor.

Three ponds occur within the SSA, all of which are different in characteristics. One waterbody is a shaded field pond that frequently dries up. The other two never dry out and are dominated by common reed.

Hinkley Power Station and the SSA lie on the boundary of two Natural England Natural Areas[1], reflecting the landscape differences to the east and west of the SSA. To the east lies the Somerset Levels and Moors Natural Area, the boundary of which is marked by the 10m contour line and as a result the Natural Area is characterised by freshwater and coastal habitats and associated species (such as otter and water vole). The SSA and the land to the west is part of the Vale of Taunton and Quantock Hills Fringes Natural Area which is characterised by gently undulating countryside and many streams in small floodplains.

2. Methods

2.1 Desk Study

Existing information regarding water vole and otter within the SSA and surrounding land was obtained from the following sources:

- EDF Energy (and British Energy, which became part of EDF Energy in 2009), which has conducted a wide range of ecological surveys of its land holding and employs a conservation warden at Hinkley to help manage its land and undertake biological recording);
- Somerset Environmental Records Centre (SERC);
- the Environmental Statement (ES) for the Decommissioning of Hinkley A (Magnox, 2006);
- the ES for the proposed West Hinkley Wind Farm (Dulas, 2006);
- Environment Agency's Fourth Otter Survey of England and Wales 2000-2002 (Wessex Region);
- the Somerset Otter Group (James Williams);
- communication with the former British Energy Conservation Warden, Jon Burrell; and

[1] A Natural Area is not a designation, but an area of countryside identified by its unique combination of physical attributes, wildlife, land use and culture. These features are considered by Natural England to give a Natural Area a "sense of place" and a distinctive nature conservation character which NE seeks to sustain.

• communication with the current EDF Energy Conservation Warden, Dick Best.

Data from SERC was requested in May 2009 (following an initial request in 2007) to ensure that any additional new records submitted in the intervening period were captured. A search radius of 3km was used for both searches, although the 2009 data request covered a larger area as it was based on the SSA boundary.

2.2 Field Surveys

2.2.1 Survey Area

Strategic Siting Area

Three water vole and two otter surveys were completed within the SSA, although the 2009 work represents the only comprehensive survey of the area and, as such, effectively updates and supersedes the 2007 and 2008 surveys. The locations of the watercourses and waterbodies that were surveyed between 2007 and 2009 are shown on Figure 2. Table 2.1 lists when each water feature has been surveyed and by whom.

Table 2.1 Survey Dates

Survey Date	Water Features Surveyed (refer to Figure 2)								Surveys Undertaken	Survey Personnel
	1	2	3	4	5	6	7	8		
14, 20 and 25 May 2009	✓	✓	✓	✓	✓	✓	✓	✓	Otter and water vole	Entec - Gemma Lee
10 and 11 September 2008	✓						✓	✓	Water vole	AMEC
16 August 2007	✓	✓	✓						Otter and water vole	Entec - Gemma Lee

Three further features were considered by AMEC (AMEC, 2008). However, these have been consistently dry through all the surveys (they have been considered as dry ditches within the Phase 1 habitat survey) and are likely to hold water only very rarely. Therefore, they have been screened out of the survey as being unsuitable for water vole and otter on this basis.

Off-Site Sampling Locations

During the 2009 surveys, a small number of the larger watercourses in the wider area (up to approximately 5km from the site in line with guidance provided in the Design Manual for Roads and Bridges, 2001) that are either connected to those water features on site, that could form good commuting corridors for otters or that had accessible features that could be well used by otter (e.g. bridges) were sampled to determine whether evidence of otter was present. The aim of the sampling was to gain a snapshot of how otter use the land around the site and from this, to draw conclusions as to how otter may use the water features on site. Whilst the sampling was aimed at collecting information on otter, evidence of water vole was also searched for. Table 2.2 lists the sampling locations and the reason for their selection.

Table 2.2 Off-Site Sampling Locations

Location Number	Location Name	Grid Reference	Reason(s) for Selection
1	North of Stolford	ST2245	Confluence of the larger East and West Brooks, which link to Bum Brook/Bayley's Brook.
2	South Brook, Combwich	ST255435	Larger watercourse flowing west to east that connects smaller watercourses closer to the SSA (around Stolford) to the River Parrett.
3	Bum Brook at Honibere Wood	ST182443	Otter known to occur on the Bum Brook. Site selected to investigate whether otter may travel up Brook and cross to the Kilve Brook catchment.
4	Stogursey Brook at Stogursey Lane	ST188208	The Stogursey Brook flows south to north and connects to the Bum Brook just east of the SSA. Site selected to investigate movement of otter from the south of the site.
5	Kilve Brook discharge	ST144443	Potentially suitable (and accessible) location to confirm otters present on Kilve catchment to west of site.
6	Bayley's Brook	ST194430	Historical records from Shurton (to the north). Site selected to investigate otter usage of the Brook (which joins with Bum Brook) to the south of the site.
7	Newnham Bridge	ST207443	Another sampling point of the Stogursey Brook to investigate if otter are travelling north-south to and from the site via this watercourse.

2.2.2 Water Vole Survey Methodology

The water features were surveyed for evidence of water voles following guidance provided in the Water Vole Conservation Handbook (Second Edition: Strachan & Moorhouse, 2006). This included searching for the following:

- Latrines - comprising a concentration of droppings in discrete locations, often near nest sites, at range boundaries or often use places to enter and exit the water;
- Feeding stations - comprising neat piles of chewed lengths of vegetation, usually up to 10cm in length, on pathways or haul-out locations;
- Burrows - these are typically found along the waters edge and on top of the bank (up to 5m from the waters edge) and are 4-8cm in diameter. Holes on top of the banks often have 'lawns' around them (areas of grazed vegetation);
- Footprints - located in soft mud or silt.

All the surveys were undertaken at the correct time of year for detecting water vole presence, i.e. between March and October when water voles are more active and mark home ranges more often (Strachan & Moorhouse, 2006).

2.2.3 Otter Survey Methodology

During the surveys the following signs, indicating the presence of otter, were searched for in the vicinity of the water features (as described in Chanin, 2003):

- spraints - which are often located on prominent features within the channel or on the bank (e.g. bridges, rocks etc); and
- footprints - located in soft mud or silt.

Additional evidence of otter presence such as the remains of dead fish or potential holt or resting up places were also looked for, but these signs can be difficult to attribute to otter rather than other species such as mink (*Neovison vison*).

The potential for holt or resting sites was also considered in more detail during this survey, as well as potential foraging and commuting routes from other watercourses in the surrounding area (particularly from the River Parrett).

The surveys were undertaken at an appropriate time of year as otters are active throughout the year.

2.3 Survey Limitations

Although the surveys have all been undertaken at suitable times of year, the watercourses within the SSA become quickly overgrown in the spring and summer season due to their small size, shallow depth and levels of nutrient enrichment (deriving from agricultural operations). There is therefore some potential for field signs to be missed. However, as both otter and water vole tend to leave signs in prominent areas, and given that in many locations the surveys have been repeated, it is likely that evidence of presence would have been detected.

The sampling of water features outside of the SSA, particularly for otter, was restricted to public footpaths and roads. Therefore, suitable locations to sample were limited. Nonetheless, as otter leave relatively conspicuous signs, it is likely that evidence would be visible on well used watercourses. Evidence of water vole may not have been visible at specific locations unless a large water vole population was present. Equally, fewer signs would be present on watercourses infrequently used by otter.

3. Results

3.1 Desk Study

3.1.1 Water Vole

SERC hold records of water vole to the west of Branland Copse and within Branland Copse, to the north of Pixies Pond (from 1995/1996). These records may relate to a historical pond in the woods, which is no longer present, or a miss quoted Pixies Pond grid reference.

Water vole has been recorded within the SSA (during *ad hoc* surveys by the British Energy Warden), with evidence found at Pixies Pond in 1995 and 2006 (although what type of evidence was not noted). Water vole was also recorded on rhynes to the east of the existing Power Station in 1995. Possible evidence of water vole in this location (latrine and burrow) was also found in autumn 2008 (Dick Best, *pers comm*.).

Table 3.1 Water Vole Records Provided by SERC in 2009

Site/Location	Grid Ref	Date	Approximate Distance and Direction from SSA
Moat at Stogursey Castle, Bridgwater	ST203426	May-93	2km to the south
12a, St Andrews Road, Stogursey	ST2042	Aug-94	1.5km to the south
Pixies Mound Pond	ST210455	Aug-95	Within
Hinkley (west of Branland Copse, not near to water)	ST205458	1995	Within
Hinkley Point East Rhyne	ST216460	1995	Adjacent (to the east)
Shurton Stream	ST201442	1994 - 1995	200m to the south
Hinkley (Branland Copse, possible at historic pond)	ST207458	1996	Within
ST1943SW	ST190430	15-May-00	1.6km to the south-west
ST1943 SW	ST194432	15-May-00	1.3km to the south-west

Beyond the desk study search area to the east lies the Somerset Levels, which are connected to the SSA via rhynes and the River Parrett. The Levels has been recognised by the UK BAP Water Vole Steering Group as a Nationally Key site for water vole. This is due to the extent of connected reed bed present. The area is known to support high numbers of water vole despite the occurrence of mink (Strachan & Moorhouse, 2006).

3.1.2 Otter

Otter signs have been found to the east of the SSA on the rhynes of Wick Moor and around a waterbody (ST216457), predominantly in the winter months by the former British Energy Warden John Burrell. Footprints are the most common sign, although spraints were found in 1999 and 2004. SERC holds records of otter on Wick Moor to the east of the existing Power Station from 1999 (ST217458).

Table 3.2 Otter Records Provided by SERC in 2009

Site/Location	Grid Ref	Date	Approximate Distance and Direction from SSA
Wick	ST2144	22-Aug-82	-
Near Hinkley Point	ST24D	Nov-85	-
Hinkley	ST216458	-1998	Adjacent (to the east)
Hinkley point, Rhynes on North and Wick Moor	ST217458	18-Feb-99 18-Mar-99 27-Apr-99	Adjacent (to the east)
Bridgwater Bay SSSI/Wick Moor	ST207454	11-Feb-03	Within
Catsford Common/Stolford	ST240457	15-Mar-03	2.3km to the east

The 10km grid square in which the SSA is located (ST n/e) was not surveyed as part of the Environment Agency's Fourth Otter Survey (2007). However, results from the adjacent grid squares show many sites have continued to support otter since the last survey and that new sites with confirmed otter presence have been found. Since the last survey in 1991-1994 there has been a 121% increase in the number of sites used by otter in the Wessex region. The report notes that in grid square ST n/e regular surveys by the Somerset Otter Group indicate the local population is strong and that the Wessex region is an important stage in the recolonisation of the Thames catchment from the densely populated areas in Cornwall and Devon.

More detailed information provided directly by James Williams (Somerset Otter Group) regarding the otter population in the wider area, suggests that the local population may be at carrying capacity, as otters are known to occur on all the major watercourses (including the River Parrett and its catchments to the east of the SSA and on smaller catchment watercourses to the west such as those that discharge at Kilve and Wiliton). As a result of this it is likely the local otters use all of the available watercourses (James Williams, *pers comm*.).

3.2 Field Survey

Figure 2 indicates the location of the water features surveyed for water vole and otter within and immediately adjacent to the SSA, and the sampling locations of water features outside this area. Photographs of the areas surveyed are provided in Appendix A.

3.2.1 Strategic Siting Area (SSA)

Watercourse 1

The watercourse issues at ST197456 within the SSA boundary, then flows east, then north through Whitewall Brake (broad-leaved woodland, ST202460) and into the sea at ST202461. It is approximately 1km in length. The banks are steep (up to approximately 80cm tall) from the origin of the watercourse to Whitewall Brake, from where the channel appears to have been re-profiled and the banks are shallower (around a 45^{o} slope). The banks consist of earth throughout. Approximately 70% of the stream bed has a muddy substrate, whilst in Whitewall Brake gravel predominates. The north-eastern section is culverted under a farm track and footpath (for approximately 3m) into Whitewall Brake. This part of the watercourse has sparse bank-side and channel vegetation. The stream exits the wood and percolates through the unconsolidated rocky shore to the sea.

Watercourse 1 tends to have a steady flow of water estimated at ~20-30cm deep during the wetter, winter months. However, sections of the watercourse dry out completely in the summer and autumn, particularly Section 1 before in turns north into Whitewall Brake. The banks support a range of ruderal and marginal species, which quickly shade the water in the summer. Species present include bramble (*Rubus fruticosus* agg.), creeping thistle (*Cirsium arvense*), great willowherb (*Epilobium hirsutum*), nettle (*Urtica dioica*), hemlock (*Conium maculatum*), hemp-agrimony (*Eupatorium cannabinum*), water figwort (*Scrophularia auriculata*) and fool’s water-cress (*Apium nodiflorum*).

- No evidence of water vole or otter presence was seen on this watercourse during the surveys in 2007, 2008 or 2009.

Waterbody 2 (Pixies Pond)

Pixies Pond is ~12m long by ~8m wide. In 2007 common reed (*Phragmites australis*) covered an estimated 75% of the water surface with an area of open water in the centre, but clearance in 2008 reduced the common reed cover to 40%. The banks are reinforced on the northern side and are shallow (~10cm) around the rest of the perimeter. Bulrush (*Typha latifolia*), meadowsweet (*Filipendula ulmaria*), marsh-marigold (*Caltha palustris*) and water mint (*Mentha aquatica*) occur around the edges of the pond. The pond is surrounded by a small strip of grassland and scrub.

- No evidence of water vole or otter presence was seen here during the surveys in 2007 or 2009.

Watercourse 3 (North Moor Ditch)

The watercourse is ~1m wide and has steep, earth banks up to 70cm in height. The bed of the watercourse is predominantly muddy, with vegetated mud platforms at the base of the banks.

Similarly to Watercourse 1, this watercourse has a steady flow. An estimated 70cm of water was present during March 2007, but the western section dries up during the summer. The east section, around the Sewage Treatment Works retains water throughout the year. The banks are approximately 40-50cm tall and comprise earth.

Section 1 of the watercourse (the west section) is bounded on the north side by scrub woodland and the substrate is predominantly decaying leaf litter. The northern bank is approximately 20cm tall and the southern bank is 40-50cm tall. The southern bank supports a wide range of ruderal and grass species including false oat grass (*Arrhenatherum elatius*), purple loosestrife (*Lythrum salicaria*), bramble, nettle, hemlock and fleabane (*Pulicaria dysenterica*). Duckweed (*Lemna minor*) covers approximately 85% of the water surface and water-plantain (*Alisma plantago-aquatica*) also occurs.

Section 2 of the watercourse (the east section) is dominated by common reed and duckweed with few other species present. The banks are ~30cm tall but are often heavily poached by cattle from the adjacent fields.

- Evidence of mammal runs was found on the banks of the ditch in 2007 and 2009. However, it was concluded that these were created by rabbits and / or badgers as they were too large for water vole. No evidence of water vole or otter was seen in this location during the surveys;

- However, in 2009 an old otter spraint was found on a rock at grid reference ST215455 (see Figure 3). This is located adjacent to a small (and predominantly dry) drain that flows into Watercourse 3. The spraint was located on a rock just before the drain is culverted, by a field gate.

Watercourse 4

Watercourse 4 is approximately 1km in length and flows west to east across the centre of the SSA before joining with the drains on Wick Moor underneath the Power Station entrance road. The watercourse is between 0.5 and 1m wide and varies in depth between 0.2 and 1m.

Section 1 of the watercourse appears to be dry most years and possibly only holds water in very heavy and prolonged rain. The ditch here supports grasses and ruderals.

Section 2 of the watercourse is located within the centre of improved grassland field grazed by cattle. Because of this, the banks are very poached and disturbed and support a limited range of species, with small amounts of hard rush (*Juncus inflexus*), false fox-sedge (*Carex otrubae*), creeping buttercup (*Ranunculus repens*), cocksfoot (*Dactylis glomerata*), fool's-watercress and brooklime (*Veronica beccabunga*) present. The base of the watercourse in this section is silt and mud, which combined with the cattle disturbance, results in limited water clarity. This section of the watercourse dried out significantly between May 2009 and July 2009, such that it no longer flowed and only pools of water were present.

In Section 3 the watercourse forms a boundary between the fields north and south of it. These are also grazed by cattle but at present the poaching is less severe. This section also appears to have been dredged in 2007 or 2008 with the arisings left on the adjacent banks (which are characterised by a ruderal community). The watercourse in Section 3 is bounded by dense hedgerow west of the road which becomes a line of scrub towards Section 2. Vegetation beneath the hedgerow is sparse and the earth at the base is compacted. The bank underneath the hedge is approximately 20cm tall. The bank opposite the hedgerow is generally species-rich, supporting a range of ruderals and grasses including meadowsweet, hard rush, reed sweet-grass (*Glyceria maxima*), false oat-grass and hemlock water-dropwort (*Oenanthe crocata*). Within the channel common reed is locally dominant and patches of starwort (*Callitriche stagnalis*) and water crowfoot (*Ranunculus aquatilis*) occur.

- No evidence of water vole or otter presence was seen here during the surveys in 2009.

Watercourse 5 (Bum Brook & Bayley's Brook)

Approximately 800m of Watercourse 5 was surveyed (the section adjacent to the SSA southern boundary), although the watercourse itself is longer and comprises a combination of Bum Brook and Bayley's Brook which converge within the survey area. Watercourse 5 varies in width and depth but along most of the area surveyed is approximately 1m wide and 30-50cm deep.

Section 1 of Watercourse 5 flows east from Pond 8 (Hinkley Great Crested Newt Report, Entec, 2009) located on Benhole Lane, forming a field boundary between arable and pasture fields. The watercourse is very shaded in this section due to the extensive bank vegetation, which includes bramble, nettle, Himalayan balsam (*Impatiens glandulifera*) and great willowherb with overhanging semi-mature crack-willow (*Salix fragilis*) trees. The banks comprise earth in this location and are ~10cm tall. The water clarity is poor, but the flow is fairly fast. At the east end of Section 1 Bum Brook joins Bayley's Brook underneath a concrete footbridge.

The banks within Section 2 of Watercourse 5 do not support trees and scrub: they are vegetated by rough grassland and hence this section is not shaded. The banks are taller in this Section, being between 50 and 70cm tall, and are a mixture of earth and stone. One bend in the watercourse has been reinforced with a stone wall. The water flow in this Section continues to be fairly fast and the water clarity is good. The base substrate is a mixture of silt and pebbles. Species recorded on the banks include cow parsley (*Anthriscus sylvestris*) and hemlock water-dropwort. Branched bur-reed (*Sparganium erectum*) and fools water-cress occur within the channel.

The west part of Section 3 is very similar to that of Section 2. The east part becomes more shaded as a hedgerow is present on the southern side of the watercourse.

- Evidence of use by otter was found in three locations along Watercourse 5 in 2009 (see Figure 3):
    - Point A - a relatively well used sprainting site is present on a rock within the channel. At the time of the 2009 survey one recent and two older spraints were present;
    - Point B - a further sprainting site was found, also on a prominent rock in the centre of the watercourse. Again, one recent spraint was present, with evidence of older spraints;
    - Point C - a small and old spraint on a rock at the western edge of the reinforced bank.
- No evidence of water vole was found. Small mammal latrines were found but these did not appear to have been from water vole due to their small size.

Waterbody 6

Waterbody 6 is a large pond (~15m x 15m) that is approximately 60% vegetated by common reed with only 40% of the pond surface being open water. Plant species diversity is limited due to the dominance of common reed with small amounts of bittersweet (*Solanum dulcamara*) and great willowherb present. The waterbody is in excess of 1m deep (actual depth could not be determined due to unsafe access around the majority of the pond margins) and the water clarity is poor. The pond has very shallow margins around the edges without proper banks.

- No evidence of water vole or otter presence was seen here during the surveys during 2009.

Waterbody 7

Waterbody 7 is located within a hedgerow boundary adjacent to an arable field. The pond has a mixture of willow and hawthorn (*Crataegus monogyna*) growing in the centre, the bases of which are currently submerged, but this may suggest the pond is prone to drying out regularly. There are very few aquatic or marginal broad-leaved plants and although there are areas of open water the pond has 90% shading from the surrounding scrub and hedgerows. The pond is approximately 20m by 8m in size.

- No evidence of water vole or otter presence was seen here during the surveys in 2008 and 2009.

Watercourse 8

Watercourse 8 comprises a ditch, approximately 850m in length, with an adjacent mature hedgerow to the south. Ruderal vegetation is extensive within the base of the ditch suggesting that it does not hold water with regularity. This is confirmed by the surveys as in autumn 2008 only a small amount of water was present in the base of the ditch and in was completely dry in May 2009.

- No evidence of water vole or otter presence was seen here during the surveys in 2008 or 2009.

3.2.2 Sampling Locations

The results of the otter and water vole surveys at the sampling locations are provided in Table 3.3.

Table 3.3 Results of Off-Site Sampling Surveys

Location	Brief Description	Results
1	The watercourses in this area have a steady flow and are located in steep sided ditches. Stock poaching occurs in some locations. The banks are generally un-mown and species-diverse. The water levels are controlled by sluice gates and several stone bridges cross the ditches.	Probable otter spraint present at the Environment Agency's Great Arch compound, ST228459 (access to confirm was not available). No other signs.
2	The South Brook is a fairly fast flowing, deep watercourse with steep tall banks (~1m tall). The banks are un-mown and support a diverse range of tall grasses and herbs.	No evidence found.
3	The Bum Brook is fast flowing in this location and ~60cm in width. At the survey location the Brook flows underneath a stone bridge and is joined by a south-north drain flowing along the edge of Honibere Wood. Stones are present within the channel.	Probable otter footprints were observed in soft mud underneath the stone bridge (restricted access prevented confirmation). No other signs.
4	The Stogursey Brook is fast flowing and approximately 1m wide. The banks are shallow in this location and the base of the watercourse is a mixture of silt and stone. The watercourse has some rough bankside vegetation and overhanging trees, although the north bank is grazed.	Otter spraint present on large rock ~5m east of the road bridge at the confluence of the Stogursey Brook and minor stream. Several spraints of varying age were present. No other signs.
5	At the survey location the Kilve Brook is fast flowing over a rocky substrate, but is heavily shaded by the adjacent trees and scrub. It is approximately 2m wide and discharges into a large pool just above the high tide mark. A well used car park is present at this location and the Brook is quite disturbed here.	No evidence found.
6	No access was possible. Vegetation obscured the view of the Brook in this location.	-

Location	Brief Description	Results
7	The watercourse here has a steady flow over a mixture of silt and rocks. The banks are fairly steep (~60cm tall) and well vegetated with rough grasses and herbs. Scattered rocks protrude from the water surface. Upstream of the bridge the watercourse is shaded adjacent to a track and garden.	No evidence found.

4. Conclusions

4.1 Water Vole

No evidence of water vole has been found during any of the surveys of the water features during 2007, 2008 or 2009.

Watercourses 1, 4 and 8, and Waterbody 7, are generally shallow (or dry) and often shaded or disturbed by stock. In most locations they also lack wide densely vegetated banks, whilst the watercourses are narrow in width. Whilst these habitat features do not preclude the presence of water vole, deep, quite wide watercourses (at least 1m) and slow flowing water which is not shaded seem to be features more favoured by this species in lowland Britain. Wide vegetated margins and in-channel vegetation are also important for water vole, providing both cover and food (Strachan & Moorhouse, 2006). Therefore, the water features within the site do not provide optimum habitat, which reduces the potential for water vole to occur.

Watercourses 3 and 5, and Waterbodies 2 and 6, have higher potential to be used by water vole as they are slow flowing and often less shaded, with species-diverse banks (which provide potential foraging habitat) which in some places extend several meters from the channel. The watercourses adjacent to the SSA are also better connected to the wider ditch and watercourse network to the east and south, but they provide limited opportunity for movement to the west of the site (i.e. Bum Brook does not connect directly to watercourses to the west).

Nonetheless, the desk study records clearly indicate that water vole do occasionally occur at Pixies Pond (within the SSA) and on water features adjacent and within 3km of the SSA boundary. The irregular records of water vole in these locations could be due to irregular survey effort. However, it seems more likely that the watercourses within the survey area have either:

- not been fully colonised by water vole from the River Parrett catchment and the occasional records relate to dispersing pioneer individuals; or
- have been previously colonised by water vole, but that the population is now absent (e.g. through mink predation), as small populations of water vole are vulnerable to extinction (Strachan & Moorhouse, 2006).

Therefore, as the water features adjacent to the site are hydrologically connected to further areas of suitable water vole habitat to the east and south (e.g. the River Parrett) and provide reasonably suitable habitat themselves, there is moderate potential that water vole could occur on these features in the future. However, given the short lengths of the watercourses within the SSA, their relatively isolated position from the many rhynes to the east of the site and the lack of further connectivity to the west (as all originate within the site), it is concluded that there is only limited potential for water vole to occur on or to colonise Watercourses 1, 4 and 8 and Waterbody 7, even if present nearby.

4.2 Otter

No evidence of otter presence was found within the SSA during any of the surveys. During the 2009 surveys evidence of otter activity was, however, recorded on the Bum Brook/Bayley's Brook adjacent to the southern boundary of the SSA and also on a drain to the south-east of the SSA. Otter presence was also recorded on watercourses that are hydrologically linked to those adjacent to the SSA, located to the west, south and east.

Based on the desk study results, it is unsurprising that otter appear to use most, if not all, of the watercourses around the SSA. Whilst none of the water features surveyed adjacent to the site and in the wider area are particularly large (i.e. could be classed as rivers), all are well connected to further watercourses and areas of wetland habitat. Therefore, they provide ideal commuting corridors. In addition, the faster flowing and larger streams surveyed (e.g. Bum Brook and Stogursey Brook) are likely to support good populations of fish and are therefore likely to be important for foraging as well as commuting.

Although otters will readily travel over land between catchments, the watercourses within the SSA are particularly poorly connected to catchments to the west. Therefore, it is unlikely an otter would use Watercourse 1, 4 or 8 to travel east to west when the Bum Brook provides a greater length of watercourse (which is also well vegetated) and therefore reduces the distance of terrestrial travel to reach the Lilstock/Kilve watercourses to the west. In addition, the smaller partly seasonal water features within the site are unlikely to provide enough resources (such as fish and amphibians) to be used extensively throughout the year.

All the water features surveyed are predominantly undisturbed by human activity and have areas of dense vegetation adjacent which may be suitable be used for as couches[2], although given the ephemeral nature of the watercourses within the site and their limited connectivity to larger watercourses this is unlikely. Given the likely limited resources associated within the water features within the SSA boundary, these are unlikely to be favoured locations for natal holt sites, which tend to be located in close proximity to the most productive areas of the home range. The Bum Brook/Bayley's Brook has greater potential to support a natal holt, although adjacent to the site it is relatively small and shallow and fish are unlikely to be abundant.

It is therefore considered that the water features within the SSA offer limited commuting, foraging or resting/breeding opportunities for otter due to their relatively isolated location and small size and that there is low potential for them to be utilised frequently by otter. The watercourses adjacent to the site (and in the wider area) provide better habitat for otter and are clearly used preferentially (and probably more regularly, given the resources available) by otter to those within the site.

[2] Couches differ from holts by being above ground, often comprising only trampled vegetation. Some couches, in favoured locations, can be re-used regularly, although many are temporary day-time resting places (Chanin, 2003).

5. References

AMEC (2008) Ecological Survey Report – Water Voles.

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Entec (2009) Hinkley Great Crested Newt Report.

Environment Agency (2007) Fourth Otter Survey of England 2000-2002.

Highways Agency (2001) Design Manual for Roads and Bridges – Volume 10, Section 4, Part 4 Nature Conservation Advice in Relation to Otters.

Strachan, R. & Moorhouse, T. (2006) Water Vole Conservation Handbook. Second Edition. WCRU.

Report template changed for consistency reasons but no other changes have been made since the original issue date.

Appendix A
Selected Water Course Photographs

Photo 1: Water feature 3 (north of Wick Moor) in winter

Photo 2: Water feature 2 – Pixies Pond in winter

Photo 3: Channel of water feature 3 showing dense duckweed

Photo 4: Water feature 1, within Whitewall Brake

Photo 5: Water feature 1 to the west of Whitewall Brake during the summer showing the dense vegetation cover

Photo 6: Water feature 1 within Whitewall Brake

Photo 7: Bum Brook eastern section

Photo 8: Bum Brook western section

Photo 9: Bum Brook channel detail

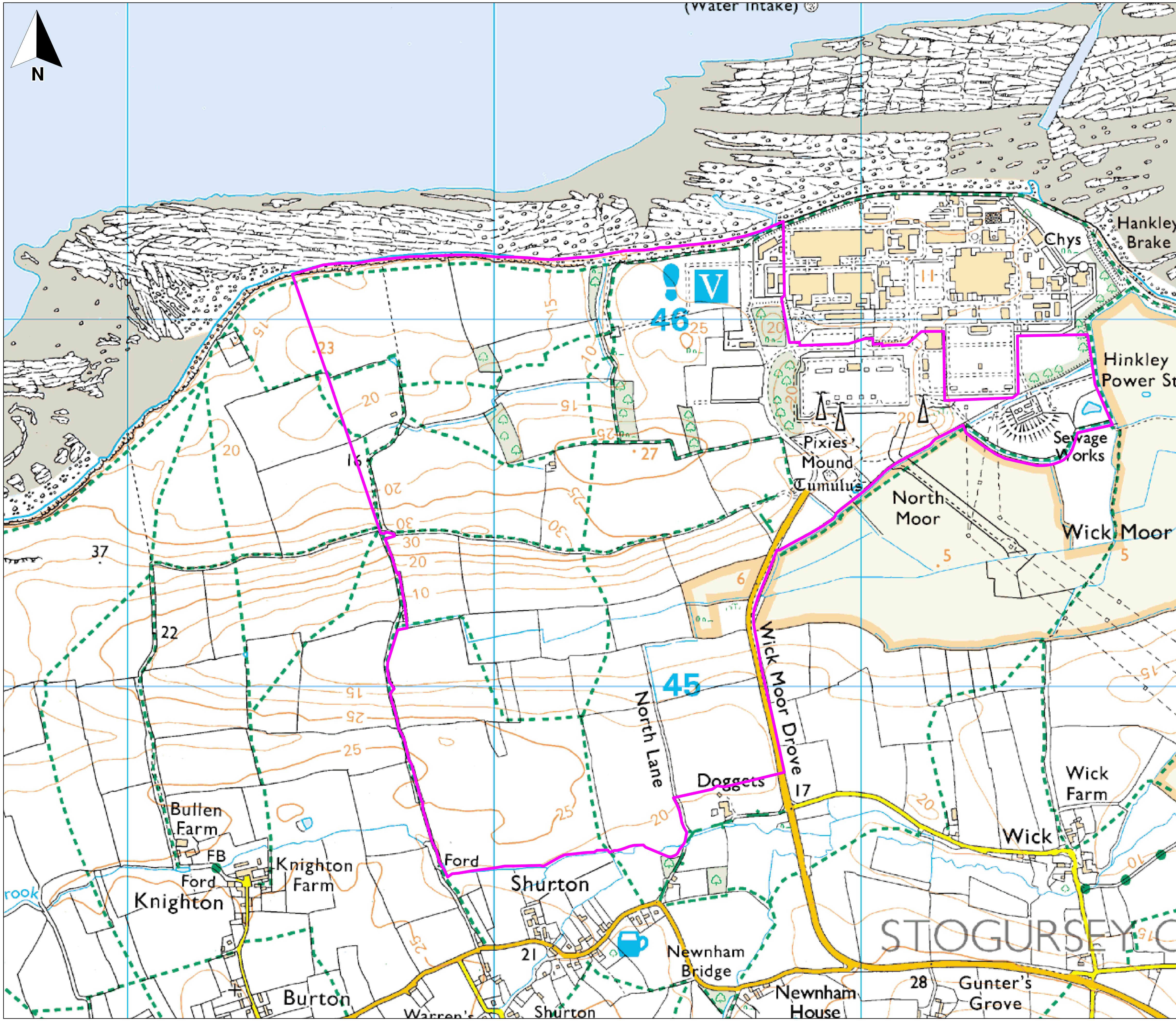
Photo 10: Central Watercourse (Hinkley Point C Drainage Ditch) eastern section

Photo 11: Central Watercourse western section

Photo 12: Central Watercourse centre section

Photo 13: Central Watercourse centre section

Photo 14: Central Watercourse channel detail



Key

SSA boundary

0 m 500 m

Scale 1:10,000 @ A3

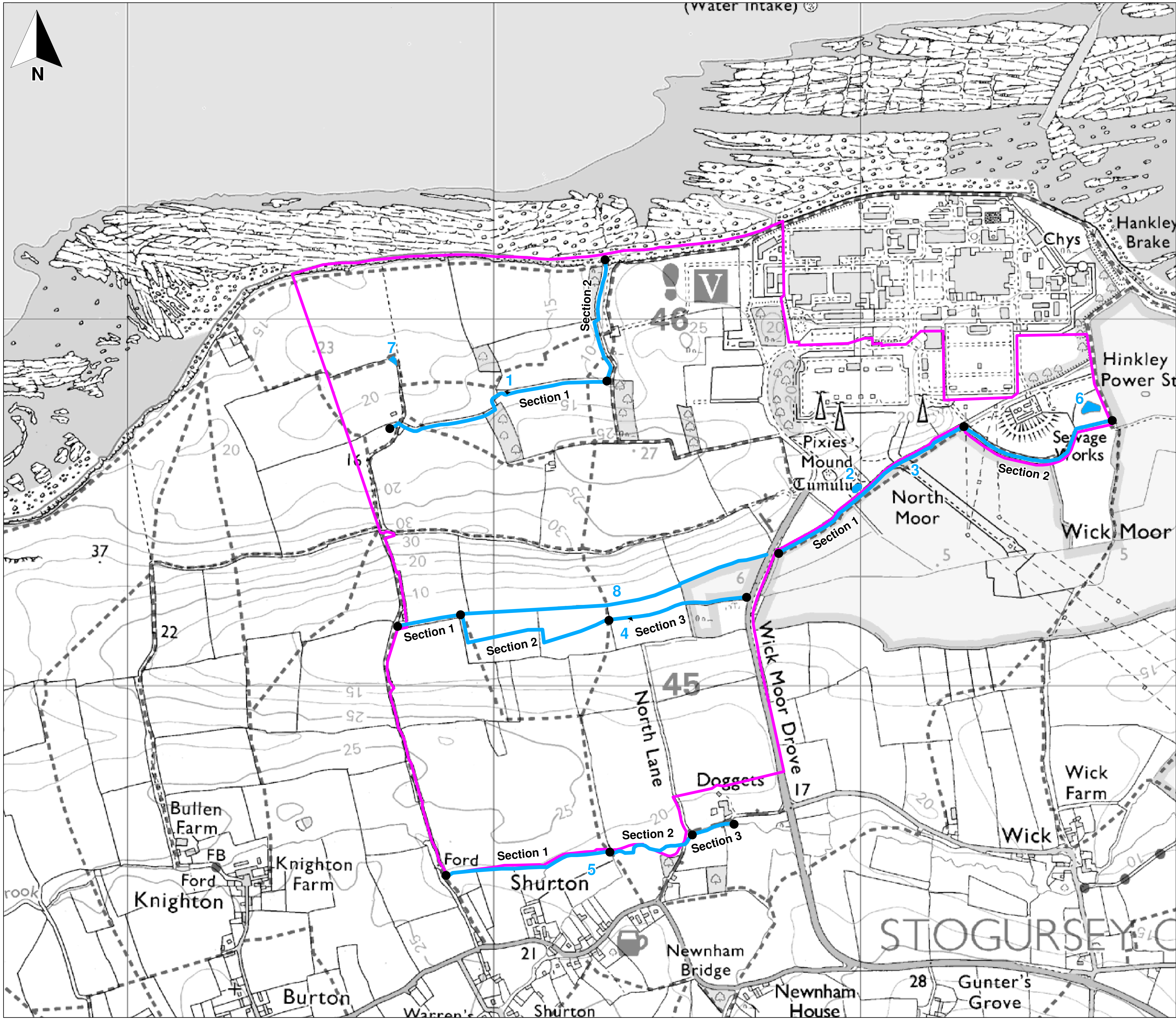
EDF

Hinkley Otter and Water Vole Survey Report

Figure 1
SSA Boundary

September 2010
19801-R374c.wor adamk

amec



Key

- SSA Boundary
- Water Features Surveyed and Reference
- Beginning and end of sections described in the text

0 m 500 m
Scale 1:10,000 @ A3

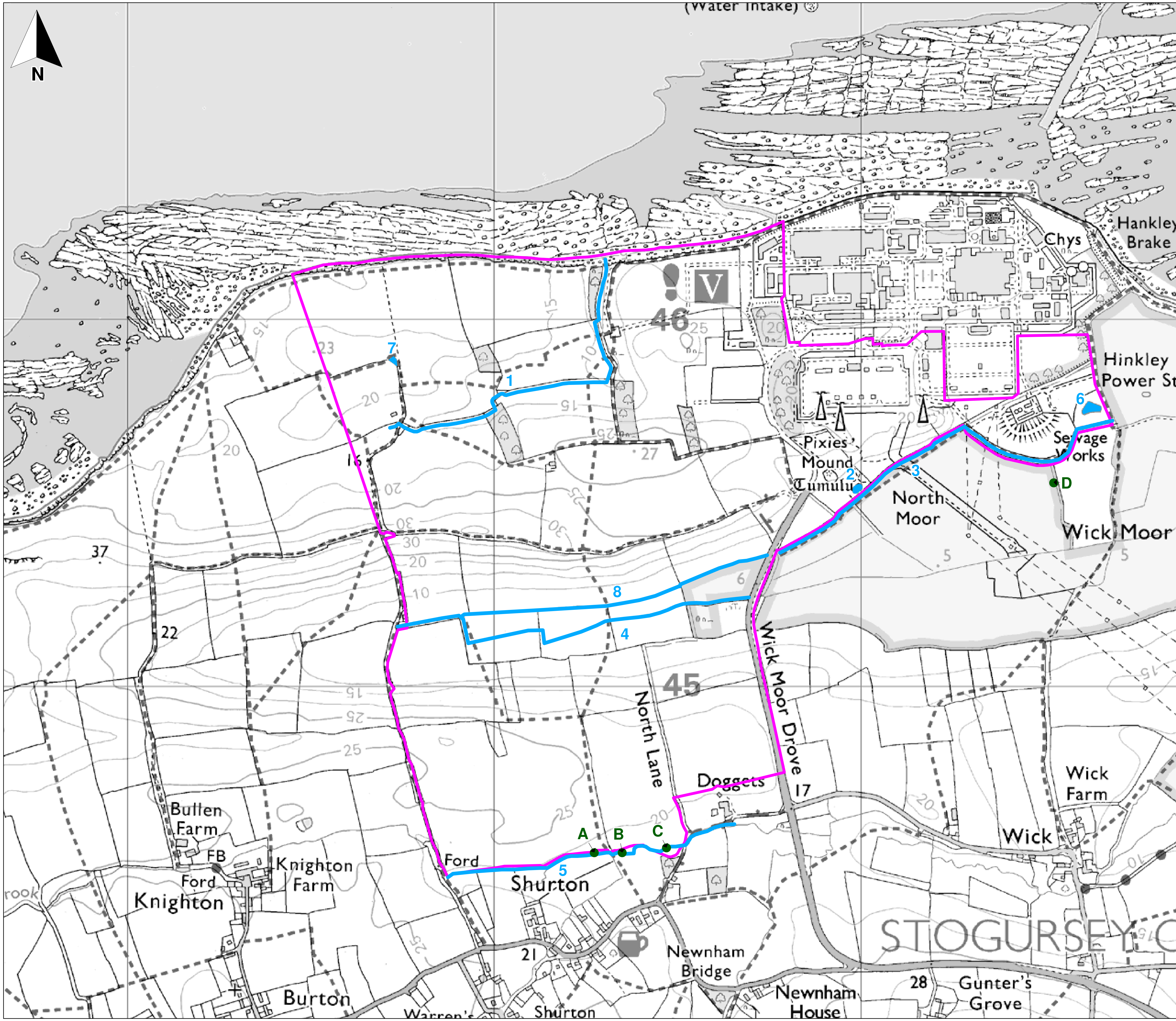
EDF

Hinkley Otter and Water Vole Survey Report

Figure 2
Location of Water Features Surveyed

September 2010
19801-R375c.wor adamk

amec



Key

SSA Boundary

Water Features Surveyed and Reference

A - D Location of Otter signs

0 m 500 m

Scale 1:10,000 @ A3

Hinkley Otter and Water Vole Survey Report

Figure 3
Location of Otter Presence Evidence

September 2010
19801-R376c.wor adamk

APPENDIX 20I: HINKLEY GREAT CRESTED NEWTS SURVEY REPORT

EDF Energy
Hinkley Great Crested Newt Survey Report

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as 'Hinkley C') on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, excluding coastal/marine biodiversity other than birds. This report details the results of great crested newt (*Triturus cristatus*) surveys that were conducted in 2009 in order to inform the assessment.

1.2 Background Information

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. At the time of the great crested newt surveys that were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1). The SSA includes all of the land within the final 'Construction Boundary'.

The survey area for the 2009 great crested newt surveys (which effectively updated and superseded surveys that were undertaken in 2007 and 2008) incorporates all water bodies within the SSA or within 500m buffer of its boundary[1].

1.2.2 Site Description

The majority of the land within the SSA is agricultural; comprising 16 arable fields and 16 grassland fields with various levels of agricultural improvement. The fields are primarily bordered by mature hedgerows. Six small broad-leaved woodlands are located within the

[1] English Nature's (now Natural England's) Great Crested Newt Mitigation Guidelines (2001), state that, in the absence of significant barriers to movement (e.g. major roads, residential areas etc.), 500m is the maximum distance that GCNs are likely to travel from their breeding ponds to utilise terrestrial habitat. It is therefore possible that GCNs from water bodies within 500m of the SSA boundary may occur within the SSA and it is for this reason that the survey area was extended 500m from the SSA.

northern part of the SSA and an area of young broad-leaved plantation has been created in the centre of the SSA, with smaller areas of isolated scrub scattered along the northern boundary and in the eastern parts of the SSA. Two watercourses flow west to east through the SSA (further seasonal ditches also occur) and a further watercourse is present on the southern boundary of the SSA. Three ponds occur within the SSA and in the wider context; there are seven ponds within 500m of the site boundary. These are mainly relict agricultural ponds which are small in size, shallow, and unmanaged.

2. Methods

2.1 Desk Study

Existing information regarding newts within the SSA and surrounding land was obtained from the following sources:

- EDF Energy (and British Energy, which is now part of EDF Energy) has conducted a wide range of ecological surveys of its land holding and employs a conservation warden at Hinkley to help manage its land and undertake biological recording);
- communication with the former conservation warden, Jon Burrell;
- Somerset Environmental Records Centre (SERC);
- the Environmental Statement (ES) for the Decommissioning of Hinkley A (Magnox, 2006); and
- the ES for the proposed West Hinkley Wind Farm (Dulas, 2006).

Data from SERC was requested in May 2009 (following an initial request in 2007) to ensure that any additional new records submitted in the intervening period were captured. A search area of 3km was used for both searches, although the 2009 data request was based on the larger SSA boundary.

In addition to the data collected from consultees, the 1:10,000 OS map of the area was used to identify water bodies within the SSA and up to approximately 500m from this boundary in both 2007 and 2009.

2.2 Field Surveys

2.2.1 Screening

Five ponds were visited during the 2007 survey and screened using the criteria below. In 2009, all 12 ponds identified during the desk study as being within approximately 500m of the SSA boundary were visited, or revisited, on the 23 April 2009 to determine if they still existed and if they were likely to support great crested newts. The 2009 survey made use of the criteria below, but also incorporated the Habitat Suitability Index (HSI) developed by Oldham *et al*

(2000), which provides a score of the suitability of a pond to support great crested newts and is a recognised tool for highlighting ponds with greatest potential to support this species.

Key features, additional to the HSI assessment, that were considered in the screening exercise included:

- receiving discharge of pollutants at excessive levels or containing anoxic waters;
- insufficient aquatic vegetation or other material that could be used for egg laying;
- extreme levels of fish activity (e.g. an intensively managed fishing lake) or waterfowl activity (where the number of waterfowl present exceeds 10 per $1000m^2$ [Oldham *et al* 2000]);
- links to fast flowing streams, or the presence of an extreme management regime; and
- the lack of suitable connecting features e.g. mature hedgerows, ditches or woodland between the pond and the site that newts could follow or a significant barrier to movement between the pond and the development area.

2.2.2 Presence/Absence

In 2009, presence/absence surveys were carried out at any pond that was considered suitable for newts following screening (and where access was available). Each pond was visited four times (the survey dates are provided in Appendix C), during suitable weather conditions,[2] within the optimum survey period[3] and during which up to three methods of surveying where employed. These were:

- <u>Bottle-trapping</u> - bottle traps made from two-litre polyethylene type bottles were secured to the substrate using a bamboo cane attached through two holes within the plastic bottle. The traps were set at regular intervals around accessible areas of the pond margins. Upon installation, each bottle trap included an air bubble to prevent newts suffocating. The traps were set each evening between 19:30 and 21:30 hours and retrieved between 06:00 and 08:00 hours the following morning;
- <u>Torch-light surveying</u> (using an adequately powerful torch);
- <u>Egg search</u> - marginal aquatic macrophytes were inspected for the presence of great crested newt eggs.

Sweep netting is an additional method that can be used to investigate the presence of newts in a pond. However, this method would have been too destructive at the site given the generally high amount of aquatic vegetation present in the ponds surveyed.

For Pond 1, the 2009 surveys updated a presence/absence survey carried out in spring 2007. The same methodology was employed for both the 2007 and 2009 surveys.

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[2] As defined in the Great Crested Newt Mitigation Guidelines (English Nature, 2001).

[3] Between mid-March and mid-June (as per the Great Crested Newt Mitigation Guidelines [English Nature, 2001])

2.3 Personnel

The 2007 surveys, pond screening exercise in 2007 and 2009 and first survey event of 2009 were conducted by Entec Ecologist Gemma Lee (Natural England Licence No. 20090830). The final three survey events of 2009 were carried out by Entec Ecologist Caroline Chipperfield (Natural England Licence No. 20092063).

3. Results

3.1 Desk Study

Table 3.1 summarises the great crested newt records provided by SERC.

Table 3.1 Great Crested Newt Records provided by SERC in 2009

Date (s)	Grid Reference	Description of Location	Approximate Distance and Direction from SSA
1993-1994, 1995, 1996	ST207458	The north-west corner of Branland copse and the edge of car park (may relate to a now defunct pond in the wood - see below)	Within SSA boundary
1995	ST210455	Pixies Pond	Within SSA boundary
1995	ST210455	Drain east of Pixies Pond	Within SSA boundary
1995	ST232453	Fields to the east of Stolford	1.6km south-east
1995 (3 records)	ST245452	Fields to the east of Stolford	2.8km south-east

Whilst there are historical records of a pond within Branland Copse, there was no standing water within woodland during the field survey. Within the central western part of the wood (ST207457) is a small ditch system (~10m in length and up to 4m wide), which may have previously held water continuously, however at present, the ditches only contain a small amount of water (~10cm) during the winter and is dry from spring onwards.

Pixies Pond was created in 1992-1993 and supported all three British species of newt; smooth, palmate and great crested (Burrell, 2005). When the pond was first created it contained abundant stonewort, which is a good egg laying plant for newts. However, the pond has been steadily colonised by common reed (*Phragmites australis*), reducing the amount of open water area present. Stickleback fish, which prey on the eggs and larvae of newts, were also introduced to the pond after it was created. These are now present in large numbers. Since 1993 the number of newts recorded within the pond has declined, with only smooth newts noted in more recent years.

In the wider area, there are populations of great crested newt known to occur to the east of the Power Station, around Stolford approximately 2km away (SERC records and John Burrell, *pers. comm.*). Given the network of rhynes within the moors between Stolford and Hinkley, it is possible great crested newt have previously colonised the ponds around the Power Stations via these drainage channels. However, newt eggs can also be transferred between ponds on the feet of wildfowl and therefore it is possible the great crested newts that were present could have originated from further away.

Five ponds were identified from the OS map as being within the SSA boundary with seven further ponds within 500m. Therefore a total of 12 ponds were subject to the screening assessment.

3.2 Screening Assessment

The HSI score for each pond subject to screening in 2009 is shown in Table 3.2. A full breakdown is shown in Appendix B. Table 3.2 also provides a brief description of each pond, highlights whether the ponds were then screened into the surveys or not and outlines the reasoning behind this. The locations of the ponds screened are illustrated in Figure 2.

Photographs of each pond are contained in Appendix A.

The categorisation of HSI scores are as follows:

- <0.5 Poor;
- 0.5-0.59 Below average;
- 0.6-0.69 Average;
- 0.7-0.79 Good; and
- >0.8 Excellent.

Note that Oldham *et al* (2000) states that the lowest HSI score obtained from a pond known to support breeding great crested newts is 0.43.

Table 3.2 Pond Descriptions and Results of Screening

Pond Number	Description	Distance from SSA Boundary	HSI Score	Screening Decision
1 (Pixies Pond)	Common reed covers approximately 30 % of the water surface with blanket weed (*Spirogyra adnate*) present in the remaining area of open water. Bulrush (*Typha latifolia*), marsh-marigold (*Caltha palustris*), meadowsweet (*Filipendula ulmaria*) and water mint (*Mentha aquatica*) also occur around the margins of the pond. Bramble (*Rubus fruticosus agg*.), hawthorn (*Crataegus monogyna*)	Within the SSA boundary	0.42 (poor)	**Screened in.** This pond has supported great crested newt in the past (last recorded 1993) and provides some limited areas of suitable habitat with open water and suitable egg laying media. No great crested newts were recorded in the presence/ absence survey in 2007. HSI score reflects the current deteriorated state of the pond.

Pond Number	Description	Distance from SSA Boundary	HSI Score	Screening Decision
	and blackthorn (*Prunus spinosa*) are present around the edges of the pond. The pond is relatively deep (over 50cm) and approximately 10m x10m in size.			
2	A relatively large water body (~15m by 15m), dominated by common reed around the entire edge of the pond with a small area of open water in the centre. Crack-willow (*Salix fragilis*) trees and blackthorn and bramble scrub occur around the edges, with great willowherb (*Epilobium hirsutum*) common in the vicinity. The pond is of unknown depth. It is frequented by ducks and swans.	Within the SSA boundary	0.38 (poor)	**Screened in**. Surveys were conducted at the pond in 2006 (for the Hinkley A decommissioning ES) with no newts of any species recorded and the HSI score is poor. However the pond is within the SSA and located between Pond 1 and historic records of great crested newt around Stolford.
3	The pond is located adjacent to a hedgerow and at the corner of an arable field. The pond has a mixture of willow and hawthorn growing in the centre, the bases of which are currently submerged, but this may suggest the pond is prone to drying out regularly. There are very few aquatic or marginal broad-leaved plants and although there are areas of open water the pond has 90% shading from the surrounding scrub and hedgerows. The pond is approximately 20m by 8m in size.	Within the SSA boundary	0.53 (below average)	**Screened in.** Although there is potential for the pond to dry out, this can favour newts by removing the fish population, which is reflected in the HSI score. Also, it lies within the SSA and therefore affects on the pond as a result of the development could be greater.
4	A small (~10m by 4m), quite shallow water body (between 0.5 and 1m), the surface of which is 100% covered in floating grasses and algae. The pond lies at the edge of an arable field with approximately 10% shading, and is adjacent to a species-poor hedgerow.	80m to the east	0.54 (below average)	**Screened in.** Although there is potential for the pond to dry out, this can favour newts by removing the fish population which is reflected in the HSI score. Also, the vegetation would provide suitable egg laying media. Hedgerow connection to SSA boundary.
5	This water body is quite small (~8m by 4m) and connected to a drain. The pond was dry.	387m to the west	0.4 (poor)	**Screened out.** The pond is likely to remain dry for the remainder of the season.
6	A small pond (~10 by 10m), fairly deep (approximately 1m), with 100% aquatic vegetation cover and 50% macrophyte cover. The pond is located in the middle of a cattle field with no shading. Ducks observed using the pond.	120m to the east	0.59 (below average)	**Screened in.** The pond is within 500m of the SSA boundary and is a suitable pond, as reflected by its HSI score, for newts. It supports an abundance of egg laying media and is bordered by habitat which could support newts in their terrestrial phase. The pond is also located between Pond 1 and historic records of great crested newt around Stolford to the east.

Pond Number	Description	Distance from SSA Boundary	HSI Score	Screening Decision
7	A fairly large pond (~20 by 20m), possibly an old quarry, with 95% duckweed cover and 10% shading. The pond has very steep sides with dense vegetation.	335m to the west	0.67 (average)	**Screened in.** The pond is within 500m of the SSA boundary and is a suitable pond for newts, as reflected by its HSI score. It supports an abundance of egg laying media and is immediately bordered by good habitat (with further good habitat within 250m) which could support newts in their terrestrial phase. Although 335m distant, the pond is reasonably well connected to the SSA via intact hedgerows.
8	The pond (~30m by 10m) is effectively the pooling of a watercourse at the end of a ford and therefore likely to be occasionally disturbed by vehicles. The base of the pond is stone, there is 10% shading and 10% macrophyte cover.	Within the SSA boundary	0.46 (poor)	**Screened in.** Whilst it appears that vehicles do cross the ford/pond, this is likely to be restricted to the occasional agricultural vehicle, and it is a large enough water body that parts of it are left undisturbed by these activities. Although the HSI score is low, some residual potential remains for it to support great crested newts.
9	The pond is not present. In this location a small watercourse is present with no significant pooling.	Within the SSA boundary	Pond no longer present	**Screened out.**
10	A small (~10m by 4m), but dry pond with approximately 10% shading, adjacent to a species-poor hedgerow.	290m to the east	0.52 (below average)	**Screened out.** The pond is likely to remain dry for the remainder of the season.
11	A small field pond, approximately 5m by 5m, with poor water quality, 100% shading and no macrophytes.	300m to the south east	0.4 (poor)	**Screened in.** The pond is within 500m of the SSA boundary and has some limited potential to support great crested newt should a source population be present in nearby ponds. There is hedgerow connection to SSA boundary.
12	A private small garden pond, 5m by 5m at the most, supporting 90% -100% macrophyte cover.	450m to the south	0.57 (below average)	**Screened out.** The pond is approximately 450m from the SSA boundary and is separated from the SSA by a minor road. The habitat connections between the pond and the SSA boundary are poor comprising four large arable fields and no substantial field boundaries leading to the SSA.

In total 12 ponds were identified either within the SSA boundary or within 500m of it in 2009. Of these, four ponds were screened out; three were dry (Ponds 5, 9 and 10), and one (Pond 12) is over 450m from the SSA boundary with poor habitat connections between it and the SSA.

In total eight ponds were screened in. Of these one pond (Pond 7) could not be accessed safely and thus only seven ponds were subject to further assessment.

Pond 7 could not be bottle trapped, netted or egg searched as the steep sides of the quarry, fringed with dense and continuous bramble scrub, prevented access to the waters edge. Torching was restricted by an abundance of duckweed.

3.3 Presence/Absence Survey

In 2007, bottle trapping, torching and egg searching were successfully carried out on each of the four survey visits at Pond 1.

On each survey visit in 2009, the most appropriate survey methods were employed, which depended on the pond conditions. For example Pond 8 had a stone base and gentle current, which restricted the use of bottle traps, but which was suitable for torch surveying. Ponds 2, 4 and 6 had large areas of vegetation which restricted torching. Although vegetation cover did not prevent torching at Pond 1 it marginally reduced the effectiveness of this survey technique. Pond 11 was very turbid, however, torching was still undertaken as the pond was small and could be adequately covered. Due to its characteristics, Pond 7 could not be surveyed using any of the recommended survey methods (see section 3.4).

Table 3.3 indicates the methods used at each of the ponds that was surveyed on each survey visit in 2009.

Table 3.3 Survey Methods Employed at each Pond Screened into the Presence/Absence Surveys 2009

Pond Name	23/04/09	29/04/09	07/05/09	09/06/09
Pond 1	Torch, trap & egg search	Torch, trap & egg search	Torch, trap & egg search	Torch, trap & egg search
Pond 2	Torch, trap & egg search	Trap & egg search	Trap & egg search	Trap & egg search
Pond 3	Torch, trap & egg search	Torch, trap & egg search	Torch, trap & egg search	Pond dry
Pond 4	Torch, trap & egg search	Trap & egg search	Trap & egg search	Trap & egg search
Pond 6	Torch, trap & egg search	Trap & egg search	Trap & egg search	Trap & egg search
Pond 8	Torch and egg search.	Torch and egg search.	Torch and egg search.	Torch and egg search.
Pond 11	Torch, trap & egg search	Torch, trap & egg search	Torch, trap & egg search	Torch, trap & egg search

No great crested newts were recorded in any of the ponds during the 2009 surveys. The surveys of Pond 1 in 2007 also did not record great crested newts. Based on the survey effort completed, and in accordance with the *Great Crested Newt Mitigation Guidelines* (English Nature, 2001), it is therefore reasonable to conclude that great crested newts do not occur within the water bodies surveyed.

Ponds 2, 3, 6 and 8 support smooth newt and Pond 4 supports palmate newt. Pond 1 also supported palmate newts in 2007 but these were not recorded again in 2009. No newts were recorded in Pond 11.

Fish were recorded in large numbers in Ponds 1 (also in 2007) and 6 and in less abundance in Pond 3. In addition, a large species of diving beetle, which predate on the larva and eggs of newts, was recorded in Pond 1.

Presence/absence results for 2007 are provided in Appendix C and for in 2009 in Appendix D.

3.4 Constraints

The *Great Crested Newt Mitigation Guidelines* (English Nature, 2001) recommend that in order to determine presence or absence of great crested newts within ponds, at least three survey methods (preferably bottle trapping, torching and egg searching) should be employed during each of the four survey visits. As described above, at some of the ponds assessed, less than three survey methods were used during some surveys due to the ponds' characteristics (e.g. extensive vegetation cover, turbidity and concrete bases).

The *Great Crested Newt Mitigation Guidelines* acknowledge that pond conditions can prevent the use of certain methods, but also highlight how effective each survey method can be in the most appropriate circumstances (e.g. bottle trapping can be effective in weedy or turbid ponds and torching can be very effective in clear ponds).

At all but one of the ponds that were surveyed, the full three survey methods were employed on the first survey visit, which was completed during the optimum survey period. Following this, the most appropriate survey methods were used at each pond depending on the characteristics of that pond and, where possible, all three survey methods were used. On the basis that the most appropriate survey methods were used at each pond, there is no requirement for further survey work at any of the ponds.

Pond 7 could not be surveyed using any of the appropriate methods. The likelihood of this pond supporting great crested newts has therefore been reappraised using relevant habitat information and the results of the surveys of other ponds. None of these other ponds support great crested newt and there are no known additional ponds within 500m of Pond 7. The absence of a breeding population of great crested newts within 500m of Pond 7 does not preclude the possibility that it supports a population of this species, although it reduces the likelihood that it does. If it were to support a population, there is good quality terrestrial habitat immediately surrounding the pond, and within 250m of it, whilst the terrestrial habitat within the SSA does not provide any additional resources or exceptional habitat that would be attractive to great crested newts. Therefore, with reference to the *Great crested newt mitigation guidelines* (EN, 2001) which state that "*as a general guide, suitable habitats within 250m of a breeding pond are likely to be used most frequently*", there is low potential that any great crested newts from Pond 7 would travel a minimum of 335m to the SSA and therefore be affected by the works.

The combination of the information set out above lead to the conclusion that great crested newts are not likely to access the development from Pond 7.

4. Summary

The habitat suitability assessment of the ponds produced low HSI scores of 0.59 or less ('below average' or 'poor') for all the ponds, except Pond 7 which scored 0.67 ('average'). The main factors contributing to the scores are the presence of fish and waterfowl, apparent poor water quality, and to a lesser degree shading and the small size of the ponds. Pond 7 scored higher due its larger size and because the presence of fish could not be confirmed (due to the restricted access).

In support of the low HSI scores, no evidence of great crested newts was found within the SSA or in the surrounding area in either the 2007 survey of Pond 1 or in any of the ponds surveyed in 2009. However, these surveys did highlight the presence of smooth newts in Ponds 2, 3, 6 and 8 and palmate newts in Pond 1 (in 2007 only) and Pond 4.

Whilst great crested newts have been historically present in Pond 1 (Pixies Pond) and Branland Copse, surveys over the past ten years have failed to record this species[4]. Great crested newts can survive for several years without breeding when conditions are sub-optimal or ponds dry out; however in this instance it is likely that great crested newt are no longer present in this pond. The HSI score for Pond 1 was 0.42 ('poor') due to the very large fish population and this is likely to restrict breeding for any newt species.

5. References

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Cresswell Associates (2005) *Hinkley A Power Station Decommissioning ES. Section 12: Ecology*. Magnox Electric.

Dulas (2006) *West Hinkley Wind Farm ES.*

English Nature (2001) *Great Crested Newt Mitigation Guidelines*. English Nature, Peterborough.

Oldham, R.S., Keeble, J., Swan, M.J.S., Jeffcote, M (2000) *Evaluating the Suitability of Habitat for Great Crested Newt (Triturus cristatus)*. Herpetological Journal 10(4) 143-155.

[4] Detail regarding the frequency and number of surveys each year is unknown, with the exception of the 2007 and 2009 presence/ absence surveys carried out by Entec.

Report template changed for consistency reasons but no other changes have been made since the original issue date.

Appendix A
Pond Photographs

Photo 1: Pond 1

Photo 2: Pond 2

Photo 3: Pond 3 (winter)

Photo 4: Pond 3

Photo 5: Pond 4

Photo 6: Pond 7

Photo 7: Pond 8

Photo 8: Pond 11

Appendix B
Habitat Suitability Index

Table B.1 Habitat Suitability Index

Pond Ref	1	2	3	4	5	6	7	8	10	11	12
SI1 - Location	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SI2 - Pond area	0.1	0.2	0.3	0.05	0.05	0.2	0.8	0.05	0.05	0.05	0.05
SI3 - Pond drying	0.9	0.9	1	1	0.1	0.9	0.9	1	0.5	0.5	0.5
SI4 - Water quality	1	0.67	0.33	0.33	0.33	0.67	0.67	0.33	0.33	0.33	0.67
SI4 - Shade	1	1	0.4	1	1	1	1	1	1	0.2	1
SI6 - Fowl	1	0.01	1	1	1	0.67	0.67	0.67	1	1	1
SI7 - Fish	0.01	0.33	1	1	1	0.33	0.67	0.33	1	1	0.67
SI8 - Ponds	0.7	0.55	0.38	1	0.7	0.66	0.66	1	0.66	0.66	0.7
SI9 - Terrestrial habitat	1	1	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	1
SI10 - Macrophytes	0.6	0.6	0.35	0.35	0.3	0.8	0.4	0.35	0.8	0.3	0.9
HSI	0.42	0.38	0.53	0.54	0.40	0.59	0.67	0.46	0.52	0.40	0.57

Appendix C
2007 Results

Table C.1 Pond 1 Survey Results - 2007

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts		
	Eggs	Torching	Trapping	Eggs	Torching	Trapping	Eggs	Torching	Trapping
1 (2nd May)	0	0	0	0	0	0	0	0	0
2 (14th May)	0	0	0	0	0	0	0	0	0
3 (15th May)	0	0	0	0	0	0	0	0	**1**♂
4 (21st May)	0	0	0	0	0	0	0	0	**1**♀

Additional Info: frogs and toads present, large numbers of sticklebacks (fish) were recorded during the bottle trapping and torching surveys.

The surveys did not record the presence of great crested newts. Very low numbers of palmate newt were recorded.

Appendix D
2009 Results

Table D.1 Pond 1

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	Torching	Trapping	Eggs	Torching	Trapping	Eggs	Torching	Trapping	
1 (23rd April)	0	0	0	0	0	0	0	0	0	0
2 (29th April)	0	0	0	0	0	0	0	0	0	0
3 (7th May)	0	0	0	0	0	0	0	0	0	0
4 (9th June)	0	0	0	0	0	0	0	0	0	0

Additional Info: Large numbers of sticklebacks (fish) and diving beetles were recorded during the bottle trapping and torching surveys. Ducks and swans also present.

The surveys did not record the presence of any newt species. No eggs of any species found. Although vegetation did not prevent torching it marginally reduced the effectiveness of this survey technique.

Table D.2 Pond 2

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	Torching	Trapping	Eggs	Torching	Trapping	Eggs	Torching	Trapping	
1 (23rd April)	0	Not torched	0	0	Not torched	**2♂ ; 1♀**	0	Not torched	0	0
2 (29th April)	0	Not torched	0	0	Not torched	**1♀**	0	Not torched	0	0
3 (7th May)	0	Not torched	0	0	Not torched	**1♀ ; 2♂**	0	Not torched	0	0
4 (9th June)	0	Not torched	0	0	Not torched	0	0	Not torched	0	0

The surveys did not record the presence of great crested newts. Smooth newt was recorded and smooth/palmate efts were also recorded. Torching was restricted by turbidity and vegetation cover. No eggs of any species found.

Table D.3 Pond 3

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	**Torching**	**Trapping**	**Eggs**	**Torching**	**Trapping**	**Eggs**	**Torching**	**Trapping**	
1 (23rd April)	0	0	0	0	0	0	0	0	0	**7**
2 (29th April)	0	0	0	0	0	0	0	**1** ♂	0	**3**
3 (7th May)	0	0	0	0	**2** ♂	0	0	0	0	0
4 (9th June)	Pond dry.									

Additional Info: Large numbers of sticklebacks (fish) were recorded during the bottle trapping and torching surveys.

The surveys did not record the presence of great crested newts. Smooth and Palmate newts were recorded. No eggs of any species found.

Table D.4 Pond 4

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	Torching	Trapping	Eggs	Torching	Trapping	Eggs	Torching	Trapping	
1 (23rd April)	0	0	0	0	0	0	0	0	**2♂ ; 2♀**	0
2 (29th April)	0	0	0	0	0	0	0	0	**1♂**	0
3 (7th May)	0	0	0	0	0	0	0	0	0	0
4 (9th June)	0	0	0	0	0	0	0	0	0	0

The surveys did not record the presence of great crested newts. Palmate newt was recorded. Although vegetation cover and turbidity did not prevent torching they marginally affected the effectiveness of this survey technique. No eggs of any species found.

Table D.5 Pond 6

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	**Torching**	**Trapping**	**Eggs**	**Torching**	**Trapping**	**Eggs**	**Torching**	**Trapping**	
1 (23rd April)	0	Not torched	0	0	Not torched	0	0	Not torched	0	0
2 (29th April)	0	Not torched	0	0	Not torched	**2** ♂	0	Not torched	0	0
3 (7th May)	0	Not torched	0	0	Not torched	0	0	Not torched	0	0
4 (9th June)	0	Not torched	0	0	Not torched	0	0	Not torched	0	0

Additional Info: Large numbers of sticklebacks (fish) and diving beetles were recorded during the bottle trapping and torching surveys.

The surveys did not record the presence of great crested newts. Smooth newt was recorded and a single smooth/palmate eft was also recorded. Torching restricted by turbidity and vegetation cover. No eggs of any species found.

Table D.6 Pond 8

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	Torching	Trapping	Eggs	Torching	Trapping	Eggs	Torching	Trapping	
1 (23rd April)	0	0	Not trapped	0	0	Not trapped	0	0	Not trapped	**9**
2 (29th April)	0	0	Not trapped	0	0	Not trapped	0	0	Not trapped	**2**
3 (7th May)	0	0	Not trapped	0	0	Not trapped	0	0	Not trapped	0
4 (9th June)	0	0	Not trapped	0	0	Not trapped	0	0	Not trapped	0

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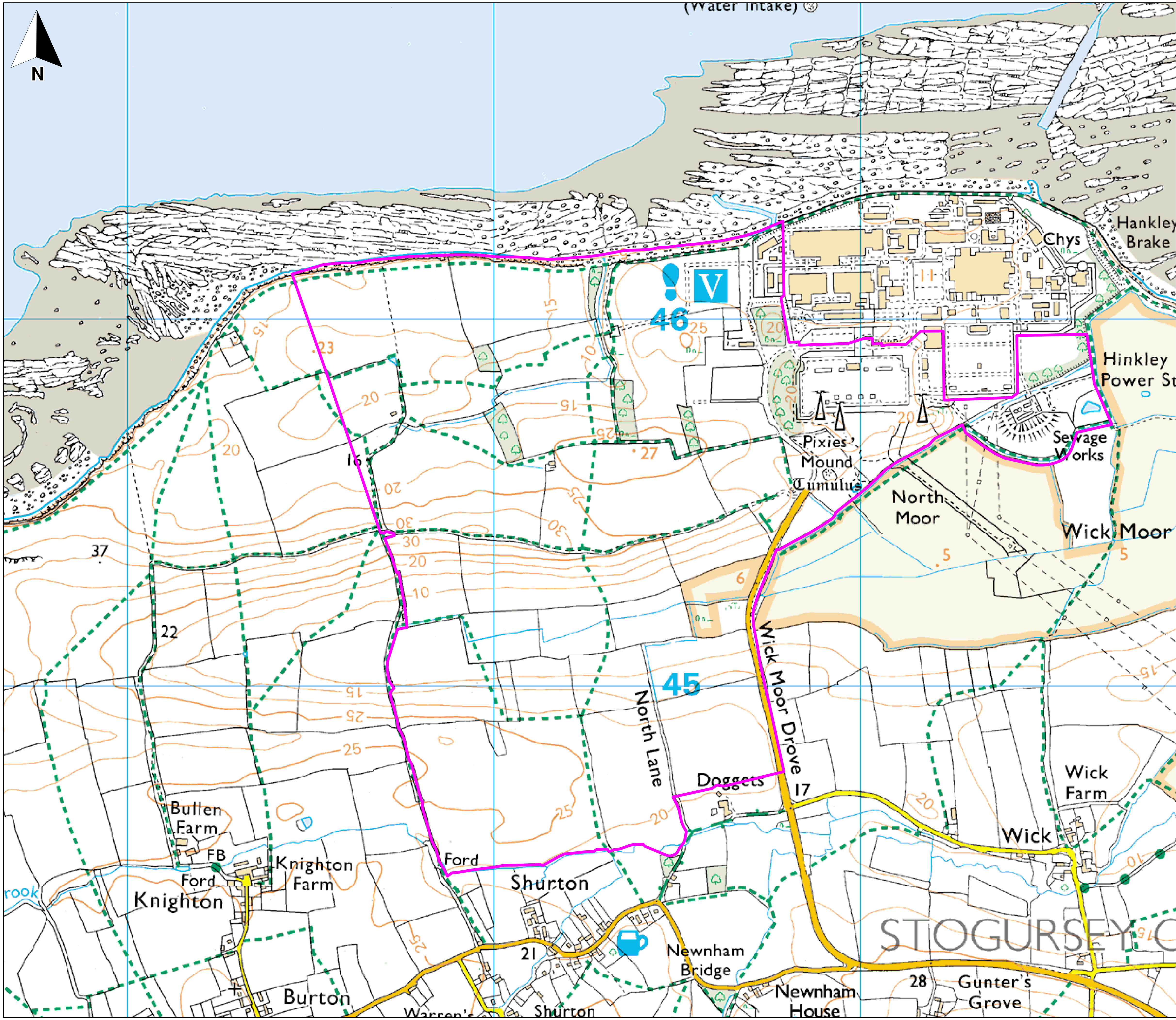
The surveys did not record the presence of great crested newts. Two smooth/ palmate females newt were recorded while torching. No eggs of any species found. Trapping was restricted by solid substrate of fords base.

Table D.7 Pond 11

Survey Event	Great Crested Newts			Smooth Newts			Palmate Newts			Smooth/Palmate Female Newts
	Eggs	Torching	Trapping	Eggs	Torching	Trapping	Eggs	Torching	Trapping	
1 (23rd April)	0	0	0	0	0	0	0	0	0	0
2 (29th April)	0	0	0	0	0	0	0	0	0	0
3 (7th May)	0	0	0	0	0	0	0	0	0	0
4 (9th June)	0	0	0	0	0	0	0	0	0	0

The surveys did not record the presence of great crested newts. Although turbidity did not prevent torching it marginally affected the effectiveness of this as a survey technique. No eggs of any species found.



Key

SSA boundary

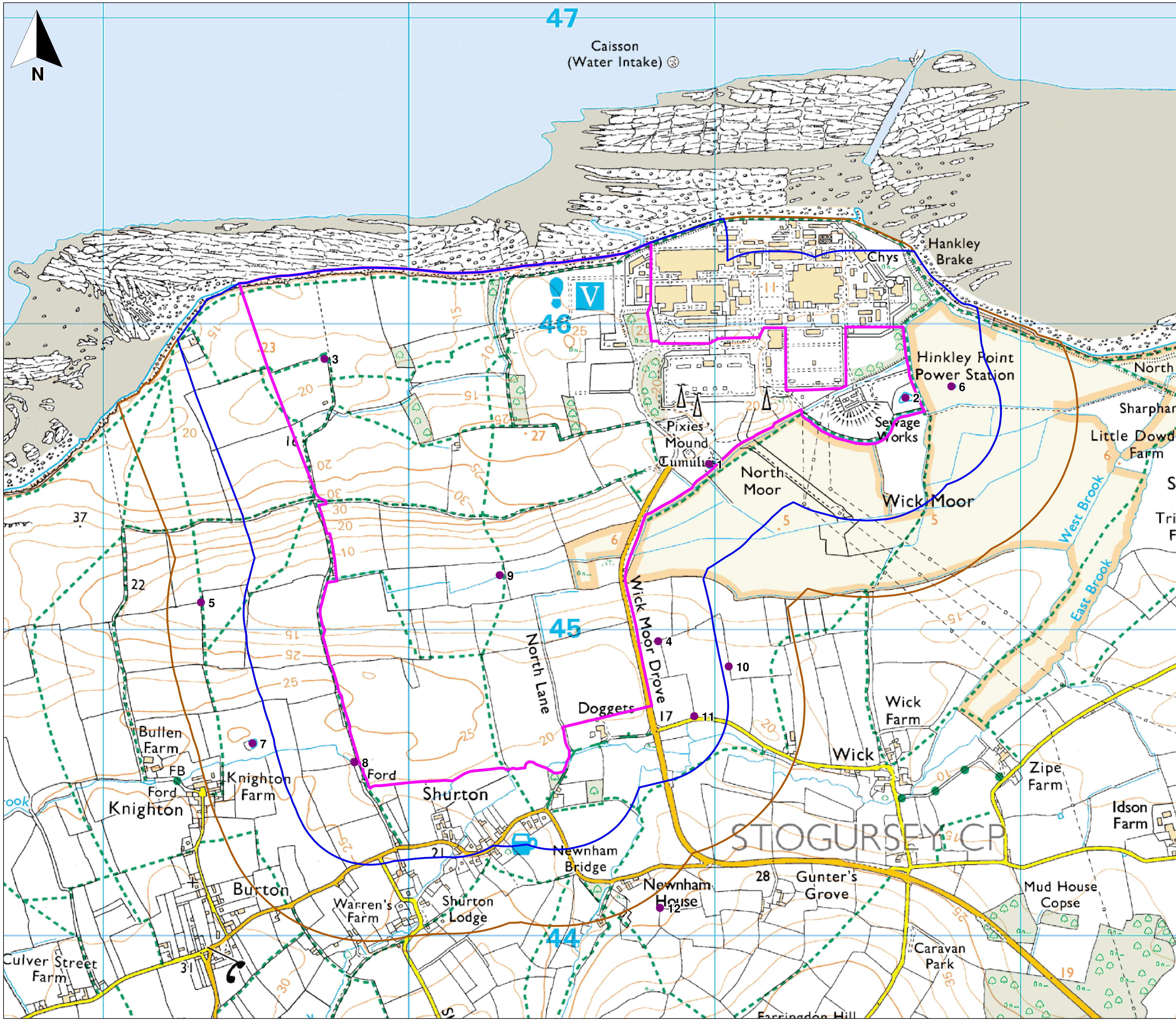
0 m 500 m

Scale 1:10,000 @ A3

Hinkley Great Crested Newt Survey Report

Figure 1
SSA Boundary

September 2010
19801-R356c.wor adamk



Key

Site boundary

250m buffer

500m buffer

1 Pond locations

0 m 500 m

Scale 1:12,000 @ A3

EDF

Hinkley Great Crested Newt Survey Report

Figure 2
Location of ponds

September 2010
19801-R357c.wor adamk

amec

APPENDIX 20J: HINKLEY REPTILES SURVEY REPORT

EDF Energy
Hinkley Reptile Survey Report

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as ‘Hinkley C’) on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, other than coastal/marine biodiversity with the exception of birds. This report details the results of reptile surveys that were conducted in 2008 and 2009 in order to inform the assessment. Relevant previous survey work for these species, undertaken in 2007 is also summarised.

1.2 Background Information

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C has been progressively refined in response to, *inter alia*, engineering and other design requirements, and environmental information. At the time of the reptile surveys that were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1). The boundary of the SSA was therefore used to define the area for the 2009 reptile surveys (which effectively updated and superseded the 2007 and 2008 surveys).

1.2.2 Site Description

The majority of the land within the SSA is agricultural; comprising 16 arable fields and 16 grassland fields with various levels of agricultural improvement. The fields are primarily bordered by mature hedgerows. Six small, rectangular broad-leaved woodlands are located within the northern part of the SSA and a square block of young broad-leaved plantation has been created in the central part of the area, with smaller areas of isolated scrub scattered along the northern boundary and in the eastern parts of the SSA. Two watercourses flow west to east through the SSA (further seasonal ditches also occur) and a further watercourse is present on the southern boundary of the SSA. Three ponds occur within the SSA.

The SSA is adjacent to the Bristol Channel. A low cliff, between 0.2m and 10m in height, forms an escarpment between the land and sea.

The land immediately adjacent to the west SSA is similar in character to that within the western part of the SSA, i.e. it comprises agricultural fields (both arable and improved pasture), which are separated by intact species-poor and species-rich hedgerows. A small number of ponds occur and the upper reaches of the Bum Brook flow through the area.

The land east of the SSA is different in character to that within the SSA. It forms part of Bridgwater Bay SSSI and comprises large open fields separated by drains, with very few hedgerows present. The fields immediately adjacent to the SSA have been agriculturally improved and are relatively species-poor. However, those fields to the south and east are less intensively grazed and support a more varied sward and have a greater diversity of plant species.

The proposed development falls into the Vale of Taunton and Quantock Fringes Natural Area[1] (English Nature, 1998), which describes the lowland landscape around the major towns of Taunton, Wellington and Minehead between the Quantock Hills, Brendon Hills, Exmoor and the Blackdown Hills. The Natural Area is characterised by a wide variety of habitats and species, including hedgerow and hedgebanks, calcareous grassland, streams, woodland and scrub, nightingale, otter and bats, all of which occur or could occur within the site.

The Natural Area immediately to the east of the site is the Somerset Levels and Moors Natural Area (English Nature, 1997).

1.3 British Reptiles and their Distribution

There are six native species of reptile in Britain; grass snake (*Natrix natrix*), adder (*Vipera berus*), smooth snake (*Coronella austriaca*), slow worm (*Anguis fragilis*), common lizard (*Zootoca vivipara*) and sand lizard (*Lacerta agilis*). Adder, grass snake, common lizard and slow worm are found throughout Britain, with the latter two species occurring in a wide range of habitats. The adder has more restricted habitat preferences and is therefore less widespread. Grass snake is widespread in England and Wales but absent from most of Scotland. Both sand lizard and smooth snake have very specific habitat requirements and are mainly confined to lowland heathland in Surrey, Hampshire and Dorset.

Adder, grass snake, common lizard and slow worm are the only native reptile species known to occur within Somerset (Beebee & Griffiths, 2000).

[1] The classification of areas of the country into distinct Natural Areas (NAs) was undertaken by English Nature (now Natural England) in order that areas of the countryside identified by unique combinations of physical attributes, wildlife, land use and culture could be grouped together. Overall, 143 NAs, including 24 Coastal NAs have been identified.

2. Methods

2.1 Desk Study

Existing information regarding reptiles within the SSA and surrounding land was obtained from the following sources:

- EDF (which has conducted a wide range of ecological surveys of its land holding and employ a conservation warden at Hinkley to help manage its land and undertake biological recording);
- Somerset Environmental Records Centre (SERC) (who also hold all the records from the Somerset Amphibian and Reptile Group);
- the Environmental Statement (ES) for the Decommissioning of Hinkley A (Magnox, 2006);
- the ES for the proposed West Hinkley Wind Farm (Dulas, 2006); and
- communication with the EDF Conservation Warden, Dick Best and his predecessor Jon Burrell.

Data from SERC was requested in May 2009 (following an initial request in 2007) to ensure that any additional new records submitted in the intervening period were captured. A search area of 3km was used for both searches, although the 2009 data request was based on the larger SSA boundary.

Dick Best provided incidental records of reptiles he encountered during 2007, 2008 and 2009.

2.2 Field Surveys

2.2.1 Survey Area

The extended Phase 1 habitat survey (conducted in March 2007 and updated in 2009) highlighted that the SSA included large areas which were considered unsuitable for reptiles, such as large, open, agricultural fields that provide little cover and restricted foraging opportunities. However, the hedgerow bases (particularly those associated with more mature, dense hedgerows) and the scrub and rough grassland/tall ruderal mosaics (i.e. south of the existing Power Stations) offer more suitable reptile habitat, with foraging and hibernating opportunities, and it is these areas that were targeted for the reptile surveys.

Hence four areas of the SSA were surveyed for the presence of reptiles between 2007 and 2009, as shown in Figure 2. Table 2.1 lists when each area was surveyed and by whom.

Table 2.1 Survey Area Information

Survey Period	Area of SSA Surveyed (refer to Figure 2)				Survey Personnel
	1	2	3	4	
July 2009				✓*	Entec
April - June 2009			✓		Entec
September and October 2008			✓		Entec
September 2008		✓			AMEC
September and October 2007	✓				Entec

* Area 4 overlaps with the southern part of Area 2 (see Figure 2) as additional survey effort was completed during 2009 in the area reptiles had previously been recorded (in 2008)

2.2.2 Reptile Survey Methodology

All the reptile surveys followed guidance provided in Froglife's Advice Sheet 10 – *Reptile Survey, an introduction to planning, conducting and interpreting surveys for snake and lizard conservation* (Froglife, 1999) and took into account additional guidance provided by the *Herpetofauna Workers' Manual* (JNCC, 1998) and *Reptiles: guidelines for developers* (EN, 2004).

Artificial refugia, comprising a range of different sized (minimum of 0.5m x 0.5m) roofing felt tiles, were laid out within the SSA in locations considered to have the highest potential to support reptiles, namely the hedgerow bases, woodland edges and areas of rough grassland. Froglife (1999) suggests placing between 5 and 10 refugia per hectare (ha). However, not all of the habitats within the SSA were considered to provide suitable habitat for reptiles (e.g. the centres of the heavily grazed or arable fields are unlikely to be attractive basking or foraging areas). Therefore, the number of refugia used was altered depending on the proportion of suitable habitat present. For example, following the Froglife guidance would have resulted in between 115 and 230 refugia being placed within Area 1 (Figure 2). Given the predominantly sub-optimal habitat present within this area (i.e. grazed pasture), this was considered to be a disproportionate number of refugia. Therefore, the total number of refugia used in this area was slightly lower. Equally, much of Area 3 provides highly suitable reptile habitat and therefore, slightly more refugia were used than would be recommended following the Froglife guidance. The number of refugia placed in each area is provided in Table 2.2.

The refugia in Areas 1 and 4 were checked on seven different occasions to determine whether reptiles were present or absent in these locations (Froglife, 1999). All the refugia in Area 2 were also checked seven times. The strip of habitat that was found to support reptiles was then subject to a further seven visits to inform an approximate population estimate. Due to the low numbers recorded on the initial seven visits and the presence of only one reptile species, it was considered a further seven visits (rather than 13 to total 20) would be sufficient to characterise the population in this area.

The refugia in Area 3 were checked on 20 different occasions, also to inform a population estimate, as moderate numbers of individuals of several species of reptile were found during the initial visits.

Table 2.2 summarises the approximate size of each area, number of refugia used in each area, the main habitats sampled, the date the refugia were set and the number of visits undertaken. The location of refugia for all Areas is shown on Figure 3.

Table 2.2 Survey Information

Survey Area	Approximate Size of Area	Number of Refugia Used	Habitats Sampled	Date Refugia Set	Number of Survey Visits
1	23ha	100	Hedgerows, woodland edges, long grassland and around scrub*	03 September 2007	7
2	10.2ha	185 (2008) 30 (2009)**	Hedgerows, woodland edges and long grassland	28 August 2008 02 July 2009	7 7
3	10ha	114	Tall ruderal vegetation, short grassland, scrub and woodland edges	02 September 2008	20
4	9.2ha	110	Rough grassland and hedgerow bases	02 July 2009	7

* The locations of the refugia were chosen to avoid stock (which had disturbed refugia initially set).

** Refer to Figure 3 for locations of refugia sampled on 14 occasions

2.3 Survey Limitations

May, April and September are considered to be the best times of the year to survey for reptiles (Froglife, 1999) as the cooler weather encourages the refugia to be used more extensively. Notwithstanding this, the Froglife guidance indicates that surveys for reptiles can be undertaken throughout the summer months as reptiles continue to bask and use refugia. Therefore, whilst most of the surveys were completed during the optimum period, undertaking further surveys outside of this is not considered to have significantly affected the results.

The four areas were surveyed at different times over the period 2007 to 2009. This could potentially limit how the results can be compared between the areas, as reptile populations will fluctuate in size from year to year depending on the availability of prey and suitable basking weather. However, given the small numbers of reptiles recorded and the broadly similar weather conditions experienced through the period this is unlikely to have significantly affected the assessment. Moreover, a benefit to having the survey effort spread over several years is that it may incorporate a mixture of optimal and less favourable years allowing for a better assessment of the whole site.

2.4 Population Classification

The Froglife (1999) guidelines set out a method for obtaining a population class size for reptile species, based on the maximum number of adults recorded on a single survey visit over a period of 20 survey visits. This is also forms part of the criteria for the selection of Key Reptile Sites. Table 2.3 summarises the method used for calculating class size.

Table 2.3 Classification of the Reptile Populations

Species	Low Population (Score 1 point)	Good Population (Score 2 points)	Exceptional Population (Score 3 points)
Common lizard	<5	5-20	>20
Slow worm	<5	5-20	>20
Adder	<5	5-10	>10
Grass snake	<5	5-10	>10

N.B. Figures in the table refer to maximum number of adults seen by observation and/or under tiles (placed at a density of 10 per hectare), by one person in one day.

To qualify for the Key Reptile Site Register a site must meet at least one of the following criteria:

- it supports three or more reptile species;
- it supports two snake species;
- it supports an exceptional population of one species;
- it supports an assemblage of species scoring a total of at least 4 points; or
- the site does not satisfy the above criteria but is of particular regional importance due to local rarity.

This population class assessment is also used to quantify any subsequent mitigation required, such as the recommended duration of any translocation exercises that may be necessary, as detailed by the Herpetofauna Groups of Britain and Ireland (HGBI, 1998). A population class assessment as outlined above was only carried out for Area 3, as the initial survey results indicated that this area could qualify as a Key Reptile Site. The results from the remaining survey areas were used to determine an indicative population class size.

3. Results

3.1 Desk Study

SERC provided several records of reptiles in the vicinity of the SSA. Grass snake has been recorded in Branland Copse (ST207458), between Branland Copse and the Sewage Treatment Works (STW) (ST210456) and offsite at Stolford (ST230459, ~2.5km distant) to the east in

1995 and 1996. Slow worm has been recorded offsite near Stolford in 1996 (ST228458, ~2km away) and to the south around Shurton in 1995 (ST202442, ~1km away);

Reptile surveys were not completed in relation to the West Hinkley Wind Farm ES (which overlaps with the western section part of the SSA) as it was considered that the extent of suitable habitat for reptiles was limited (Dulas, 2006). The ecology surveys in relation to the decommissioning of Hinkley A also did not include reptile surveys as the habitats affected by the works (predominantly hard standing) were not considered suitable for reptiles;

No formal reptile surveys have previously been conducted within the BE landholding, although it is noted (in British Energy [2006]) that the last sighting of grass snake was in 1999. A more recent observation of this species was recorded along the western edge of the SSA boundary at the top of Benhole Lane in 2008 (Stuart Thomas, *Pers. comm.*). A single common lizard was recorded during both the butterfly (Dick Best, *Pers.comm.*) and bird surveys (Stuart Thomas, *Pers. comm.*) to the east of the survey area near the sea front in 2007.

Within the eastern section of the survey area a mature grass snake has been seen in recent years near to Pixies Pond and slow worm are occasionally recorded, most regularly in the area directly south of the Power Station. Common lizard may also occur within the survey area, but there are no confirmed sightings (Dick Best, *Pers. comm.*).

3.2 Field Survey

The presence of two reptile species (slow worm and grass snake) was confirmed within the survey area.

Table 3.1 summarises the maximum counts of adults for each species, within each area (i.e. the highest number of adults recorded on a single survey visit). Juveniles were also detected during these surveys but are not included within this population class assessment, as per Froglife (1999) guidelines. The presence of juveniles does however prove that the populations on site are breeding. A summary of the findings for each day of the surveys in Areas 1, 3 and 4 are presented in Appendix A, with a summary of results from Area 2 presented in Appendix B.

Table 3.1 Maximum Counts of Adults of Each Species in all Compartments

Species	Common Lizard	Slow Worm	Grass Snake
Area 1	0	0	0
Area 2	0	3	0
Area 3	0	9	4
Area 4	0	1*	0

*****This individual was recorded in the part of Area 4 that overlaps with Area 2 (see Figure 2)

Area 1
In Area 1 no reptiles were observed underneath or on top of any refugia placed. Common toads were found using the refugia on two occasions.

Area 2
In Area 2 a maximum count of three slow worms was recorded in 2007, which equates to a density of 0.2 slow worm per hectare. These were all recorded along the south facing side of the hedge adjacent to the track which bisects the site from east to west (Figure 4). This spot is likely to be favoured as the hedge is wide and species-rich, offering refuge and places to hibernate, and supporting an abundance of invertebrate species for slow worm to predate. This side of the hedge also offers good basking potential, as it is south facing and sheltered from the prevailing wind, and as the field is arable it is undisturbed by cattle.

Area 3
In Area 3 a maximum adult count of nine slow worms and four grass snakes were recorded, which equates to a density of 0.9 slow worm and 0.4 grass snake per hectare. Pixies Pond and the western edge of Branland Copse (i.e. adjacent to the road) appeared to be favoured by grass snake. Both these areas include wetter vegetation; which, as grass snakes largely prey on amphibian species, is a preferred foraging habitat. The teasel field at the centre of Area 3 (i.e. between the communication masts), which includes small areas of poorly drained and wet grassland, also supports grass snake and slow worm. In both these areas large numbers of juveniles were recorded suggesting that both species are successfully breeding and that population size maybe increasing.

On two occasion's inconclusive sightings of common lizard in the Pixies Mound field were recorded by surveyors. These are considered inconclusive as on both occasions the surveyor saw, on approaching refugia, a 'quick movement' belonging to what looked like a lizards tail and so could not be confident of their assessment. Given the desk study records the presence of common lizard within the survey area is possible, although based on the results of the targeted reptile surveys completed (and reported here) it is concluded only a very small population of common lizard is likely to occur.

Area 4
In Area 4 a maximum count of one slow worm was recorded in 2009. This was in the same location that slow worm was found in 2008 (i.e. in Area 2, along the south facing side of the hedge adjacent to the track which bisects the site from east to west). As the hedge does not appear to have been regularly managed it is unlikely to have changed significantly since 2008, and remains just as suitable to reptiles, and which is reflected in the similarities between the two surveys results. No other reptiles were recorded in Area 4.

3.3 Population Classification

The population classification, as set out in Froglife (1999), only applies where 20 visits to an area have been completed, which only occurred within the SSA where the initial surveys indicated that a larger population of reptiles could occur, i.e. Area 3. Therefore, as Areas 2 and 4 support only very low reptile numbers, the population classification can only be applied to Area 3. Based on Table 2.3, Area 3 supports a 'good' population of slow worm and a 'low' population of grass snake. Therefore, Area 3 does not qualify as a Key Reptile Site. However, if it is assumed that a very small population of common lizard occur within Area 3, this area alone would then qualify as a Key Reptile Site as it would support three reptile species (common lizard, grass snake and slow worm).

Notwithstanding this, the site does support a low population of both grass snake and slow worm, which are largely concentrated in the Country Wildlife Site located in Area 3, with smaller numbers along woodland edges and hedgerows in the overlap between Areas 2 and 4.

3.4 Habitat Suitability

Due to current management practices Area 3 supports a mosaic of rough grassland, scrub, wetland areas, and woodland, which is currently ideal for foraging, basking and hibernating reptiles.

Areas 2 and 4 support limited habitat favourable to reptiles, restricted to wide-based hedgerows watercourse margins, woodland edges and rough pasture. Whilst these areas are small in extent individually, and unlikely to be sufficiently large enough to support high numbers of reptiles, they are reasonably well-connected into the wider landscape via the hedgerow and ditch network and are therefore accessible to dispersing reptiles.

The habitats present in Area 1 are not considered to be optimal for reptiles as they comprise heavily grazed pasture and regularly managed hedgerows, which are likely to support a poor assemblage of prey species and limited basking and hibernation locations that could be prone to disturbance by cattle.

4. References

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Report template changed for consistency reasons but no other changes have been made since the original issue date.

Appendix A
Full Reptile Survey Results
(Areas 1, 3 and 4)

Table A.1 Reptile Survey Visits Information for Area 1

Visit Number	Date	Time	Weather	Reptile Species Recorded (Location show in Figure 4).
1	14/09/07	16:00-17:40	Mainly cloudy, dry and bright. Temp approx 16-17ºC, wind W 3-4.	None
2	19/09/07	09:00- 12:00	Warm and sunny, Temp approx 18ºC.	None
3	20/09/07	09:00-11:00	SW 2-3 Sunny spells. Some light rain early on. Temp approx 16ºC.	None
4	22/09/07	16:00-17:50	SW1-2 Bright spells but mainly dull and dry. Temp approx 15ºC	None
5	26/09/07	16:20-18:15	N/NE 2-3 Sunny spells. Dry. Some rain during the morning but clearing. Temp approx 14ºC	None
6	03/10/07	08:30-10:35	V0-1. Bright but cloudy. Dry and mild. Temp approx 17-18ºC.	None
7	04/10/07	09:00-11:00	Bright and sunny. NW1-3. Dry. Temp approx 18ºC. Slight frost am.	None

Table A.2 Reptile Survey Visits Information for Area 3

Visit Number	Date	Time	Weather	Reptile Species Recorded (Location show in Figure 4).
1	10/09/08	09:30-11:00	Warm and sunny, Temp approx 18ºC.	Mature Grass snake by Pixies Pond and young slow worm on edge of teasel field (central grid reference ST 211 456).
2	16/09/08	09:30-11:00	Warm with clouds in places, Temp approx 17ºC.	Possible common lizard noted at Pixies Mound and grass snake noted on the edge of Pixies Pond. Two grass snake and a young slow worm noted under refugia in teasel field (central grid reference ST 211 456).
3	19/09/08	09:30-11:00	Warm with clouds in places, Temp approx 19ºC.	Possible common lizard noted at Pixies Mound. Two grass snake and a young slow worm noted under refugia in the teasel field (central grid reference ST 211 456). A large toad was also noted.

Table A.2 (continued) Reptile Survey Visits Information for Area 3

Visit Number	Date	Time	Weather	Reptile Species Recorded (Location show in Figure 4).
4	23/09/08	09:30-11:00	Warm with clouds in places, Temp approx 19ºC.	One grass snake noted under refugia in teasel field (central grid reference ST 211 456) by masts.
5	26/09/08	16:30-18:00	Warm and sunny. Temp approx 18ºC.	One grass snake noted under refugia in teasel field (central grid reference ST 211 456).
6	29/09/08	16:30-18:00	Warm with clouds in places, Temp approx 18ºC.	Two mature grass snake noted under refugia along Branland Copse adjacent to road. Juvenile grass snakes noted under refugia in teasel field (central grid reference ST 211 456).
7	02/10/08	09:30-11:00	Warm with clouds in places but some direct sunlight. Temp approx 12ºC.	None
8	22/04/09	09:00-11:00	Foggy but some direct sunlight. Temp approx 12ºC.	Three mature slow worm, two juvenile slow worm and two juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
9	24/04/09	16:00-17:00	Warm with clouds in places but some direct sunlight. Temp approx 12ºC.	Two mature slow worm, a single juvenile slow worm and two juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
10	30/04/09	09:00-11:00	Cloud, damp but warm. Temp approx. 13ºC.	Three mature slow worm, two juvenile slow worm and a single mature grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
11	08/05/09	09:00-11:00	Sunny with occasional shower. Temp approx 12ºC.	A single mature slow worm, one juvenile slow worm and four mature grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
12	11/05/09	09:00-11:00	Sunny and windy. Temp approx 15ºC.	Two juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456).

Table A.2 (continued) Reptile Survey Visits Information for Area 3

Visit Number	Date	Time	Weather	Reptile Species Recorded (Location show in Figure 4).
13	12/05/09	09:00-11:00	Sunny and windy. Temp approx 18ºC.	Two mature slow worm, one mature grass snake and one juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456). One mature grass snake noted under refugia on western boundary of Pixies mound field.
14	14/05/09	09:00-11:00	Overcast and humid. Temp approx 14.5ºC.	Two mature slow worm, one juvenile slow worm and three juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
15	21/05/09	09:00-11:00	Sunny and windy. Temp approx 15ºC.	Three mature slow worm, two juvenile slow worm and one juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
16	22/05/09	09:00-11:00	Overcast and warm. Temp approx 15ºC.	Three mature slow worm, two juvenile slow worm, one mature grass snake and four juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456).
17	26/05/09	09:00-11:00	Sunny and breezy. Temp approx 15ºC.	Nine mature slow worm, one juvenile slow worm and one juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456). One mature and one juvenile grass snake noted under refugia on western boundary of Pixies mound field.
18	27/05/09	09:00-11:00	Warm. Temp approx 18ºC.	Three mature slow worm and one juvenile slow worm in the teasel field (central grid reference ST 211 456). One mature and one juvenile grass snake noted under refugia on western boundary of Pixies mound field.

Table A.2 (continued) Reptile Survey Visits Information for Area 3

Visit Number	Date	Time	Weather	Reptile Species Recorded (Location show in Figure 4).
19	03/06/09	15:00-16:00	Warm and sunny. Temp approx 18ºC.	Five mature slow worm, two juvenile slow worm, one mature grass snake and two juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456). Two mature and two juvenile grass snake noted under refugia on western boundary of Pixies mound field.
20	04/06/09	09:00-11:00	Warm and sunny. Temp approx 15ºC.	Two mature slow worm, one mature grass snake and four juvenile grass snake noted under refugia in the teasel field (central grid reference ST 211 456). Two mature and two juvenile grass snake noted under refugia on western boundary of Pixies mound field.

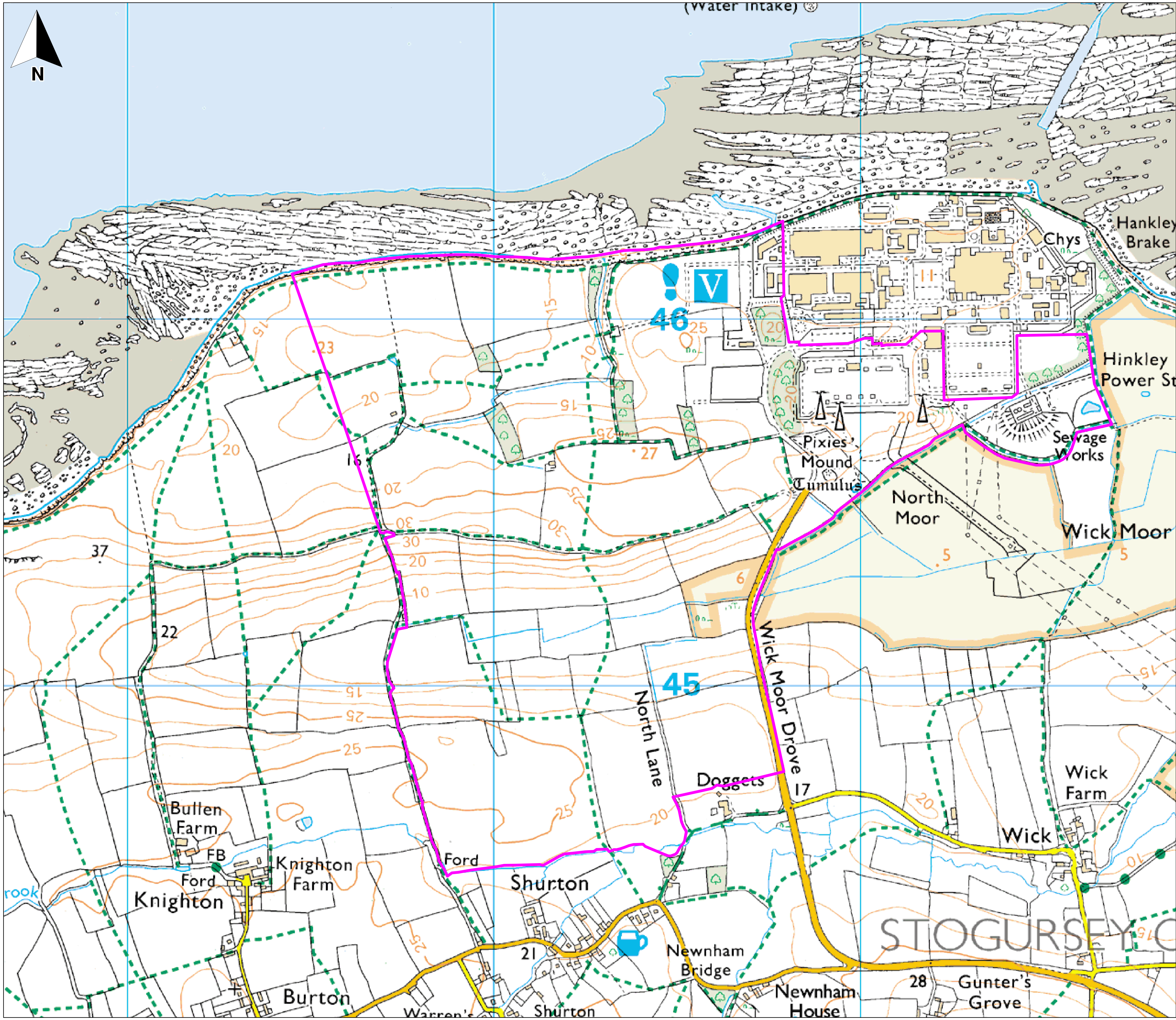
Table A.3 – Reptile Survey Visits Information for Area 4

Visit Number	Date	Time	Weather	Reptile Species Recorded (Location show in Figure 4).
1	09/07/2009	16:00-17:30	Mainly cloudy, windy. Temp approx 19ºC.	None
2	10/07/2009	09:00-11:00	Warm and sunny, Temp approx 16ºC.	1 slow worm recorded along south facing side of hedge adjacent to track (ST 202 453)
3	20/07/2009	09:00-11:00	Patchy cloud. Temp approx 18ºC.	None
4	22/07/2009	09:00-11:00	Patchy cloud. Temp approx 18ºC.	1 slow worm recorded along south facing side of hedge adjacent to track (ST 202 453)
5	23/07/2009	09:00-11:00	Bright sunny,. Temp approx 20ºC.	1 slow worm recorded along south facing side of hedge adjacent to track (ST 202 453)
6	28/07/2009	16:00-17:30	Overcast and breezy. Temp approx 19ºC.	1 slow worm recorded along south facing side of hedge adjacent to track (ST 202 453)
7	30/07/2009	16:00-17:30	Bright and sunny. Temp approx 17ºC.	1 slow worm recorded along south facing side of hedge adjacent to track (ST 202 453)

All survey visits were undertaken during suitable weather conditions and at an appropriate time of day (following the guidance in Froglife, 1999).

Appendix B
Full Reptile Survey Results (Areas 2 - Surveyed by AMEC)

	Visit Number	1	2	3	4	5	6	7
	Date	10/09/2008	11/09/2008	17/09/08	18/09/08	24/09/08	25/09/08	29/09/08
	Weather	Dry, patchy cloud. 17°C	Dry, patchy cloud. 16°C	Dry and Sunny, partial cloud, 14°C	Sunny 18°C	Dry, patchy cloud 11°C	Dry, patchy cloud 16°C	Sunny, 13°C
	Surveyors	L.B + J.D	L.B + J.D	L.B + S.H	L.B + S.H	J.D + S.H	J.D + S.H	L.B + M.P
R1	Common lizard	0	0	0	0	0	0	0
	Slow worm	0	0	0	0	0	0	0
	Grass snake	0	0	0	0	0	0	0
	Adder	0	0	0	0	0	0	0
R2	Common lizard	0	0	0	0	0	0	0
	Slow worm	**1**	**3**	**3**	**3**	0	0	0
	Grass snake	0	0	0	0	0	0	0
	Adder	0	0	0	0	0	0	0
R3	Common lizard	0	0	0	0	0	0	0
	Slow worm	0	0	0	0	0	0	0
	Grass snake	0	0	0	0	0	0	0
	Adder	0	0	0	0	0	0	0



Key

SSA boundary

0 m 500 m

Scale 1:10,000 @ A3

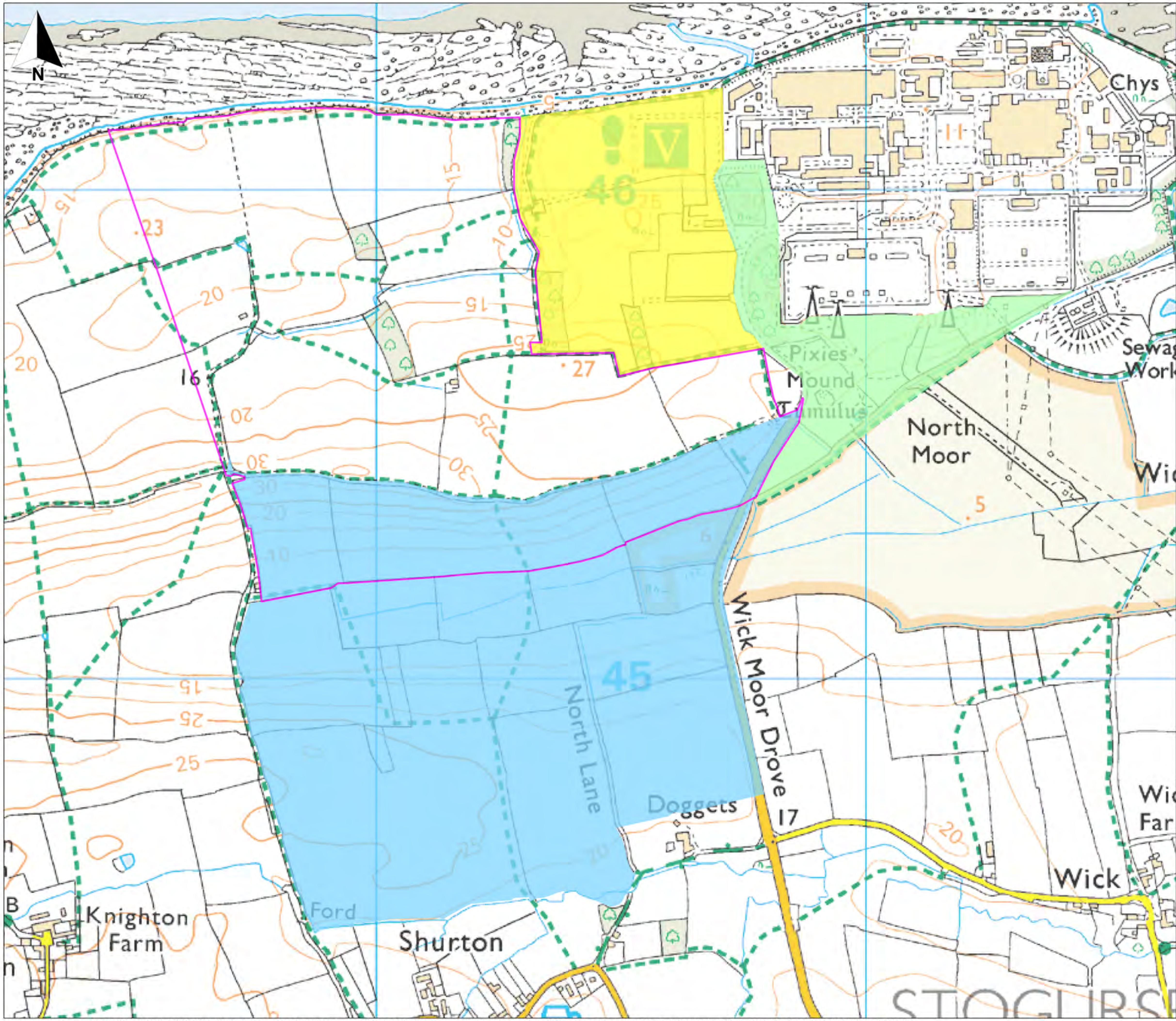
EDF

Hinkley Reptile Survey Report

Figure 1
SSA Boundary

September 2010
19801-R358c.wor adamk

amec



Key

- Survey Area 1
- Survey Area 2
- Survey Area 3
- Survey Area 4

0 m 400 m

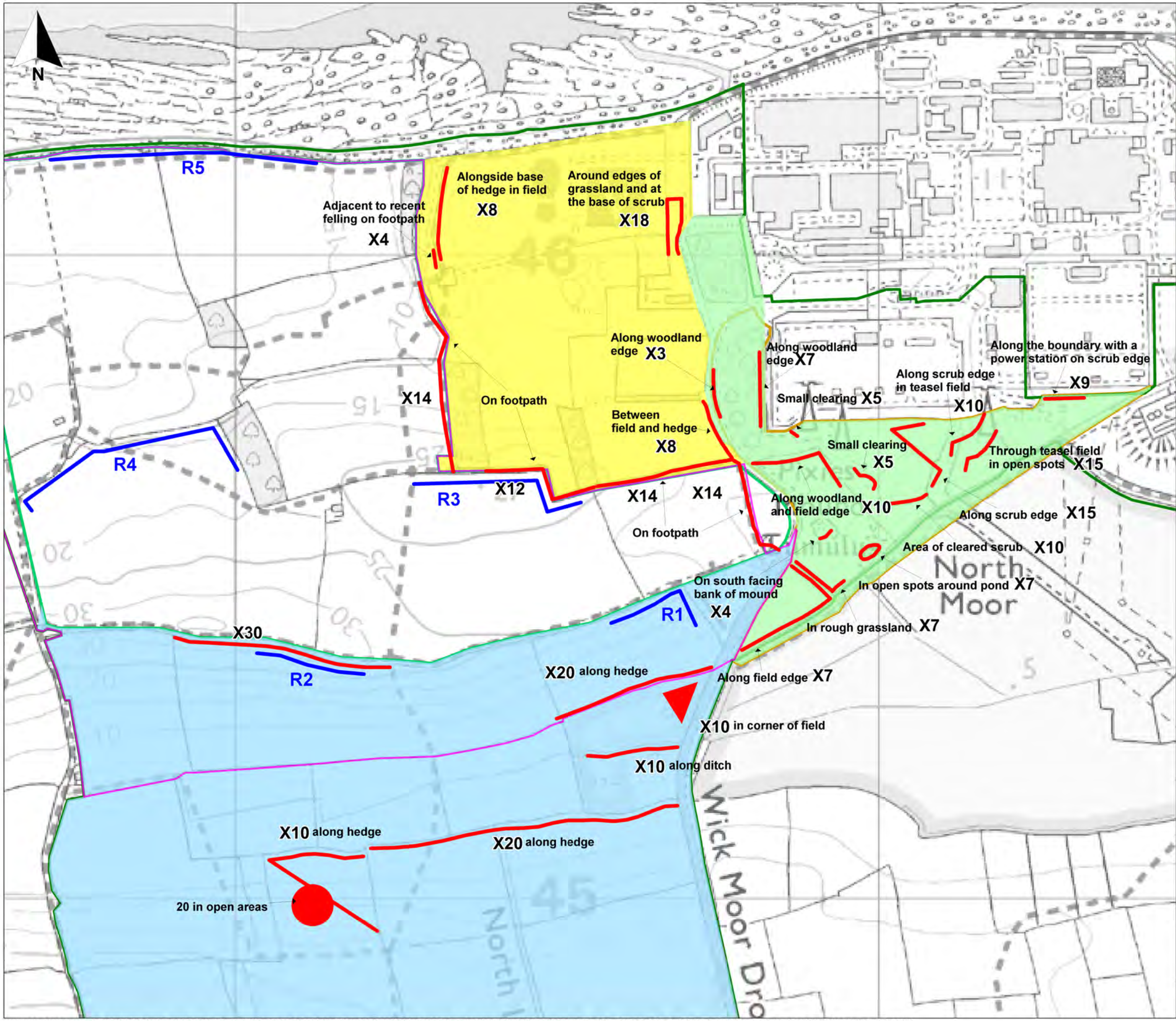
EDF

Hinkley Reptile Survey Report

Figure 2
Reptile survey areas

September 2010
19801-R359c.wor adamk

amec



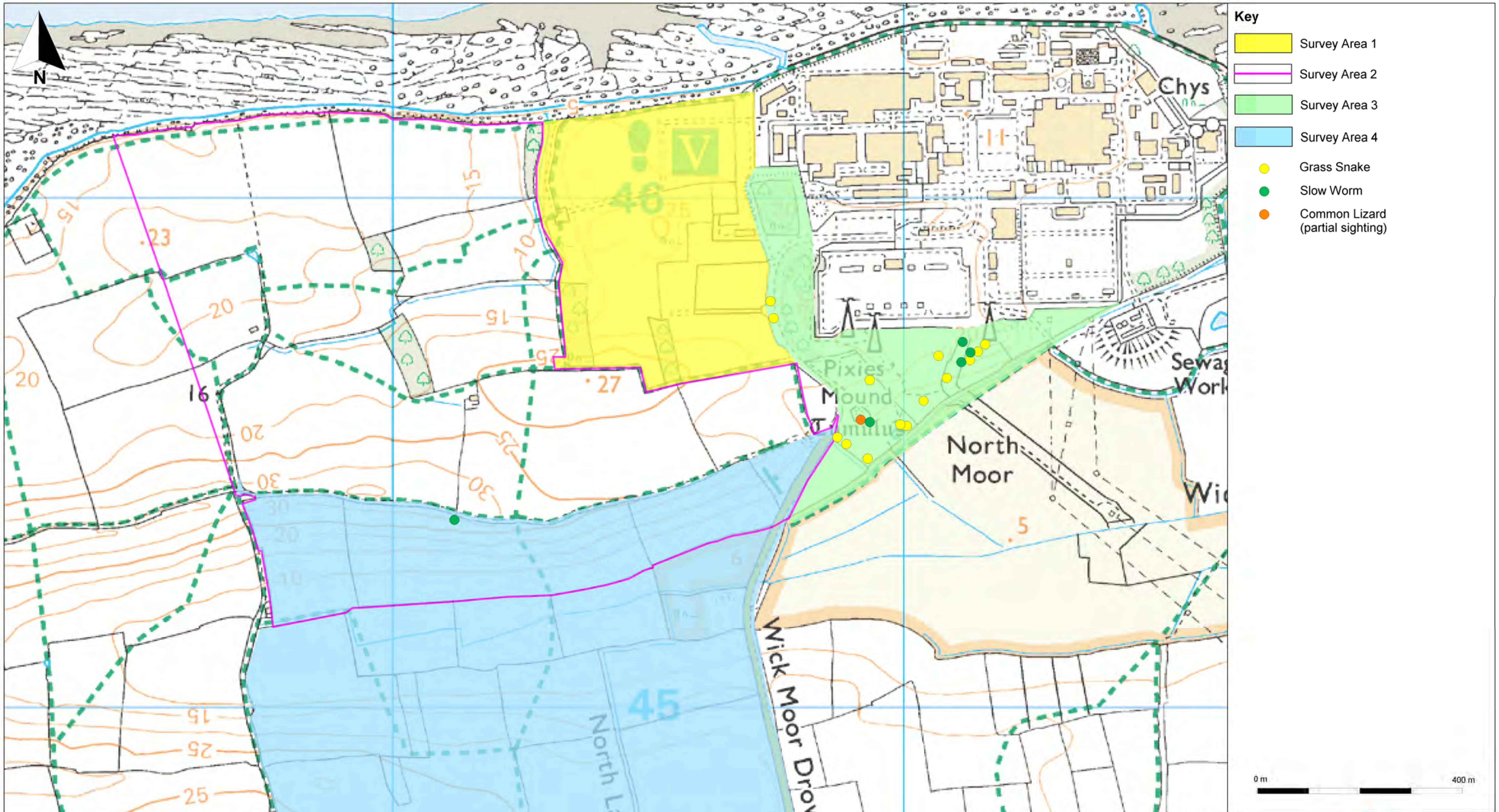
EDF

Hinkley Reptile Survey Report

Figure 3
Location of Reptile Refugia

September 2010
19801-R360c.wor adamk

amec



Hinkley Reptile Survey Report

Figure 4
Location of reptiles recorded in survey area

September 2010
19801-R361c.wor adamk

amec

APPENDIX 20K: HINKLEY INVERTEBRATE SURVEY REPORT

EDF Energy
Hinkley Invertebrate Survey Report

1. Introduction

1.1 Purpose of this Report

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as 'Hinkley C') on land to the west of the existing Hinkley A and B stations. Entec UK Ltd (now AMEC Environment and Infrastructure UK Ltd) was appointed to undertake the assessment of the impacts of the proposed Hinkley C development on biodiversity, with the exception of coastal/marine biodiversity other than birds. This report details the results of invertebrate surveys that were conducted in 2008 and 2009 in order to inform the assessment.

1.2 Background to Development

1.2.1 Survey Area

The boundary of the area within which it is proposed to develop Hinkley C was progressively refined in response to, amongst other things, engineering and other design requirements, and environmental information. At the time of the invertebrate surveys that were undertaken in 2009, the area within which it was envisaged that Hinkley C would be located was referred to as the Strategic Siting Area (SSA - see Figure 1). The boundary of the SSA was therefore used to define the area for the 2009 invertebrate surveys (which effectively updated and superseded the 2008 surveys). The SSA boundary includes all of the land within the final 'Construction Boundary'.

1.2.2 Site Description

The SSA comprises open, gently rolling mixed lowland farmland with hedgerows of variable quality, small scrubby[1] woodlands and occasional standard trees. Much of the area is intensively managed, and there is little semi-natural habitat present away from the cliff edge and within the immediate vicinity of the built plant.

A relatively extensive area of land on the southern side, and small areas of ground to the east and west of the built nuclear plant have been subject to management by EDF. This has been

[1] Given their coastal location it is likely that new growth is intermittently 'burnt off' by salt-laden winds. As a result the woodlands are dense and have a low canopy. Woodland only occurs (in terms of the site) within a few hundred metres of the coast.

implemented through a land management plan; initiatives have included the mowing and harrowing of grassland, establishment and management of scrub and the creation of two pools. The result has been the establishment of a range of habitat types including flower-rich grassland (much of which has calcareous influences), woodland, scrub and reedbed.

There are no substantial water-bodies within the SSA, although two streams (Bum Brook and the Holford Stream) that run east-west across the site connect to the Bridgewater Bay SSSI, and Hinkley Point C Drainage Ditch discharges to the intertidal. A more substantial drain (or rhyne) forms the boundary between the site and Wick Moor (North Moor). Standing water is also limited in extent, with the largest pools being to the south of the plant sewage works and in Pixie’s Field.

The eastern boundary of the site is formed (moving north to south) by the operational nuclear plant, the Bridgwater Bay SSSI and mixed farmland which has similar characteristics to that found within the site. This part of the SSSI consists of an area of flat, open improved grassland which is seasonally grazed. To the south and west of the site there is further mixed farmland and a series of small villages including Wick, Shurton and Knighton.

The northern SSA boundary lies adjacent to the Bristol Channel from which it is separated by a low cliff, between 5m and 10m in height that forms an escarpment between the land and sea. At low tide, the shore adjacent to the site comprises a relatively narrow neck of rock (extending to approximately 200m from the cliff and running parallel to it), interspersed with and fringed by muddy sand. Intertidal areas to the west include more extensive areas of mobile sand, while to the east, adjacent to the built nuclear power stations, the intertidal rock platforms, mud and sand extend up to 500m from the upper shore at low water. Further east again, approximately 1km from the proposed build area, the mosaic of intertidal habitats grades into an area of open mud and sand known as Steart Bay.

1.3 Purpose of Survey Work

An aquatic invertebrate survey of watercourses and waterbodies within the SSA was undertaken in May and June 2009. This followed a preliminary aquatic invertebrate survey undertaken in September 2008 (AMEC, 2009) and a walkover survey to identify areas of potential importance to terrestrial invertebrates conducted on 15 August 2008.

The freshwater invertebrate survey took in Hinkley Point C Drainage Ditch, which issues within the coastal fields and discharges to the intertidal, the Holford Stream, Bum Brook (on the southern SSA boundary) and the ditch forming the northern boundary of the Bridgwater Bay SSSI.

The terrestrial invertebrate survey concentrated on the semi-natural area of coombe woodland known as Whitewall Brake (which the surveyor considered to have the most potential invertebrate interest of the woodlands present) and the mosaic of grassland, scrub and woodland habitats immediately south of the existing power station (including the grassland and fringing woody scrub around the plant sewage treatment works).

The 2009 surveys and the August 2008 visit were conducted by Andy Godfrey, an experienced, professional invertebrate ecologist.

2. Methods

2.1 Desk Study

Organisations contacted for contextual data were:

- Natural England;
- Somerset County Council;
- Somerset Environmental Records Centre (SERC); and
- Butterfly Conservation (Bristol & Somerset Branch).

Other sources of information were:

- Hinkley Point Land Management Annual Reviews for the period 1998-2008 (British Energy 1998-2008);
- a list of the fauna and flora recorded from Hinkley Point Nature Trail (Burrell 2006);
- an ecological survey of Hinkley Point' CEGB/NERC Contract ITE Project 945 (Daniels 1986);
- Foster, A. (1986) Hinkley Point, Aquatic Invertebrate Survey. Unpublished survey;
- Drake, C.M. (2003) A survey of the aquatic invertebrates of the Stert Peninsula. Unpublished report to English Nature; and
- a freshwater invertebrate survey of watercourses within the SSA conducted by AMEC in 2008 (AMEC, 2009).

2.2 Field Surveys

2.2.1 Terrestrial Invertebrates

No survey methods were employed on the initial site walkover on 15 August 2008 with the exception of occasional hand searching under reptile mats and the recording of conspicuous invertebrates in the field. The intention of the site walkover was to assess the habitats present throughout the site for invertebrates as a precursor to any requirement for more formal survey work.

In 2009 survey methods concentrated on sweep netting and direct searching. The former involved using a 40cm diameter net mounted on a 1m long angling pole through or around low vegetation as well as the edges of scrub and amongst low tree branches. This method is excellent for sampling a wide selection of active insects and other invertebrates that occur in the ground or scrub layer. Selected target invertebrates were removed using a pooter (aspirator) and preserved in alcohol for later examination. The taxa recorded included Orthoptera (grasshopper and allies), Hemiptera (true-bugs), various Coleoptera families, selected Diptera families

(Tipuloidea, Empidoidea, Syrphidae, Tephritidae, etc.), aculeate Hymenoptera (ants, bees and wasps). Conspicuous species such as butterflies, day-flying moths and adult dragonflies were identified in the field. Some invertebrate taxa had been fairly well recorded in the past particularly moths and butterflies and the present survey concentrated on the less well recorded groups. The direct searching including searching under rocks and reptile mats (for taxa such as molluscs, millipedes, woodlice, ground beetles, etc.), on flower-heads, recording plant galls and leaf-mines, etc.

2.2.2 Aquatic Invertebrates

All the watercourses within the SSA were sampled with a standard pond net[2] during both May and June 2009. The method was as follows:

- Each location selected was surveyed for a three minute period by passing the net along the banks and over the beds of the shallower ditches;
- The contents of the net were washed and sieved on the bank (this involved placing the sample in a 1cm coarse sieve, with a 500 micron sieve and then a bowl beneath it);
- After several decantings, the contents of the 1cm sieve were checked for large freshwater invertebrates and if there were none or once these had been noted, the coarse fraction was returned to the watercourse, whilst the finer fraction was placed in a pot for later examination in the lab;
- The samples were preserved in 10% formalin;
- Once in the lab, each bulk sample was divided up into small parts and these were placed in gridded petri-dishes to which water was added. The petri-dishes were then examined under a binocular stereo-microscope and invertebrates were identified and counted;
- A number of physical and chemical measurements were made on site including pH, conductivity and water temperature using a Hanna HI 98129 handheld meter.

3. Results

3.1 Desk Study

A summary of invertebrate information from all available sources is included below.

[2] 1mm mesh bag, net supplied by EFE/GB Nets Ltd, Totnes.

3.1.1 Annual Land Management Reviews

The Annual Reviews focus on habitat management work undertaken during the year and the results of wildlife monitoring by the site warden and contractors. Butterfly monitoring is conducted each year, and a complete set of annual data are available going back into the early 1990s. Moth-recording has been undertaken on an *ad hoc* basis, glow-worms (*Lampyris noctiluca*) appear to be noted in the report if recorded, while records of other invertebrates are largely incidental.

The more notable invertebrate records from the Annual Reviews are summarised below:

- 1998-1999: Glow-worms are mentioned as occurring in scrub between Pixies Mound and the sub-stations[3];
- 1999-2000: Chalkhill blue (*Polyommatus coridon*) and five other invertebrates are mentioned as new to the site;
- 2000-2001: Grassland management for the marbled white population is mentioned;
- 2001-2002: Butterfly transect results for the years 1996-2001 are provided: 29 species had been recorded at this stage, the most significant of which were dingy skipper (*Erynnis tages*)[4] (low numbers in all years), chalkhill blue in 1999, dark green fritillary (*Argynnis aglaja*) (1996, 1998-2000) and silver-washed fritillary (*Argynnis paphia*) in 1997. Thirteen moth species are also mentioned as new to the site, two of which are UK BAP species, namely the powdered quaker (*Orthosia gracilis*) and the dusky brocade (*Apamea remissa*);
- 2002-2003: Butterfly transect results for 1996-2002 are given. Five moths new to the site are mentioned, and the total number of moth species known from the site is stated to be 184. Habitat management for glow-worm and marbled white are mentioned;
- 2003-2004: Butterfly transect results for the period 1996-2003 are presented and a total of 30 species are listed, with grizzled skipper (*Pyrgus malvae*) being recorded for the first time since 1993. Five moth species new to the site are mentioned, two of which are UK BAP species[5]. Information on glow-worm counts is given;
- 2004-2005: Butterfly transect records for the period 1996-2004 are provided; green hairstreak (*Callophrys rubi*) was recorded for the first time in 11 years in 2004. Golden-ringed dragonfly (*Cordulegaster boltoni*) was recorded for the first time (the total number of dragonfly species recorded from the site stood at 15 when the report was issued). Eight moths were recorded for the first time, one of which, the sallow (*Xanthia icteritia*) is a UK BAP species. The total moth list stood at 199;
- 2005-2006: Butterfly transect records for the period 1996-2005 are provided. Observations on brown argus (*Aricia agrestis*) and its foodplants at Hinkley are given. Two moth species are mentioned as new to the site;

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[3] This is a county or local BAP species in many English counties or vice-counties, but not in Somerset.

[4] The population has since 'petered out' (John Burrell, pers comm, 2009).

[5] These are the spinach (*Eulithis mellinata*) and garden dart (*Euxoa nigricans*).

- 2006-2007: Further observations on the brown argus at Hinkley Point are provided. Butterfly transect records for the period 1996-2005 are provided. Grayling (*Hipparchia semele*) was recorded for the first time in 2006. Fifteen moth species new to the site are mentioned. Comments on the glow-worm colony are also provided;

- 2007-2008: The report states that up to 20 butterfly species were seen in 2007. The 2007 results are compared with data for the years 2003-2006. Three common day-flying moth species were also recorded.

3.1.2 Hinkley Power Station Nature Trail (Burrell 2006)

This is list of the recorded fauna and flora on the Nature Trail[6] at Hinkley Point compiled by the former warden John Burrell. The lists contain mainly common and widespread invertebrates but some uncommon species are noted:

- The orange ladybird (*Halyzia* 16-*punctata*) was formerly of Notable status in Hyman (1986) but was downgraded by (Hyman & Parsons (1992)[7];

- The UK Biodiversity Action Plan moss carder bee (*Bombus muscorum*) is listed in the report without further detail. Like other declining bumblebee species this species is associated with large areas of open, flower-rich grassland and it has a predominantly coastal distribution in England and Wales (although it occurs in extensive moorland in north-east England and in Scotland (Edwards 2005));

- A total list of moths for the Nature Trail is provided and this includes 25 UK Biodiversity Action Plan species. A list of these species along with the larval foodplants and preferred habitats is provided in Table 1 in Appendix A.

3.1.3 An Ecological Survey of Hinkley Point (Daniels, 1986)

This report provides details of ecological work undertaken in summer 1985 by the Institute of Terrestrial Ecology (ITE). A range of ecological survey was conducted including a butterfly survey and an aquatic invertebrate survey.

The ITE aquatic invertebrate survey involved taking samples from twelve sites on one day (20 June 1985). The results of a survey undertaken by Andy Foster (Nature Conservancy Council) on 16 July 1986 (discussed further in section 3.1.4) were included in this report for comparison: the 1985 survey recorded eighteen taxa from a single ditch sample. It appears reasonable to conclude on this basis that the 1986 survey commented on below was of higher quality than that conducted in 1985.

Key points following a review of data from the ITE survey are as follows:

- Twenty-three butterfly species were recorded from fourteen sampling areas. The most significant species recorded was marsh fritillary (*Eurodryas aurina*) noted

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[6] The Nature Trail starts in Branland Copse and follows a short route through the woodland, scrub and grassland habitats present to the south of the existing Hinkley A and B Power Stations.

[7] It was formerly scarcer and is one of those species that has presumably spread as a result of climate change.

during the ornithological survey. The location and number of individuals is unclear, and the species does not appear to have been recorded on or near the SSA since;

- There appear to be a number of erroneous records such as the whirlpool ram's-horn snail (*Anisus vorticulatus*) which is a rare species mainly known from East Anglia and a few sites in south-east England. The doubtful record of yellow-veined darter (*Sympetrum flaveolum*) is also likely to be incorrect, since it appears to be based on the nymphal stage and this had not convincingly been recorded in Britain at this time (the species has only regularly started breeding in Britain in recent years). The record of small red damselfly (*Ceriagrion tenellum*) may also be questionable, since this species is associated with bog pools and there are no records for the North Somerset coast (Merritt *et al*, 1996). Additionally, no special comment is made in the text with regard to these species or with regard to the record of the shining ram's-horn snail (*Segmentina nitida*), which is a provisional Red Data Book 2 and a UK BAP species;

- None of these questionable species were recorded on the extensive and relatively recent aquatic invertebrate survey of the Steart Peninsula conducted by Drake in 2003.

3.1.4 Aquatic Invertebrate Surveys

Further results of aquatic invertebrate surveys initially mentioned in the previous section are summarised below. One comprised a single day of survey on Wick Moor (Foster, 1986) and the second was a far more detailed survey of the whole Steart Peninsula (Drake, 2003).

- The survey conducted by Foster (ibid) covered six sample sites. One Red Data Book water beetle *(Haliplus mucronatus)* and three Nationally Scarce water beetle species were recorded. Two ‘Notable’ species *(Coccidula rufa* and *Oplodonta viridula)* recorded during the survey have since been downgraded in status;

- Drake (2003) sampled ten sites on Wick Moor (sample sites 91-100 in the report) and around Stolford with another 90 spread out further east as far as Steart. From the 10 sample sites on Wick Moor and around Stolford, Drake (ibid) recorded one RDB2 soldierfly *(Odontomyia ornata)* and 11 Nationally Scarce species (*Helochares lividus* has recently been downgraded from Notable).

A survey of several water-bodies (eight sample sites) within the SSA was conducted by AMEC on 10 September 2008. Sampling was limited to one-minute per sample[8] and recorded 31 taxa. The main findings were:

- invertebrate communities largely consisted of common and widespread species with no rarities present;

- invertebrate diversity was low at all sites;

- invertebrate abundance was low at five sites and moderate at three; and

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[8] As opposed to the 3 minutes sampling regime used in the Biological Monitoring Working Party (BMWP) methodology and in the subsequent Entec surveys.

- invertebrate communities reflect slightly acidic to circum-neutral, eutrophic conditions with high levels of organic enrichment.

3.1.5 Further Contextual Information

Invertebrate records for Hinkley Point and environs were obtained from SERC in January 2009. Most of the data appear to be from John Burrell, the previous warden at Hinkley Point. These data are provided in Appendices 1-3 and include several UK BAP, Local BAP, Nationally Scarce (= Notable), and County Notable species. A small number of the records are for the Quantocks SSSI and other areas several kilometres from the SSA.

The Bridgwater Bay SSSI citation specifically mentions a number of invertebrate species. The only one of these species to be recorded on the present survey is the hairy dragonfly (*Brachytron pratense*). This is discussed later in this report.

No invertebrates are listed as county BAP species in the West Somerset Biodiversity Action Plan (West Somerset District Council 2008). The UK BAP click beetle *Synaptus filiformis* which is confined in Britain to a short section of the River Parrott near Bridgwater occurs on the eastern part of the town (Duff 1993) and therefore several miles from Hinkley Point.

A list of County Notable invertebrate species for Somerset has been drawn up and is available on the SERC website.

3.2 Field Surveys

A global positioning system (GPS) was used to obtain accurate grid references of sampling locations and species present, and notes were taken of all the habitats within the SSA. Survey locations are shown on Figure 2.

Generally, vouchers of Red Data Book and Nationally Scarce species have been retained and are available to check by third parties (such as national recorders) if this is required. These vouchers will be retained indefinitely by the surveyor.

Red Data Book and Nationally Scarce/Notable species have been identified as such using the published and unpublished reviews such as Falk (1991), Falk & Chandler (2005) and Foster (2004). A definition of Red Data Book and Nationally Scarce/Notable statuses is provided in Appendix B.

3.2.1 Terrestrial Invertebrate Survey

The most notable result of the initial walkover survey conducted in August 2008 was a record of the Nationally Scarce bombardier beetle *Brachinus crepitans*, which was present under a reptile mat in the cliff top grassland.

The terrestrial invertebrate survey in 2009 included Whitewall Brake, as this is the most natural woodland within the SSA as indicated by the semi-natural vegetation, well-defined woodland vegetation structure and presence of mature oaks and other trees[9]. Also included in the 2009

[9] Other woodland was not surveyed as it comprises tightly spaced, species-poor, similar-aged broad-leaved or mixed plantation with little understorey and a general lack of clearings, rides, footpaths, embayments etc.

terrestrial survey was the grassland-scrub-woodland edge mosaic immediately south of the existing power station including the grassland (and more isolated scrub habitats) around the sewage treatment works.

The terrestrial invertebrate survey recorded a total of 149 species (excluding 29 terrestrial species recorded on the aquatic invertebrate survey). These included two Red Data Book species and four Nationally Scarce species.

- The two Red Data Book species were lauxaniid flies belonging to the genus Homoneura, namely *H. limnea* and *H. interstincta*. Both are poorly known and belong to an under-recorded family and may not be as rare as the few records suggest. Both were represented by males and were determined using the distinctive male genitalia. *Homoneura limnea* is currently only known from three sites according to a recent unpublished review (Falk & Ismay *in prep*.) and most of the records are old. Most *Homoneura* species are associated with isolated scrub or the edges of scrub often in open habitats although this may not be immediately apparent from the information provided in Appendix C;
- Of the Nationally Scarce species, the cranefly *Atypophthalmus inusta* is a damp woodland and carr species and the snail-killing fly *Tetanocera punctifrons* is associated with wetlands, damp woodland, riverside situations, damp heathland and coastal marshes. The picture-winged fly *Acanthiophilus helianthi* is typically found on dry grassland where the larvae feed on common knapweed and other composites whilst *Dioxyna bidentis* has been found on dunes, marshes and other wet areas where its larval foodplant *Bidens tripartita* occurs although there is evidence that it uses a wider range of composite hosts than previously thought. Further details of the ecology, status and distribution of these species are provided in Appendix C whilst the precise locations of these species at Hinkley are summarised in Table 2 in Appendix A;
- *Orthoceratium lacustre* was given Notable status in Falk (1991) but downgraded by Falk & Crossley (2006). Similarly, the orange ladybird, *Halyzia* 16-*guttata* was given Notable status by Hyman (1986) but downgraded by Hyman & Parsons (1992). *Minettia tabidiventris* was introduced as a new name to the British fauna by Merz (2004). The latticed heath *Chiasmia clathrata* is a UK Biodiversity Action Plan species and was already recorded from the Nature Trail (Burrell 2006).

3.2.2 Aquatic Invertebrate Survey (May and June 2009)

Sampling was initially undertaken on 27 May 2009. The intention was to sample the same sample locations surveyed by AMEC (2009). Several of the sample sites surveyed by AMEC (2009) were dry including all of the ponds, and only five samples could be taken to the north of the east-west Green Lane (track) that runs through the centre of the SSA. Details of the taxa recorded are provided in Appendix D whilst details of the sample sites are provided in Appendix E (notes on some of the dry sites were taken and these have been added to Appendix E). The survey on 27 May 2009 also involved sampling the Holford Stream which is located immediately south of the Green Lane. Three samples were taken from this watercourse.

Further sampling was undertaken on 19 June 2009 on the Bum Brook, north of the village of Shurton, (two samples) and on a rhyne separating the existing power station from Wick Moor (three samples). In total thirteen three minute samples were taken by sweeping from the bank or within the watercourse, but slow flow prevented kick sampling.

A total of 152 taxa were recorded, a relatively large proportion of which were in the larval or pupal stage. In addition, two fish, one amphibian and 29 terrestrial invertebrates were caught in the pond net and details of these have been entered into the table in Appendix D.

Two Nationally Scarce species were recorded: the hairy dragonfly (*Brachytron pratense*) and the reed beetle *Donacia clavipes*. The anthomzid fly, *Anagnota bicolor*, caught in one of the pond net samples, is also Nationally Scarce. Details of the ecology, status and distribution of these Nationally Scarce species are provided in Appendix F whilst the precise locations of these species at Hinkley is summarised in Table 2.

Species richness and diversity was generally low in the SSA, confirming the findings of AMEC (2009), although the Holford Stream was generally richer and more faunistically similar to the Wick Moor rhyne than other water courses surveyed. The Bum Brooke has mostly common and widespread running-water taxa in the upstream sample, with taxa more characteristic of slow or still water in the downstream sample, which was taken near the 'ponded-up' ford. The Wick Moor rhyne was relatively rich in taxa but disappointing in that more rare or uncommon species might have been expected from an SSSI.

Some taxa could not be identified to species due to taxonomic uncertainty (such as the *Hydra* species) whilst the identification of nymphs and larvae have generally been left at family level. *Sericostoma schneideri* is used in the sense of Again (2003). It is difficult to differentiate from *Sericostoma personatum* and specimens of this species from other sites, collected by the surveyor, are currently with Professor Rudiger Wagner in Germany awaiting confirmation. The small red-eyed damselfly *Erythromma viridulum* was first found in Britain in 1999 when it was found in Essex (Cham, 2001). Since then, this species has spread rapidly throughout Britain and it is probably present throughout much of England now as far north as Yorkshire. The ephydrid fly *Notiphila graecula* is mentioned as British by Drake (2001).

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Report template changed for consistency reasons but no other changes have been made since the original issue date.

Appendix A
Hinkley Moths Records

Table A1 UK Biodiversity Action Plan Moths Recorded from Hinkley Point Nature Trail with Details of their Foodplants and Habitats

UK BAP Moth	Larval Foodplants	Habitat
Malacosoma neustria	Trees and shrubs including hawthorn, blackthorn, sallow and fruit trees.	Open, sunny habitats especially hedgerows, scrubby places, gardens, etc.
Hemistola chrysoprasaria	Traveller's-joy	Downland, hedgerows and woodland rides.
Scotopteryx chenopodiata	Vetches and clovers	Wide range including dunes, downland, waste ground and grassy embankments.
Eulithis mellinata	Red currant and black currant	Commons and open woodland
Chiasmia clathrata	Lucerne, clover and trefoil	Downland, embankments, heaths, commons, open woodland and waste ground.
Ennomos fuscantaria	Ash	Woodland and parkland
Diloba caeruleocephala	Hawthorn, blackthorn, apple and other fruit trees	Woodland, commons and hedgerows.
Tyria jacobaeae	Common ragwort, groundsel and other Senecio spp	Especially well-drained, rabbit grazed grassland, also dunes and heaths.
Arctia caja	Wide variety of wild and garden plants	Wide range of open habitats including gardens, damp meadows, fens, river banks, dunes and open woodland.
Spilosoma lubricipeda	Various wild and garden plants	Most rural and urban habitats including gardens, hedgerows, grassland, etc
Spilosoma luteum	Various wild and garden plants	Most rural and urban habitats including gardens, hedgerows, parks and woodland, etc
Euxoa nigricans	Variety of wild and garden plants, trees and shrubs.	Commons, waste ground, gardens, dunes, marshes, etc
Diarsia rubi	Wide variety of herbaceous plants	Most abundant in damp woodland and other marshy places.
Mythimna comma	Cock's-foot and other grasses	Most numerous in fens and marshes, also in grassy places.
Allophyes oxyacanthae	Blackthorn, hawthorn, birch, sallow, apple and rowan	Woodland, hedgerows and bushy places.
Agrochola lychnidis	Various low plants	Wide variety of habitats
Xanthia icteritia	Sallow catkins then the leaves or low plants	Damp woodland, commons, marshy places, heaths, moorland, etc.

Table A1 (continued) **UK Biodiversity Action Plan Moths Recorded from Hinkley Point Nature Trail with Details of their Foodplants and Habitats**

UK BAP Moth	Larval Foodplants	Habitat
Atethmia centrago	Ash (buds then the leaves)	Woodland, hedgerows, river banks, etc.
Acronicta psi	Birch, oak, lime, elm, rowan, hawthorn, blackthorn, etc	Woodland, commons, gardens, heathlands, etc.
Acronicta rumicis	Variety of plants including plantains, docks, bramble, thistles, hop, etc	Most open habitats including gardens, grassland, heaths, wetlands, etc.
Amphipyra tragopoginis	Wide variety of wild and garden plants	Woodland, fens, dunes, moorland, gardens, etc.
Mesoligia literosa	Various grasses	Dunes, chalk sea-cliffs, commons, waste ground, etc.
Hydraecia micacea	Variety of low plants	Sea-cliffs, marshes, waste ground, etc.
Caradrina morpheus	Nettle, dandelion and other low plants	Wide variety of lowland habitats
Hoplodrina blanda	Variety of low plants such as plantain and docks	Gardens, waste ground, dunes, heaths, downland, etc

Table A2 **Occurrence throughout the Hinkley Sample Sites of Red Data Book and Nationally Scarce Invertebrates Recorded In 2009**

RDB & NS Species	Where Recorded in 2009
Homoneura limnea	Habitat mosaic immediately south of power station
Homoneura interstincta	Habitat mosaic immediately south of power station
Brachytron pratense	Wick Moor 4
Donacia clavipes	Wick Moor 5
Atypophthalmus inusta	Whitewall Brake and habitat mosaic immediately south of power station
Acanthiophilus helianthi	Grassland surrounding sewage treatment works
Dioxyna bidentis	Habitat mosaic immediately south of power station
Tetanocera punctifrons	Whitewall Brake
Anagnota bicolor	Wick Moor 4

Table A3 Invertebrate Importance of the Areas Surveyed on the Strategic Site Area

Area Surveyed	Valuation	Rationale
SSA streams north of the Green Lane	Parish	One Regionally Important water beetle. Low aquatic invertebrate species richness and diversity.
SSA ditch south of Green Lane (= Holford Stream)	Parish	No rare or uncommon aquatic species. Low aquatic invertebrate species richness and diversity but better than the streams north of the Green Lane.
Bum Brook	Parish	No rare or uncommon aquatic species. Low aquatic invertebrate species richness and diversity
Wick Moor rhyne	District	Three Nationally Scarce invertebrates suggests local/district interest. More species-rich and diverse than the other watercourses sampled.
Whitewall Brake	District	Two Nationally Scarce species suggests local/district interest. Mature trees and semi-natural woodland vegetation suggest more interest than plantations elsewhere on SSA.
Grassland-scrub-woodland mosaic immediately south of existing power station	District	Two RDB and three NS species suggests local/district interest (RDB species are under-recorded and probably more widespread).

Appendix B
Invertebrate Status Categories

[This document is reproduced from an English Nature document. Full details of the references given are given in the original document].

For the purposes of evaluating invertebrate faunas and priorities for conservation action, invertebrates are attributed various rarity status categories, the meanings of which are given below. Criteria for the selection of species into Red Data Book categories 1 to 5 follow Shirt (1987), with minor modifications derived from Hyman & Parsons (1992) and Parsons (1993).

Categories RDBI (Indeterminate) and RDBK (Insufficiently Known) are based on the criteria used by Wells, Pyle and Collins (1983). Criteria for the selection of Nationally Scarce species follow Eversham (1983) and Ball (1986).

Red Data Book Category 1 RDB1 - ENDANGERED

Definition	Taxa in danger of extinction in Great Britain and whose survival is unlikely if the causal factors continue operating.
	Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so dramatically reduced that they are deemed to be in immediate danger of extinction. Also included are some taxa that are possibly extinct.
Criteria	Species, which are known or believed, to occur as only a single population within one 10km square of the National Grid.
	Species, which only occur in habitats known to be especially vulnerable.
	Species, which have shown a rapid and continuous decline over the last twenty years and are now estimated to exist in five or fewer 10km squares.
	Species which are possibly extinct but have been recorded this century but which if rediscovered would need protection.

Red Data Book Category 2 RDB2 - VULNERABLE

Definition	Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating.
	Included are taxa of which most or all of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.
Criteria.	Species declining throughout their range.
	Species in vulnerable habitats.

Red Data Book Category 3 **RDB3 - RARE**

Definition	Taxa with small populations in Great Britain that are not at present Endangered or Vulnerable, but are at risk. These taxa are usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range.
Criteria	Species, which are estimated to exist in only 15 or fewer 10km, squares. This criterion may be relaxed where populations are likely to exist in over 15 10km squares but occupy small areas of especially vulnerable habitat.

Red Data Book Category 4 **RDB4 - OUT OF DANGER**

Definition	Taxa formerly meeting the criteria of one of the aforementioned categories but which are now considered relatively secure because effective conservation measures have been taken or the previous threat to their survival in Great Britain has been removed.

Red Data Book Category 5 **RDB5 - ENDEMIC**

Definition	Taxa, which are not known to occur naturally outside Great Britain. Taxa within this category may also be in any of the other RDB categories or not threatened at all. There are few truly endemic species in Great Britain. Most that have been identified are in fairly obscure groups, which are relatively poorly known, and the species may well eventually be discovered elsewhere in Europe.

Red Data Book Appendix **RDBApp. - EXTINCT**

Definition	Taxa which formerly had breeding populations in Great Britain but which are now believed to have died out. (Taxa not recorded since 1900)

Red Data Book Category I **RDB I - INDETERMINATE**

Definition	Taxa considered being Endangered, Vulnerable or Rare, but where there is not enough information to say which of the three categories (RDB1 to 3) is appropriate.

Red Data Book Category K **RDBK - INSUFFICIENTLY KNOWN**

Definition	Taxa that are suspected, but not definitely known, to belong to any of the aforementioned categories, because of lack of information.
Criteria	Taxa recently discovered or recognised in Great Britain, which may prove to be more widespread in the future (although some recent discoveries may be placed in other categories if the group to which they belong is thought not to be under- recorded).
	Taxa with very few or perhaps only a single known locality but which belong to poorly recorded or taxonomically difficult or unstable groups.
	Species with very few or perhaps only a single known locality, inhabiting inaccessible or infrequently sampled but widespread habitats, such as some northern moorland species, species associated with some agricultural situations and species which are adult only during the winter.
	Species with very few or perhaps only a single known locality and of questionable native status, but not clearly falling into the category of recent colonist, vagrant or introduction.

Provisional Red Data Book **pRDB**

Definition	The prefix ‘p’ before any Red Data Book category implies that the grading is provisional. In the majority of cases this means that the species' status has been reconsidered and changed in a Species Group Review produced subsequent to the publication of the relevant Red Data Book.
	The statuses so given are described as provisional, pending the publication of a future edition of that Red Data Book. These statuses are however, based upon a greater amount of evidence than was available for the original Red Data Book and therefore are more likely to be a true representation of the species' actual status.
	The prefix ‘p’ is also used for RDB status categories in groups where a Red Data Book has not yet been produced but is in preparation, or is used for species in groups covered by the original Red Data Book, where it is considered that there is evidence that the original grading was incorrect or that there has been a genuine change in status of the taxon.

Nationally Scarce (Notable) Species

The term ‘Nationally Scarce‘ was adopted and replaced the term ‘Notable‘ during the compilation of the Guidelines for the Selection of Biological SSSIs. The two terms are thus interchangeable but ‘Nationally Scarce’ is preferable.

Ball (1986) discusses the allocation of species to Nationally Scarce categories:

‘’The Invertebrate Site Register project includes the preparation of National Species Reviews which seek to identify and document uncommon species. The criteria used have been based directly on those evolved by botanists and two levels of 'National Notability’ has been used. These are Notable A, for species known to occur in 30 or less 10km squares of the National Grid and Notable B for those known from 100 or less squares.

Although this system can be used directly with well-recorded groups like Dragonflies, Butterflies and Grasshoppers; when dealing with many other groups of insects, the level of recording is not sufficient to apply the criteria rigorously. A combination of three alternative approaches has been employed:

1. *The approximate number of squares in which a species may occur can be estimated by looking at the number it has been recorded from as a proportion of the total in which the whole group (e.g. its family) has been recorded.*

Coarser measurements such as the number of vice-counties in which a species has occurred can be used (7 or less for Notable A, 20 or less for Notable B).

2. *Experts can be asked to use their field experience to judge the status of species in their particular specialist group against others with a better-established status. By consulting as many people as possible and taking a consensus of their views, geographical and personal biases can be minimized.*

3. *In some groups in which widespread interest and recording is a rather recent phenomenon, no attempt has yet been made to separate Notable A and Notable B species, and all Nationally Notable species are simply graded 'Notable'.*

Nationally Scarce (Notable) N - NOTABLE

Definition.	Species, which are estimated to occur in 16 to 100 10km, squares in Great Britain. The subdividing of this category into Nationally Scarce A and Nationally Scarce B has not been attempted for some species because of either the degree of recording that has been carried out in the group to which the species belongs, or because there is some other reason why it is not sensible to be so exact.

Nationally Scarce (Notable) Category A Na - NOTABLE A

Definition	Taxa which do not fall within RDB categories but which are uncommon in Great Britain and thought to occur in 30 or fewer 10km squares of the National Grid or, for less well recorded groups, within 7 or fewer vice-counties.

Nationally Scarce (Notable) Category B Nb - NOTABLE B

Definition	Taxa which do not fall within RDB categories but which are uncommon in Great Britain and thought to occur in between 31 and 100 10km squares of the National Grid or, for less well recorded groups, between 8 and 20 vice-counties.

Regionally Scarce (Notable) Nr - NOTABLE

Definition	Species which are considered to occur in 5 or less 10km squares in an area equivalent in size to a region of the old Nature Conservancy Council or larger, approximately one eighth the total area of England. Such statuses were worked out during the compilation of the Invertebrate Site Registers. They cover various groups in Scotland, in northern England as a whole, in north-east and north-west England, in vice-county Yorkshire and in the east Midlands and East Anglia. They were worked out by local entomologists.

LOCAL

Definition	The term is not rigidly defined, but loosely means species confined to a particular habitat type (usually associated with better quality examples of that habitat), a particular geographic area, or species that are too widespread to warrant Nationally Scarce (Notable) status but are nevertheless infrequently encountered.

COMMON

Definition	Common or very widespread species, frequently recorded.

SYANTHROPIC SPECIES

Definition	Species dependent upon man, his buildings, livestock or crops.

UNKNOWN

Definition	Species where no status has been attributed. There may be confusion over the species' taxonomy, it may belong to a poorly recorded group or may occur in an infrequently sampled habitat. As a species is entered into the Invertebrate Site Register or RECORDER, the status automatically defaults to 'Unknown'. Certain common or local species may therefore occasionally appear in this category if there has been no necessity to use the species record.

Appendix C
Terrestrial Invertebrates Recorded from Hinkley, Somerset: 2009

Site Name	WhitewallBrake	S.of p.station	STW
Survey Date	**18/06/09**	**18/06/09**	**07/08/09**
Grid Reference		2084945773	2138845764
Cepaea hortensis	1		
Helix aspersa	1		
Oxyloma pfeifferi	1		
Armadillium vulgare		1	
Philoscia muscorum		1	
Porcellio scaber	1		
Enoplognatha ovata	1	2	1
Eriophyes campestricola	1	1	
Eriophyes goniothorax typicus	1	1	
Eriophyes macrorhynchus		1	
Eriophyes macrochelus	1		
Phalangium opilio			1
Forficula auricularia		2	1
Cohorthippus brunneus			1
Leptophyes punctatissima	2	1	
Panorpa germanica			1
Ischnura elegans			1
Plectrocnemia conspersa	1		
Philaenus spumarius	2	6	3
Anthocoris nemorum	1		
Aphrophora alni		5	3
Calocoris sexguttatus	3		
Deraeocoris ruber			1
Liocoris tripustulatus		1	
Palomena prasina			2
Paedurus litoralis		1	
Malachius bipustulatus		1	
Oedemera nobilis		1	
Coccinella 7-punctata			1
Halyzia 16-guttata		1	
Leiopus nebulosus	1		
Pieris brassicae	1	1	1
Pieris rapae		1	
Aglais urticae		1	1
Vanessa cardui		1	1
Maniola jurtina		1	1
Parage aegeria	1	1	
Pyronia tithonus			1
Aricia agrestis			2
Polyommatus icarus			4
Ochlodes venatus	1		
Camptogramma bilineata		1	
Chiasmia clathrata			1
Opisthograptis luteolata	1		
Zygaena filipendulae			2
Tipula oleracea	1	1	
Achyrolimonia decemmaculata		2	
Atypophthalmus inusta	**5**	**2**	
Austrolimnophila ochracea	6	12	
Dicranomyia chorea	1		
Dicranomyia modesta	7	1	
Epiphragma ocellare		4	
Gonempeda flava	1		
Limonia nubeculosa	3	7	

Site Name	WhitewallBrake	S.of p.station	STW
Survey Date	**18/06/09**	**18/06/09**	**07/08/09**
Limonia phragmitidis		4	
Molophilus appendiculatus	5		
Molophilus bifidus	2		
Neolimnophila nemoralis	2		
Rhipidia duplicata	1		
Pseudolimnophila sepium	12		
Symplecta stictica	3		
Ptychoptera lacustris	3		
Dilophus febrilis			3
Sylvicola punctatus	1	2	
Beris clavipes	12		
Chloromyia formosa	2		
Pachygaster atra		2	
Chrysopilus cristatus		1	
Rhagio tringarius		3	
Dioctria linearis		1	
Platypalpus minuta s.l. (females)	1	2	
Ocydromia glabricula	1	4	
Empis lutea		4	
Chrysotus gramineus	1	6	2
Dolichopus griseipennis			1
Dolichopus wahlbergi	1		
Orthoceratium lacustre	1		
Poecilobothrus nobilitatus	2	2	
Sciapus platypterus	2	3	
Lonchoptera lutea	2		
Opetia nigra	1		
Cephalops semifumosus	1		
Baccha elongata	1		
Episyrphus balteatus	1		
Eristalinus sepulchralis			1
Eristalis arbustorum		1	3
Eristalis tenax			2
Ferdinandea cuprea		1	
Helophilus pendulus		1	1
Melanostoma mellinum			3
Melanostoma scalare		3	3
Pipizella viduata		2	2
Platycheirus albimanus	1	1	
Platycheirus angustatus			2
Platycheirus clypeatus		1	8
Platycheirus granditarsa			2
Platycheirus scutatus		1	
Rhingia campestris			4
Ripponensia splendens		1	
Sphaerophoria scripta			1
Syritta pipiens		2	
Syrphus vitripennis/rectus	1		
Acanthiophilus helianthi			**2**
Chaetostomella cylindrica			3
Dioxyna bidentis		**1**	
Urophora quadrifasciata			24
Urophora stylata		3	
Herina germinationis			1
Calliopum simillimum	1		

Site Name	WhitewallBrake	S.of p.station	STW
Survey Date	**18/06/09**	**18/06/09**	**07/08/09**
Homoneura interstincta		**1**	
Homoneura limnea		**1**	
Meiosimyza rorida	3	8	
Minettia fasciata	3	9	5
Minettia longipennis	10	7	
Minettia tabidiventris		5	
Minettia tubifer	3	1	
Peplomyza litura	1		
Sapromyzosoma quadripunctata			1
Limnia unguicornis			1
Pherbellia cinerella		1	3
Pherbellia scutellaris		1	
Tetanocera punctifrons	**10**		
Opomyza germinationis		2	
Opomyza petrei			2
Sepsis duplicata	1		
Agromyza reptans/pseudoreptans	1	1	
Clusiodes albimana	1	1	
Tephrochlamys rufiventris	1		
Diastata fuscula	1		
Drosophila andalusiaca	1		
Leucophenga maculata		1	
Scaptomyza pallida	3		
Limosina sylvatica	1		
Lotophila atra		3	
Scathophaga stercoraria		1	1
Calliphora vicina		1	
Haematobosca stimulans		2	
Mesembrina meridiana		1	2
Musca autumnalis		1	
Muscina levida		1	
Muscina prolapsa		1	
Myospila meditabunda	1		
Polietes lardarius		2	
Fannia armata	1	5	
Fannia hamata		1	
Abia sp		2	
Amblyteles armatorius	1		
Lasius niger		1	
Vespula rufa	1		
Hylaeus hyalinatus		1	
Bombus lapidarius		1	>30
Bombus pascuorum			2
Bombus terrestris			1

Appendix D
Aquatic Invertebrates Recorded from Hinkley, Somerset: May-June 2009

Sample Name	**D1**	**D2**	**D3**	**D5**	**D6**	**D13**	**D14**	**D15**	**BumBrookU**	**BumBrookD**	**WickMoor3**	**WickMoor4**	**WickMoor5**
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Hydra sp								1					
Nematoda	1												
Polycelis sp	102		5	3	2	2	1	1					
Annelida indet.				1									
Oligochaeta			272	299	8	609	8			20			
Eisenella tetraedra	476		5	1					2				
Erpobdella testacea						1							
Glossiphonia complanata	7		10	6	4	1				12	1		
Helobdella stagnalis	1			7	2								
Theromyzon tessulatum									1				
Anisus leucostoma													
Anisus vortex			1					16			1		2
Aplexa hypnorum								2			1		1
Armiger crista										1			
Galba truncatula							22						
Lymnaea stagnalis							1	1			30	13	49
Oxyloma pfeifferi				65	4	2		2		1	2		
Physa fontinalis								3		5	1		22
Planorbis planorbis							9	315			154	33	330
Potamopyrgus antipodarum				52	3200			2	3		105	539	1100
Radix balthica	1		1			223	1100	2000		2	273	13	9
Vertigo sp				1									
Musculium lacustre											1	1	
Pisidium sp	2		187	572	5	811			3	196	2		
Asellus aquaticus						1444	33	60		60	49		8
Asellus meridianus	42		221	117	279			3					
Crangonyx pseudogracilis												2	4
Gammarus pulex									93	96			
Copepoda	119		119	3	1								
Ostracoda	5			1	1	2				26			
Simocephalus vetulus	11												
Hydrachnellae													
Arrhenurus ?securiformis			1										
Arrhenurus sp	4		1	1	1								
Eylais hamata							7						
Hydrachnellae indet.				1									

Sample Name	**D1**	**D2**	**D3**	**D5**	**D6**	**D13**	**D14**	**D15**	**BumBrookU**	**BumBrookD**	**WickMoor3**	**WickMoor4**	**WickMoor5**
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Hydryphantes ruber				1									
Hygrobates fluviatilis					3								
Hygrobates longipalpis						3				8			
Hygrobates nigromaculatus						3			3	4			
Lebertia sp	1		2		2				1	8			
Sperchon longissimus	1												
Sperchon sp				8									
Thyas rivalis	2		16	3	1								
Baetis rhodani									3				
Caenis luctuosa									10				
Cloeon dipterum						1							
Ephemerella ignita									14				
Leptophlebia marginata										1			
Sialis lutaria										1	2	5	1
Coenagrion puella					1		1	3					
Ischnura elegans								6			9	5	7
Pyrrhosoma nymphula					1								
Brachytron pratense												**1**	
Cordulegaster boltoni					1								
Libellulidae (small instars)							3						
Sympetrum sanguineum/striolatum						2							
Beraea pullata	4		2	5									
Limnephilus lunatus	1		1		14	42			5	4	3	4	2
Sericostoma personatum										1			
Sericostoma schneideri									1				
Callicorixa praeusta							1						
Hesperocorixa sahlbergi							1				1		
Corixidae (N)					2	47	66	7			77	5	4
Gerris lacustris						1						1	1
Gerris sp (N)								9			7	5	25
Hydrometra stagnorum										1			
Notonecta sp (N)					3	7	1	6	1	5	2	1	1
Sigara dorsalis										2	9		
Sigara venusta					1								
Velia sp (N)			2	2		1	2	1	10	2	1		
Gyrinus substriatus						1	1	1	1	2	3	3	9

Sample Name	D1	D2	D3	D5	D6	D13	D14	D15	BumBrookU	BumBrookD	WickMoor3	WickMoor4	WickMoor5
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Gyrinus sp (L)							1						
Haliplus lineatocollis							11			1	4	4	2
Haliplus ruficollis (M)							1				3		3
Haliplus ruficollis gp (F)						1	2	1			7	4	4
Haliplus sibiricus (M)												2	2
Haliplus sp (L)				1							9	3	3
Noterus clavicornis							1						
Agabus bipustulatus	3					12	2			2	3		3
Agabus congener			**1**										
Agabus didymus			1								5		1
Agabus sturmii											1		
Coelambus impressopunctatus							1						
Colymbetes fuscus (A)						1							
Colymbetes fuscus (L)							6						
Dytiscus marginalis											1		
Dytiscus sp (L)						2	4	1			1		2
Dytiscini (L)	19		3	1	1	2	44			1		1	2
Graptodytes pictus								1					
Hydroporus incognitus							1	1					
Hydroporus palustris							1	1		1	1	1	1
Hydroporus planus						1							
Hydroporus pubescens										1			
Hydroporus tessellatus	1					7	8	4			1		
Hydroporini (L)						1	2						
Hygrotus inaequalis							1						
Ilybius ater											3		
Ilybius fuliginosus						1							
Nebrioporus depressus elegans									2		2		
Platambus maculatus									4				
Anacaena globulus			1										
Anacaena limbata						27	3	7			7	2	
Anacaena lutescens							1						
Enochrus testaceus											1		
Hydrobius fuscipes						4	21						2
Laccobius bipunctatus						1					2	1	2
Hydrophilidae (L)	1				1	7	30	2				1	

Sample Name	**D1**	**D2**	**D3**	**D5**	**D6**	**D13**	**D14**	**D15**	**BumBrookU**	**BumBrookD**	**WickMoor3**	**WickMoor4**	**WickMoor5**
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Helophorus brevipalpis	1				1	77	47	21	28	5	476	151	401
Helophorus grandis						9	14	2			5	1	11
Helophorus minutus						11		2			1	5	
Ochthebius dilitatus						1			2		5	3	2
Elmis aenea (A)									6				
Elmis aenea (L)									3				
Limnius volckmari (L)									3	1			
Oulimnius sp (L)					2								
Dryops sp (F)								1					
Scirtes sp (L)									3				1
Donacia clavipes													**1**
Tipula sp (L)	53		1				1	1		1			
Molophilus sp (L)			1										
Ptychoptera sp (L)	51		1		3								
Chironomini (L)	51				1	133	22	12	39	12	1	2	1
Chironomus sp (PE)						361	16	1	1				
Tanytarsini (L)	136		34	1	201	2			6	204	1	4	2
Orthocladiinae (L)	170		3	1			4		1				
Brillia modesta (L)	11		51		14								
Metriocnemus sp (L)	29		2	1	1		1						
Prodiamesa olivacea (L)	1						1			5	1		
Tanypodinae (L)	3		7	6	139	77	1	1		24	3		1
Procladius (*Holotanypus*) sp (P)						1					4		
Psectrotanypus varius (PE)						28	1						
Culicidae indet. (L)			1			1							
Anopheles sp (L)	5				1		1						
Culex sp (L)							1						
Culicidae (P)					3	1	3						
Ceratopogonidae (L)	3		12	91						1		1	
Ceratopogonidae (P)			3	3		3	3						
Dixidae (L)	2		1										
Dixa nebulosa (L)					6				1	1			
Dixella sp (L)							1						
Dixella aestivalis (L)						1							
Psychodidae (L)	14		289	65	6		1	1		8			
Psychodidae (P)			3	1	2								

Sample Name	**D1**	**D2**	**D3**	**D5**	**D6**	**D13**	**D14**	**D15**	**BumBrookU**	**BumBrookD**	**WickMoor3**	**WickMoor4**	**WickMoor5**
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Psychoda sp (L)			4										
Simulium sp (L)					2								
Oxycera nigricornis (L)			1										
Lonchoptera sp (L)	1												
Hemerodrominae (L)	1												
Clinocera sp (PE)					1								
Sciomyzidae (L)							1	1					
Scatella sp (L)						2							
VERTEBRATES RECORDED IN POND NET SAMPLES													
Gasterosteus aculeatus						5	121	4	1	6	27	11	27
Pungitius pungitius											1		
Rana temporaria (tadpoles)						10					1		
TERRESTRIAL INVERTEBRATES RECORDED IN POND NET SAMPLES													
Clausilia bidentata	1						1			2			
Discus rotundatus				1						3			
Ena obscura													
Euconulus sp					2								
Lauria cylindracea					2								
Punctum pygmaeum						1							
Tetragnatha extensa (M)			1										
Trichoniscus pusillus	1		1		2								
Leptophyes punctatissima			1										
Tetrix subulata		1											
Erythromma viridulum (F)						1							
Sphaeridium scarabaeoides	1												
Malachius bipustulatus												1	
Prasocuris phellandri						1	2				1		1
Erioptera griseipennis (M)			1										
Euphylidorea lineola		1											
Chloromyia formosa												1	
Poecilobothrus nobilitatus													2
Teucophorus spinigerellus											1		14
Anagnota bicolor												**1**	

Sample Name	D1	D2	D3	D5	D6	D13	D14	D15	BumBrookU	BumBrookD	WickMoor3	WickMoor4	WickMoor5
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Hydrellia albilabris								2					
Hydrellia appendiculata						26							1
Hydrellia maura							4	1			6		
Notiphila cinerea													
Notiphila graecula							11						
Notiphila nubila						27							
Notiphila riparia													6
Parydra coarctata						2							1
Scatella stagnalis											1		

A = Adult(s)
F = Female(s)
L = Larva(e)
M = Male(s)
N = Nymph(s)
P = Pupa(e)
PE = Pupal exuvia(e)

Appendix E
Details of the Aquatic Invertebrate Sample Sites, Hinkley, Somerset: May-June 2009

Sample Name	D1	D2	D3	D5	D6	D7	D11	D13	D14	D15	BumBrookU	BumBrookD	WickMoor3	WickMoor4	WickMoor5
Sample Date	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**27/05/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**	**19/06/09**
Grid Ref (ST)	1999945778	1975045718	2014045817	2030845831	No GPS	1970745879	1994245205	2065945258	2074745263	2139045361	2035744555	1986644464	2169445724	2162545991	2164545857
Mud substrate (%)	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100
Silt substrate (%)	0	0	0	0	0	0	0	0	0	0	70	0	0	0	0
Stony substrate (%)	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0
Wetted channel width (cm)	40	0	30	30	100	0	0	100	150	200	200	400	100	150	100
Water depth (cm)	5	Dry	5	5	8	Dry	Dry	40	50	>50	40	40	40	40	40
Water flow	0	Dry	0	0	1	Dry	Dry	0	0	0	1	1	0	0	0
pH	7.06	Dry	7.33	7.23	7.45	Dry	Dry	7.71	7.68	9.57	8.6	8.29	7.94	8	8.3
Conductivity	869	Dry	760	746	993	Dry	Dry	923	1299	410	548	813	490	516	498
Total dissolved solids (ppm)	435	Dry	381	373	493	Dry	Dry	463	649	205	271	408	243	258	247
Temperature (ºC)	12	Dry	11.4	11.7	11.6	Dry	Dry	15.3	14.2	15.6	14.6	18.2	16.9	19.8	20.6
Acer campestre	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Apium nodiflorum	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Bryonia dioica	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Callitriche stagnalis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Carex pendula	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Ceratophyllum sp	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Cirsium sp	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Coarse grasses	0	0	1	1	0	0	1	0	0	1	1	0	0	1	1
Corylus avellana	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
Crataegus monogyna	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0
Epilobium sp	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Equisetum sp	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eupatorium cannabinum	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Geranium robertianum	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Glyceria sp	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0
Hedera helix	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Heracleum sphondylium	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Impatiens glandulifera	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Juncus effusus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Lemna minor	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ligustrum vulgare	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Mentha aquatica	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Myosotis scorpioides	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Oenanthe sp	1	1	1	0	1	1	1	0	1	0	0	1	0	0	0
Phragmites australis	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1
Phyllitis scolopendrium	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Prunus spinosus	0	0	1	1	0	1	1	0	0	1	0	0	0	0	0
Ranunculus (Batrachium) sp	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Rorippa nasturtium-aquaticum	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Rosa sp	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Rubus fruticosus agg.	1	1	0	1	1	1	1	0	0	0	1	0	0	0	0
Rumex obtusifolius	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rumex palustris	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0
Salix caprea	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Scrophularia aquatica	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Solanum dulcamara	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Sparganium erectum	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Urtica dioica	1	1	1	1	0	0	1	1	0	0	0	0	0	1	0

Water flow (row 10): 0 = absent, 1 = slow, 2 = moderate, 3 = fast

For rows 15-52, 0 = absent, 1 = present

Appendix F
Details of the Ecology, Status and Distribution of the Red Data Book and Nationally Scarce Species Recorded

Red Data Book 2

Homoneura limnea

Falk & Ismay (in prep.) state that this species has only been recorded from three UK sites, namely, the Monnow Valley, Herefordshire (between 1907 and 1912); Merthyr Mawr Warren, South Wales (1992), Pyle (1908) and nearby Porthcawl (1906), Glamorganshire. There is no recent information on this species in Britain. It may persist at sites in Glamorganshire such as Kenfig Burrows NNR (which may encompass the Pyle and Porthcawl sites), although there has been some degrading of the coast through construction of steel works and recreational facilities. The Glamorganshire sites are essentially coastal dunes and the River Monnow has numerous sandy banks, suggesting a link with sandy areas. The early stages of this species are unknown; larvae of this family are believed to develop in decaying vegetable matter including fallen leaves.

Red Data Book 3

Homoneura interstincta

This species has been recorded widely in southern England (nine counties) with an isolated record for North Wales (Merionethshire). There are seven known post-1960 records according to Falk and Ismay (in prep.). It is probably more widespread but belongs to an under-recorded family. Most records refer to damp broad-leaved woodland, a few refer to wetlands, possibly in shaded situations or associated woods and a record for Thompson Common, Norfolk refers to an area with pingo pools, possibly in association with carr. The early stages of this species are unknown; larvae of this family are believed to develop in decaying vegetable matter including fallen leaves.

Nationally Scarce

Brachytron pratense

The hairy dragonfly is most commonly found in Britain on the coastal levels and grazing marshes of Somerset, Sussex, Kent and Norfolk. It also occurs in the fens of Anglesey, the Cheshire meres and on the wetlands along the coast of South Wales and Suffolk. This species breeds in mesotrophic ponds, lakes including mature gravel pits, canals, ditches and marshy fens where there is plenty of tall emergent vegetation such as common club-rush, common reed, bulrush and great fen-sedge. This species has a short flight season from mid-May to mid-July. It can be found with other species that favour unpolluted well-vegetated dykes and fens (Merritt et al 1997).

Donacia clavipes

This reed beetle has been recorded from England, Scotland and Wales. It is found in aquatic and semi-aquatic habitats such as freshwater lakes, ponds and ditches. It is usually associated with reed *Phragmites australis* and bur-reed *Sparganium* spp. The adults are typically found on emergent and marginal vegetation and have been recorded in June.

Atypophthalmus inusta

This cranefly occurs as far north as Yorkshire and Wales with records predominating in southern counties. Falk (1991) stated that he knew of 40 post-1960 records; this is likely to have increased quite considerably over the last 20 years. This species is found in damp woodland and carr in lowland areas. The larvae breed in fungi including decaying *Merulius tremellosus*. The adults have been recorded from June to September.

Acanthiophilus helianthi

This picture-winged fly has been recorded from scattered localities in southern England (nine counties) and one county in Wales. Falk (1991) stated that there were about ten post-1960 sites known to him, scattered widely over the known range. It has been found more frequently since (Clemons 1996). This species occurs in dry grassland, meadows and occasionally gardens. The larvae have been reared from the flowerheads of common knapweed (*Centaurea nigra*) in Britain although abroad they are known from around fifty species of Cardueae. The adults have been recorded from June to September.

Dioxyna bidentis

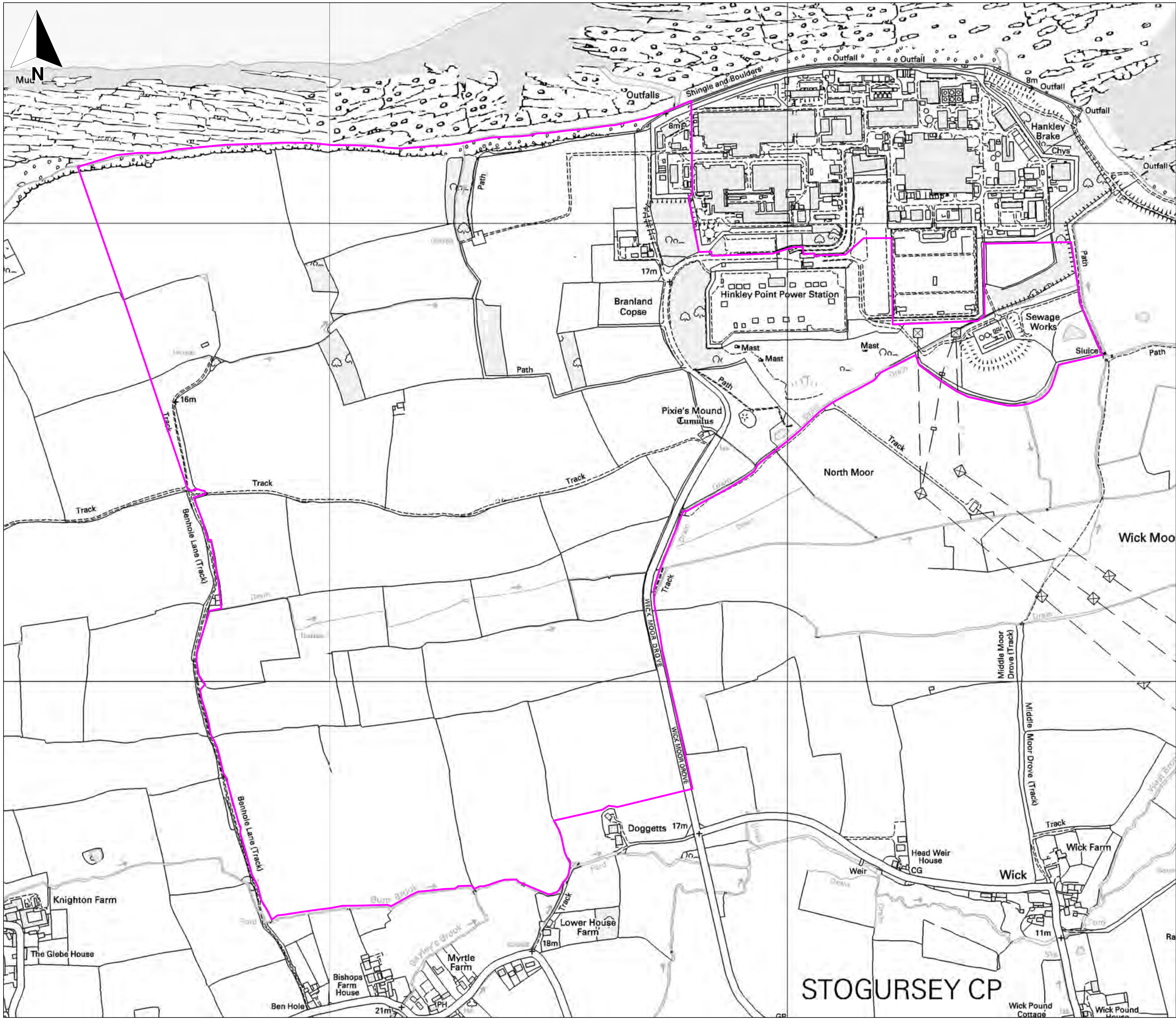
Records for this picture-winged fly are widely dispersed in England as far north as Yorkshire and with an old (1936) record for Scotland. This species is widespread but local with nine known post-1960 records. The habitat preferences of this species are unclear, records include marshes and wet areas on commons and dunes. The larvae usually develop in the flowerheads of the local tripartite bur-marigold *Bidens tripartita* although it may develop in a range of composite hosts according to Clemons (1996). The adults have been recorded from June to October.

Tetanocera punctifrons

Records of this snail-parasitoid fly have been widely scattered in England (nine counties), Wales (two counties) and Scotland (three counties). This species is widespread with about 20 post-1960 sites known to Falk (1991). This species occurs in wetlands, damp woodland, also riverside situations, damp heathland and coastal marshes. The larvae probably develop as predators or parasitoids of gastropod molluscs, but it is unclear whether they attack aquatic or terrestrial species.

Anagnota bicolor

Records for this minute anthomyzid fly are widespread with records from thirteen English counties, four Welsh counties and five Scottish. There are 16 post-1960 records according to Falk and Ismay (in prep.) but it is probably more widespread but too secretive or scarce to be detected by the present levels of recording. This species is usually associated with *Phragmites* in marshes and coastal levels according to Falk and Ismay (in prep.), although most of the surveyors records have come from grass and sedge tussocks. There are records of the larvae developing in the galls of the chloropid fly *Lipara* on *Phragmites*.



Key

SSA boundary

0 m — 250 m

Scale 1:8000 @ A3

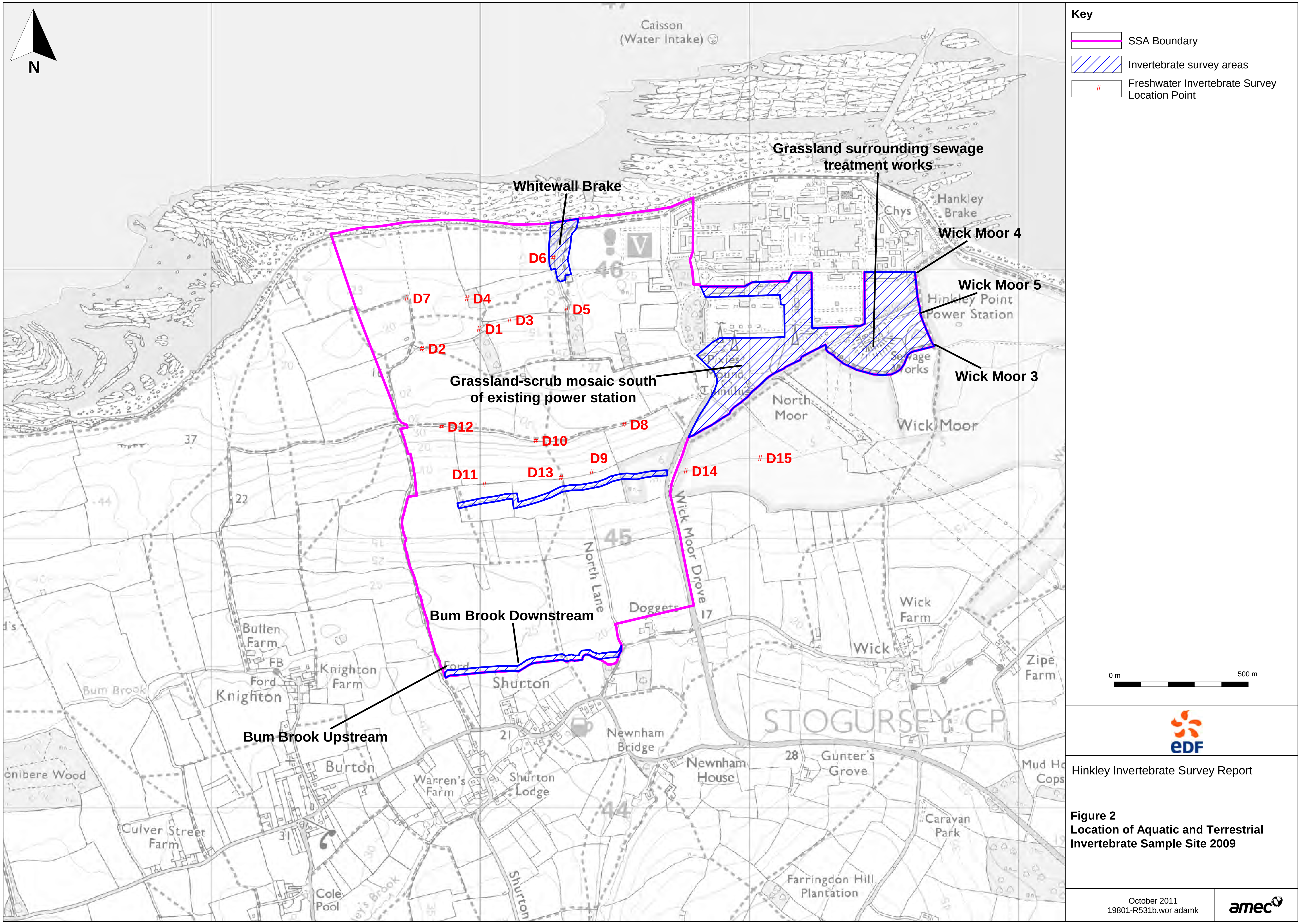
EDF

Hinkley Invertebrate Survey Report

Figure 1
SSA boundary

October 2009
19801-R530b.wor adamk

amec



EDF

Hinkley Invertebrate Survey Report

Figure 2
Location of Aquatic and Terrestrial Invertebrate Sample Site 2009

October 2011
19801-R531b.wor adamk

amec

APPENDIX 20L: HINKLEY INVERTEBRATE SURVEY REPORT – COASTAL INVERTEBRATE SURVEY

Coastal Invertebrate Survey 2010

June 2011

CONTENTS

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1 INTRODUCTION

1.1.1 During the Hinkley Point C (HPC) Project Stage 2 consultation in 2010, Somerset County Council commented that a number of notable invertebrate species had been recorded in coastal habitats on the north side of the Severn Estuary in Gwent and Glamorgan. In view of this, they suggested that there may be potential for notable invertebrates to occur in the coastal habitats within and/or adjacent to the HPC site boundary.

1.1.2 In response to the County Council's concerns, a survey was undertaken to assess the potential for notable invertebrate populations to occur in the coastal habitats adjacent to the HPC site. This survey was undertaken by an experienced entomologist (Andy Godfrey) and augmented previous invertebrate survey work that he had undertaken in relation to habitats elsewhere on the HPC site.

2 METHODS

2.1 Survey Area

2.1.1 The survey area comprised a 1km stretch of coastline west of the existing Hinkley Point Power Station Complex. This included the entire length of coastal habitats adjacent to the HPC site.

2.2 Habitat Assessment

2.2.1 The main purpose of the survey was to identify whether there are any habitats along the coastal strip that are likely to support important populations of invertebrates. Information was collected about vegetation cover, and about habitat features that could support important populations of invertebrates, including recently slumped areas of cliff with 'soft' areas of bare ground, seepage and other wetland areas.

2.3 Sampling Methods

2.3.1 To supplement the habitat suitability assessment, the opportunity was taken to collect invertebrate records in order to augment the findings from any future systematic survey work, should this be needed. This involved the use of a suite of standard methods for collecting invertebrates, as described below.

2.3.2 All observations of butterflies, day-flying moths and other conspicuous invertebrates were recorded in the field, without the need for collection. In addition, terrestrial invertebrate samples were collected by both sweep-netting and direct searching (e.g. under stones or timber, on flower-heads) at regular sample points on each transect route.

2.3.3 During the survey of the foreshore, decaying seaweed and other shoreline material was sieved in order to extract any associated invertebrates. All samples were preserved in alcohol for later identification under a microscope (to species-level wherever practical), using standard reference works.

3 RESULTS

3.1 Weather Conditions

3.1.1 The survey work was undertaken on 15 September 2010. The weather conditions were sunny, with 30% cloud cover and a strong south westerly wind.

3.2 Habitats

3.2.1 The habitats present comprise sections of cliff, which, especially in the vicinity of Whitewall Brake, support dense scrub dominated by elder (*Sambucus nigra*), bramble (*Rubus fruticosus agg.*) and blackthorn (*Prunus spinosa*). There are also some areas of bramble combined with tall herb grassland, supporting species that include teasel (*Dipsacus fullonum*), broad-leaved dock (*Rumex obtusifolius*), *Myosotis* sp., false oat-grass (*Arrhenatherum elatius*), hedge woundwort (*Stachys sylvatica*), creeping thistle (*Cirsium arvense*) and cleavers (*Galium aparine*). Where Whitewall Brake adjoins the coastal strip, there is a section of the shoreline where there is no cliff.

3.2.2 Along the shallow section of cliff in the vicinity of Whitewall Brake, no habitats were recorded that are likely to support important populations of invertebrates. Towards the eastern end of the coastal strip and to the west of Whitewall Brake, the cliffs are taller and have extensive exposures of hard rock, often with sparse vegetation. Again no habitats were recorded that are likely to support important populations of invertebrates.

3.2.3 Along the cliff top, habitats include scrub, and short and rank grassland, as well as the semi-natural woodland of Whitewall Brake. To the west of Whitewall Brake, the extent of scrub declines until the semi-natural habitat along the cliff top is restricted to narrow strips of calcareous grassland between the arable crops and cliff edge. The topography here is more uniform than to the east of Whitewall Brake, with few areas that provide a sheltered microclimate for invertebrates.

3.2.4 The foreshore mostly comprises coarse shingle and exposed wave-cut platforms with infrequent drift-lines of seaweed and piles of sea-worn timber, which provide habitat for invertebrates that are adapted to live in this environment.

3.3 Invertebrate records

3.3.1 Fifty three terrestrial invertebrate species were recorded during the survey. These included three Nationally Scarce species. **Table 1** lists these species, their nature conservation status and the location in which they were found. In addition to these three notable species, the Nationally Scarce bombardier beetle *Brachinus crepitans* was recorded on the cliff top during a previous survey (15 August 2008 - Hinkley Invertebrate Survey Report, Entec 2009).

Table 1 – Notable invertebrate species recorded

Scientific name	Common Name	Nature Conservation Status	Location
Platycleis albopunctata	Grey bush-cricket	Nationally Scarce	Cliff top
Cercyon depressus	A scavenger beetle	Nationally Scarce	Foreshore
Heterota plumbea	A rove beetle	Nationally Scarce	Foreshore

3.3.2 A single grey bush-cricket (*Platycleis albopunctata*) was swept from scrub vegetation on the cliff top. This large cricket is strictly a coastal species in Britain and is frequent along the coast of southern England and Wales, occurring amongst coarse grasses and rough vegetation on sand dunes, shingle beaches and sea cliffs.

3.3.3 The scavenger beetle *Cercyon depressus* has been recorded throughout England, Scotland and Wales and is labelled as very local in Somerset, with old records (from the 1950s) from Blue Anchor and Berrow to the west and east of the site respectively (Duff, 1993). It is associated with coastal habitats such as beaches and saltmarsh creeks and is usually found under decaying seaweed and other coastal debris (as it was during this survey).

3.3.4 The rove beetle *Heterota plumbea* has mainly been recorded from southern England and Wales, but is also very local in Somerset (Duff, 1993) and is a Somerset Notable species. It is another coastal species, occurring under seaweed and amongst shingle.

4 CONCLUSIONS

4.1.1 None of the habitats that were recorded along the coastal strip are likely to support important populations of invertebrates. There is therefore no need for systematic invertebrate surveys on this part of the site.

4.1.2 Although the four notable invertebrate species were recorded at only a limited number of locations along the strandline or cliftop, it is likely that these species also occur elsewhere along the coastal strip that adjoins the site of the proposed development. Thus there is no reason to design the development to avoid the locations where these species were recorded.

5 REFERENCES

Duff, A. (1993) Beetles of Somerset. Somerset Archaeological & Natural History Society.
Entec (2009) Hinkley Invertebrate Survey Report. Unpubl. report to EDF Energy.

Appendix A
Raw data

2 Pages

Table A1: Invertebrates recorded during the survey

	Location recorded (and number of individuals)	
Species	**CLIFF TOP**	**FORESHORE**
Ligia oceanica		5
Porcellio scaber		2
Petrobius brevistylis		5
Chorthippus parallelus	1	
Leptophyes punctatissima	1	
Platycleis albopunctata	**1**	
Philaenus spumarius	2	
Limnephilus auricula	1	
Paranchus albipes		1
Cercyon depressus		**1**
Cercyon littoralis		1
Omalium laeviusculum		1
Teropalpus unicolor		1
Cafius xantholoma		1
Heterota plumbea		**1**
Phaleria cadaverina		1
Harmonia axyridis	1	
Pieris napi/rapae	1	
Polyommatus icarus	1	
Coptotriche marginea	1	
Rhegmoclema coxendix		2
Schwenkfeldina carbonaria		2
Sciara hemerobioides	1	
Chersodromia arenaria		3

Ocydromia glabricula	1	
Dolichopus griseipennis	1	
Eristalis tenax	1	
Minettia fasciata	3	
Sapromyza sordida	3	
Pherbellia ventralis	1	
Opomyza germinationis	1	
Orygma luctuosum		13
Sepsis cynipsea	2	
Galiomyza morio	1	
Elachiptera cornuta	1	
Oscinella maura	1	
Thaumatomyia glabra	1	
Coelopa frigida		1
Coelopa pilipes		6
Malacomyia sciomyzina	1	
Thoracochaeta zosterae		50
Thrysocnema incisilobata	1	
Calliphora vicina	1	
Melinda viridicyanea	1	
Nyctia halterata	1	
Anthomyia liturata	7	
Delia florilega	1	
Delia platura	1	
Delia radicum	1	
Helina evector	3	
Helina impuncta	6	
Neomyia cornicina	3	
Siphona setosa	4	

APPENDIX 20M: IDENTIFICATION OF BIODIVERSITY RECEPTORS

Appendix 20M - Identification of Biodiversity Receptors

Box 20M.1 Designated Wildlife Sites, and Priority Habitats and Species

Statutory Nature Conservation Sites

- Special Areas of Conservation (SACs) and candidate SACs.
- Special Protection Areas (SPAs) and proposed SPAs.
- Sites of Community Importance.
- Ramsar sites.
- European offshore marine sites.
- Sites of Special Scientific Interest (SSSIs).
- National Nature Reserves (NNRs).
- Local Nature Reserves (LNRs).

Non-statutory Nature Conservation Sites

Non-statutory nature conservation sites in Somerset are notified as County Wildlife Sites.

Priority Habitats and Species

- Populations of species or areas of habitat for which European sites are designated.
- Populations of birds meeting the threshold for European importance (1% of the relevant international population).
- Species listed as Near Threatened, Vulnerable or Endangered in the UK on the IUCN Red Data List (http://www.iucnredlist.org/apps/redlist/search).
- Habitats and species of principal importance for the conservation of biological diversity in England. These are listed on http://www.ukbap-reporting.org.uk/news/details.asp?X=45. These include those UK BAP priority habitats and species that occur in England.
- Species listed as being of conservation concern in the relevant UK Red Data Book (RDB) or the Birds of Conservation Concern Red List.
- Nationally Rare and Nationally Scarce species, which are species recorded from, respectively, 1-15 and 16-100 10x10km squares of the national grid;
- Populations of birds comprising at least 1% of the relevant British breeding/wintering population (where data is available).
- Ancient woodland (i.e. areas that have been under continuous woodland cover since at least 1600).
- Habitats and species listed in the Somerset LBAP.
- Species listed in County Red Data Books or other county lists of rare or declining species.
- Populations of birds comprising at least 1% of the relevant County breeding/wintering population (where data are available).
- Habitats and species listed in the West Somerset LBAP.
- Habitat networks.

Box 20M.2 Legally Protected and Controlled Species

Legal Protection

Many species of animal and plant receive some degree of legal protection. For the purposes of this ES, legal protection refers to:

- species included on Schedules 1, 5 and 8 of the *Wildlife and Countryside Act 1981* (as amended), excluding species that are only protected in relation to their sale (see Section 9[5] and 13[2]), reflecting the fact that the Scheme does not include any proposals relating to the sale of species;
- species included on Schedules 2 and 5 of the *Habitats Regulations 2010*; and
- badgers, which are protected under the *Protection of Badgers Act 1992*.

Legal Control

Schedule 9 of the *Wildlife and Countryside Act 1981* (as amended) lists species of animal that it is an offence to release or allow to escape into the wild and species of plant that it is an offence to plant or otherwise cause to grow in the wild.

APPENDIX 20N: BIODIVERSITY RECEPTOR SCOPING TABLE

Appendix 20N: Biodiversity Receptor Scoping Table

Table 20N.1 – Results of biodiversity receptor scoping – PART 1

'Important' receptors (i.e. that meet the criteria in Appendix 20M) recorded within the study area from both desk study and field surveys	Legally protected and/or could be of sufficient value for potential impacts to be significant?		Justification if receptors are of insufficient value for impacts to be significant	Scoping conclusion
	Legally protected	Value[1]		
Habitats				
Off-site ditches and grazing marsh	Yes	Yes	N/A	See Table 20N.2
Off-site wetland areas	No	Yes	N/A	See Table 20N.2
Lowland calcareous grassland	No	Yes	N/A	See Table 20N.2
Woodland	No	Yes	N/A	See Table 20N.2
Hedgerows	No	Yes	N/A	See Table 20N.2
Watercourses	No	Yes	N/A	See Table 20N.2
Water bodies	No	No	The pond within the site is a heavily shaded and scrub-encroached seasonal waterbody. It does not meet the criteria for the UKBAP 'Ponds' priority habitat.	Scoped out

[1] Value - the receptor is of sufficient quality (for sites and habitats) or size (for sites, habitats or species populations) that an impact upon it could be significant.

'Important' receptors (i.e. that meet the criteria in Appendix 20M) recorded within the study area from both desk study and field surveys	Legally protected and/or could be of sufficient value for potential impacts to be significant?		Justification if receptors are of insufficient value for impacts to be significant	Scoping conclusion
	Legally protected	**Value[1]**		
Habitat networks	No	Yes	N/A	See Table 20N.2
Fauna				
Breeding birds	Yes	Yes	N/A	See Table 20N.2
Lesser whitethroat	Yes	Yes	N/A	See Table 20N.2
Cetti's warbler	Yes	Yes	N/A	See Table 20N.2
Wintering waterbirds (including SPA/Ramsar/SSSI qualifying features)	Yes (in part)	Yes	N/A	See Table 20N.2
Passage waterbirds (including SPA/Ramsar/SSSI qualifying features)	Yes (in part)	Yes	N/A	See Table 20N.2
Wintering and passage birds (other than waterbirds)	No	Yes	N/A	See Table 20N.2
Badger	Yes	No	Badgers are sufficiently common and widespread in Somerset that an impact upon the local population would not be significant	See Table 20N.2 (due to legal requirements)
Barbastelle bat	Yes	Yes	N/A	See Table 20N.2
Lesser horseshoe bat	Yes	Yes	N/A	See Table 20N.2
Greater horseshoe bat	Yes	Yes	N/A	See Table 20N.2
Bat assemblage	Yes	Yes	N/A	See Table 20N.2
Otter	Yes	Yes	N/A	See Table 20N.2

'Important' receptors (i.e. that meet the criteria in Appendix 20M) recorded within the study area from both desk study and field surveys	Legally protected and/or could be of sufficient value for potential impacts to be significant?		Justification if receptors are of insufficient value for impacts to be significant	Scoping conclusion
	Legally protected	Value[1]		
Water vole	Yes	Yes	N/A	See Table 20N.2
Hedgehog	No	No	The limited extent of semi-natural habitats on the site mean that the number of individuals are likely to be present is too small for an impact to be significant	Scoped out
Reptiles	Yes	No	The density at which slow-worm occurs within the site is low (due to the majority of the habitat present being of poor-quality) and slow-worms are common and widespread in Somerset. Therefore, the number of individuals that could be affected is likely to be too small for an impact to be significant.	See Table 20N.2 (due to legal requirements)
Great crested newt	Yes	Yes	N/A	See Table 20N.2
Common toad	No	No	Only a single common toad was recorded at the proposed development site despite regular site visits for both amphibian and reptile surveys. This indicates that the site is unlikely to support a large toad population. Therefore it is unlikely that a significant impact on the local common toad population would occur.	Scoped out
Invertebrate assemblage (including Nationally Scarce, UKBAP and Somerset Notable species)	No	Yes	N/A	See Table 20N.2
Somerset Notable plants (on-site)	No	Yes	N/A	See Table 20N.2
LBAP and Somerset Notable plants (off-site)	No	Yes	N/A	See Table 20N.2
Designated Sites				
Exmoor and Quantocks Oakwoods SAC	Yes	Yes	N/A	See Table 20N.2

‘Important’ receptors (i.e. that meet the criteria in Appendix 20M) recorded within the study area from both desk study and field surveys	Legally protected and/or could be of sufficient value for potential impacts to be significant?		Justification if receptors are of insufficient value for impacts to be significant	Scoping conclusion
	Legally protected	Value[1]		
Severn Estuary SPA and Ramsar	Yes	Yes	N/A	See Table 20N.2
Severn Estuary SAC	Yes	Yes	N/A	See Table 20N.2
Bridgwater Bay SSSI	Yes	Yes	N/A	See Table 20N.2
Hinkley CWS	No	Yes	N/A	See Table 20N.2
Claylands Corner CWS	No	Yes	N/A	See Table 20N.2
J24 Embankment CWS	No	Yes	N/A	See Table 20N.2
Other CWSs	No	Yes	N/A	See Table 20N.2

Table 20N.2 – Results of biodiversity receptor scoping – PART 2

Receptor (those that meet the value criteria or that are legally protected – from Table 20M.1)	Environmental Change - Land take/land cover change*		Environmental Change – Noise and visual disturbance*		Environmental Change – Hydrological changes*		Environmental Change - Lighting*		Environmental Change – Thermal and chemical changes*		Environmental Change – Air quality changes*		Conclusion – potential for significant impact and/or contravention of protected species legislation
	ZoI	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	
Habitats													
Off-site ditches and grazing marsh	Within Construction Area only	No	N/A 1	N/A	Downstream water-courses	**Yes**	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**
Off-site wetland areas	Within construction area only	No	N/A 1	N/A	Wetlands supported by the HPC site	**Yes**	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**
Lowland calcareous grassland	Within construction area only	**Yes**	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**
Woodland	Within construction area only	**Yes**	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**
Hedgerows	Within construction area only	**Yes**	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**
Watercourses	Within construction area only	**Yes**	N/A 1	N/A	Off-site ditches are covered	No	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**

Receptor (those that meet the value criteria or that are legally protected – from Table 20M.1)	Environmental Change - Land take/land cover change*		Environmental Change – Noise and visual disturbance*		Environmental Change – Hydrological changes*		Environmental Change - Lighting*		Environmental Change – Thermal and chemical changes*		Environmental Change – Air quality changes*		Conclusion – potential for significant impact and/or contravention of protected species legislation
	ZoI	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	
					above								
Habitat networks	Within construction area only	**Yes**	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	50m	**Yes**	**Yes**
Species													
Breeding birds	Within construction area only	**Yes**	<250m	**Yes**	N/A 1	No	N/A 1	N/A	N/A 1	N/A	N/A 1	N/A	**Yes**
Lesser whitethroat	Within construction area only	**Yes**	<250m	**Yes**	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**
Cetti's warbler	Within construction area only	No	<250m	**Yes**	Wetlands supported by the HPC site	**Yes**	15m	**No**	N/A 1	N/A	N/A 1	N/A	**Yes**
Wintering waterbirds (including SPA/Ramsar/ SSSI qualifying features)	Within construction area only	**Yes**	<250m	**Yes**	Wetlands supported by the HPC site	**Yes**	15m	**Yes**	See Chapter 19	Yes	N/A 1	N/A	**Yes**
Passage	Within	**Yes**	<250m	**Yes**	Wetlands	**Yes**	15m	**Yes**	See	Yes	N/A 1	N/A	**Yes**

Receptor (those that meet the value criteria or that are legally protected – from Table 20M.1)	Environmental Change - Land take/land cover change*		Environmental Change – Noise and visual disturbance*		Environmental Change – Hydrological changes*		Environmental Change - Lighting*		Environmental Change – Thermal and chemical changes*		Environmental Change – Air quality changes*		Conclusion – potential for significant impact and/or contravention of protected species legislation
	ZoI	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	
waterbirds (including SPA/Ramsar/ SSSI qualifying features)	construction area only				supported by the HPC site				Chapter 19				
Wintering and passage birds (other than waterbirds)	Within construction area only	**Yes**	<250m	**Yes**	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**
Badger	Within construction area only	**Yes**	30m from sett	**Yes**	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**
Barbastelle bat	Within construction area only	**Yes**	30m from a roost	No	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**
Lesser horseshoe bat	Within construction area only	**Yes**	30m from a roost	No	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**
Greater horseshoe bat	Within construction area only	**Yes**	30m from a roost	No	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**
Bat	Within construction	**Yes**	30m from	**Yes** (Common	N/A 1	No	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**

Receptor (those that meet the value criteria or that are legally protected – from Table 20M.1)	Environmental Change - Land take/land cover change*		Environmental Change – Noise and visual disturbance*		Environmental Change – Hydrological changes*		Environmental Change - Lighting*		Environmental Change – Thermal and chemical changes*		Environmental Change – Air quality changes*		Conclusion – potential for significant impact and/or contravention of protected species legislation
	ZoI	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	
assemblage	area only		a roost	Pipistrelle)									
Otter	Within construction area only	**Yes**	30m from holt or resting place	No	Wetlands supported by the HPC site	**Yes**	15m	No	N/A 1	N/A	N/A 1	N/A	**Yes**
Water vole	N/A3	No	30m from burrow	No	Wetlands supported by the HPC site	**Yes**	15m	No	N/A 1	N/A	N/A 1	N/A	**Yes**
Reptiles	Within construction area only	**Yes**	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	N/A 1	N/A	**Yes**
Great crested newt	N/A3 Within construction area only (highway improvement sites)	No **Yes** (Highway sites_	N/A 1	N/A	Wetlands supported by the HPC site	**No**	N/A 1	N/A	N/A 1	N/A	N/A 1	N/A	**No (HPC site)** **Yes (Highway Improvement sites)**
Invertebrate assemblage (including Nationally Scarce, UKBAP and	Within construction area only	**Yes**	N/A 1	N/A	Wetlands supported by the HPC site	**Yes**	15m	**Yes**	N/A 1	N/A	N/A 1	N/A	**Yes**

Receptor (those that meet the value criteria or that are legally protected – from Table 20M.1)	Environmental Change - Land take/land cover change*		Environmental Change – Noise and visual disturbance*		Environmental Change – Hydrological changes*		Environmental Change - Lighting*		Environmental Change – Thermal and chemical changes*		Environmental Change – Air quality changes*		Conclusion – potential for significant impact and/or contravention of protected species legislation
	ZoI	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	
Somerset Notable species)													
Somerset Notable plants (on-site)	Within construction area only	**Yes**	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	50m	Yes	**Yes**
LBAP and Somerset Notable plants (off-site)	N/A3	No	N/A 1	N/A	N/A 1	No	N/A 1	N/A	N/A 1	N/A	50m	No	No
Designated Sites													
Exmoor and Quantocks Oakwoods SAC	Barbastelle recorded on site could roost in the off-site SAC - hence ZoI = within construction area only	**Yes**	30m from roost	No	N/A 1	No	15m	**Yes**	N/A 1	N/A	50m	**No**	**Yes** (in relation to the barbastelle bat interest feature only). Impacts on the SAC are assessed within the HRA
Severn Estuary SPA and Ramsar	N/A 3	N/A	<250m	**Yes**	N/A 1	No	15m	**Yes**	See Chapter 19	Yes	50m	Yes	**Yes.** Impacts on the SPA are assessed within the HRA

Receptor (those that meet the value criteria or that are legally protected – from Table 20M.1)	Environmental Change - Land take/land cover change*		Environmental Change – Noise and visual disturbance*		Environmental Change – Hydrological changes*		Environmental Change - Lighting*		Environmental Change – Thermal and chemical changes*		Environmental Change – Air quality changes*		Conclusion – potential for significant impact and/or contravention of protected species legislation
	ZoI	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	**ZoI**	**Receptor within ZoI?**	
Severn Estuary SAC	N/A 3	N/A	N/A 1	N/A	N/A 1	No	N/A 1	N/A	See Chapter 19	Yes	50m	Yes	**Yes.** Impacts on the SPA are assessed within Chapter 19 and the HRA
Bridgwater Bay SSSI	N/A 3	N/A	<250m	**Yes**	Off-site ditches and water-courses	**Yes**	15m	**Yes**	N/A 1	N/A	50m	Yes	**Yes**
Hinkley CWS	Within construction area only	**Yes**	N/A 1	N/A	Wetlands supported by the HPC site	**Yes**	N/A 1	N/A	N/A 1	N/A	50m	Yes	**Yes**
Claylands Corner	N/A 3	N/A	N/A 1	N/A	Wetlands supported by the HPC site	No	N/A 1	N/A	N/A 1	N/A	0m	No	No
J24 Embankment CWS	N/A 3	N/A	N/A 1	N/A	Wetlands supported by the HPC site	No	N/A 1	N/A	N/A 1	N/A	0m	No	No
Other CWSs	N/A 3	N/A	N/A 1	N/A	Wetlands supported by the HPC site	No	N/A 1	N/A	N/A 1	N/A	50m	No	No

* Where a ZoI is not applicable (N/A) to a receptor, the main reason is given under the column headed ‘ZoI’ using the categories that are listed below. In these instances, the ‘Receptor within ZoI’ column is also not applicable.

N/A 1 The receptor is not sensitive to the environmental change.

N/A 2 The receptor is likely to be of insufficient value for the environmental change to have a significant impact (these receptors are recorded as ‘No’ in the third column of Table 20N.1).

N/A 3 The receptor is located outside of the zone of influence associated with land-take.

APPENDIX 20O: PROTECTED AND NOTABLE SPECIES RECORDS

Appendix 20O
Protected and Notable Species Records

7 Pages

Table 20O.1 Protected and Notable Species Records from SERC within 2km of the Site

Common Name	Latin Name	Rationale for Species Importance	Location			Distance (km) & Direction from Site
			Date of Record	NGR	Site Name	
Amphibians						
Common Toad	*Bufo bufo*	WCA, UKBAP	1995 - 1996	ST207458	Hinkley	0.3 E
Great Crested Newt	*Triturus cristatus*	WCA, EUHD, UKBAP, LBAP	1995	ST210455	Hinkley	0.7 ESE
			1993 - 1996	ST207458	Hinkley	0.3 E
Birds						
Barn Owl	*Tyto alba*	WCA, LBAP	1993 -1995	ST207458	Hinkley	0.3 E
			19-Jun-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Black-tailed Godwit	*Limosa limosa*	WCA	23-Nov-03	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			16-Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Bullfinch	*Pyrrhula pyrrhula*	LBAP	1995 - 2005	ST207458	Hinkley	0.3 E
			Mar 06 - Jun 06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Common Scoter	*Melanitta nigra*	WCA, EUBD, UKBAP	20-Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Cuckoo	*Cuculus canorus*	UKBAP	1995	ST207458	Hinkley	0.3 E
Curlew	*Numenius arquata*	UKBAP, LBAP	1993 - 1995	ST207458	Hinkley	0.3 E
			OCT 2003 - MAY 2004	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Dunlin	*Calidris alpina*	EUBD	1993 - 1995	ST207458	Hinkley	0.3 E

Common Name	Latin Name	Rationale for Species Importance	Location: Date of Record	Location: NGR	Location: Site Name	Distance (km) & Direction from Site
Dunlin	*Calidris alpina*	EUBD	20-Oct-03	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
Green Sandpiper	*Tringa ochropus*	WCA	1998	ST216458	Hinkley Rhyne	1.2 E
Golden Plover	*Pluvialis apricaria*	EUBD	1992 - 1995	ST207458	Hinkley	0.3 E
			Feb-05	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			01-Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Grey Partridge	*Perdix perdix*	EUBD, UKBAP, LBAP	Spring 1992	ST207458	Hinkley	0.3 E
Grey Plover	*Pluvialis squatarola*	EUBD	20-Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
House Sparrow	*Passer domesticus*	UKBAP, LBAP	1995	ST207458	Hinkley	0.3 E
Kingfisher	*Alcedo atthis*	WCA, EUBD	1998	ST215458	Hinkley	1.1 E
			10-Oct-96	ST207458	Hinkley	0.3 E
			08-Feb-04	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
Lapwing	*Vanellus vanellus*	LBAP	1995	ST207458	Hinkley	0.3 E
			Dec-04	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			16-Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Linnet	*Carduelis cannabina*	LBAP	1995 - 2005	ST207458	Hinkley	0.3 E
			Mar 06 - Jun 06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Merlin	*Falco columbarius*	WCA, EUBD, LBAP	03-Nov-92	ST207458	Hinkley	0.3 E
			Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Mistle Thrush	*Turdus viscivorus*	LBAP	1995	ST207458	Hinkley	0.3 E
Mute Swan	*Cygnus olor*	EUBD	1995	ST207458	Hinkley	0.3 E

Common Name	Latin Name	Rationale for Species Importance	Location			Distance (km) & Direction from Site
			Date of Record	NGR	Site Name	
Osprey	*Pandion haliaetus*	WCA, EUBD	Sept 91 - May 95	ST207458	Hinkley	0.3 E
Pintail	*Anas acuta*	WCA, EUBD	20-Oct-03	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Purple Sandpiper	*Calidris maritima*	WCA	27-Dec-03	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
Redshank	*Tringa totanus*	EUBD, LBAP	1995	ST207458	Hinkley	0.3 E
			Feb-05	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			24-Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Red-throated Diver	*Gavia stellata*	EUBD	07-Mar-94	ST207458	Hinkley	0.3 E
Reed Bunting	*Emberiza schoeniclus*	UKBAP, LBAP	1995	ST207458	Hinkley	0.3 E
			15-Apr-00	ST206452	Not Specified	0.6 SSE
Shoveler	*Anas clypeata*	EUBD	Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Skylark	*Alauda arvensis*	UKBD, UKBAP, LBAP	1995	ST207458	Hinkley	0.3 E
			Mar 06 - Jun 06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Song Thrush	*Turdus philomelos*	LBAP	1995	ST207458	Hinkley	0.3 E
			Mar 06 - Jun 06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Teal	*Anas crecca*	EUBD	1998	ST214458	Hinkley	1 E
			Oct 03 - May 05	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW
Wigeon	*Anas penelope*	EUBD	Oct 03 - May 05	ST200457	Proposed Wind Farm, Hinkley	0.4 WSW
			Mar-06	ST197452	Proposed Wind Farm, Hinkley	0.9 SW

Common Name	Latin Name	Rationale for Species Importance	Location			Distance (km) & Direction from Site
			Date of Record	NGR	Site Name	
Woodcock	*Scolopax rusticola*	EUBD	-1998	ST211456	Hinkley	0.7 ESE
Butterflies and Moths (Lepidoptera)						
Cinnabar	*Tyria jacobaeae*	UKBAP	1995	ST207458	Hinkley	0.3 E
Dingy Skipper	*Erynnis tages*	UKBAP, LBAP	1992 - 1993	ST212457	Hinkley	0.8 E
			1993 - 1994	ST209457	Hinkley	0.5 ESE
			May 96 - May 98	ST206458	Hinkley	0.2 E
Garden Tiger	*Arctia caja*	UKBAP	1994 - 1995	ST207458	Hinkley	0.3 E
Grizzled Skipper	*Pyrgus malvae*	UKBAP, LBAP	1992	ST211458	Hinkley Point	0.7 E
			1992 - 1995	ST207458	Hinkley	0.3 E
Lackey	*Malacosoma neustria*	UKBAP	1994 - 1995	ST207458	Hinkley	0.3 E
Mouse Moth	*Amphipyra tragopoginis*	UKBAP	1995	ST207458	Hinkley	0.3 E
Rosy Minor	*Mesoligia literosa*	UKBAP	05-Aug-94	ST207458	Hinkley	0.3 E
Rosy Rustic	*Hydraecia micacea*	UKBAP	05-Aug-94	ST207458	Hinkley	0.3 E
Rustic	*Hoplodrina blanda*	UKBAP	1995	ST207458	Hinkley	0.3 E
Shaded Broad-bar	*Scotopteryx chenopodiata*	UKBAP	1994 - 1995	ST207458	Hinkley	0.3 E
Small Heath	*Coenonympha pamphilus*	UKBAP	1992	ST211458	Hinkley Point	0.7 E
			1995 - 2005	ST207458	Hinkley	0.3 E
Small Square-spot	*Diarsia rubi*	UKBAP	1994 - 1995	ST207458	Hinkley	0.3 E
Wall	*Lasiommata megera*	UKBAP, LBAP	1992	ST211458	Hinkley Point	0.7 E
			-1995	ST207458	Hinkley	0.3 E

Common Name	Latin Name	Rationale for Species Importance	Location: Date of Record	NGR	Site Name	Distance (km) & Direction from Site
Mammals						
Badger	*Meles meles*	BA, HA	1992 - 1996	ST207458	Hinkley	0.3 E
Bat (unidentified)	*Chiroptera*		1998	ST211456	Hinkley	0.7 ESE
Bat (unidentified)	*Myotis sp.*	WCA	Jun 06 - Sept 06	ST200456	Not Specified	0.5 WSW
Brown Long-eared Bat	*Plecotus auritus*	WCA, EUHD, UKBAP	Jun 06 - Sept 06	ST206455	Not Specified	0.4 SSE
Grey Long-eared Bat	*Plecotus austriacus*	WCA, EUHD, LBAP	1992 - 1996	ST207458	Hinkley	0.3 E
Grey Seal	*Halichoerus grypus*	?EUHD?	1995 - 1996	ST207458	Hinkley	0.3 E
Hedgehog	*Erinaceus europaeus*	UKBAP	1998	ST208458	Branland Copse South	0.4 E
			1995 - 1996	ST207458	Hinkley	0.3 E
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	WCA, EUHD, UKBAP, LBAP	28-Sep-06	ST206455	Not Specified	0.4 SSE
Noctule	*Nyctalus noctula*	WCA, EUHD, UKBAP	1992 - 1993	ST209456	Not Specified	0.5 ESE
			1992 - 1999	ST207458	Not Specified	0.3 E
			Jun 06 - Sept 06	ST200456	Not Specified	0.5 WSW
Otter	*Lutra lutra*		1998	ST216458	Hinkley	1.2 E
			11-Feb-03	ST207454	Bridgwater Bay SSSI / Wick Moor	0.5 SE
Pipistrelle	*Pipistrellus pipistrellus*		1992 - 1993	ST210455	Not Specified	0.7 ESE
			1998	ST208458	Not Specified	0.4 E
			1992 - 1999	ST207458	Not Specified	0.3 E
Serotine	*Eptesicus serotinus*	WCA, EUHD, LBAP	1996	ST207458	Not Specified	0.3 E
			1998	ST204458	Not Specified	0 E

Common Name	Latin Name	Rationale for Species Importance	Location: Date of Record	NGR	Site Name	Distance (km) & Direction from Site
			Jun 06 - Sept 06	ST200456	Not Specified	0.5 WSW
Water Vole	*Arvicola terrestris*		Aug 1995 - Sep 1995	ST210455	Pixies Mound	0.7 ESE
			1996	ST207458	Hinkley	0.3 E
			1995	ST205458	Hinkley	0.1 E
Reptiles						
Grass Snake	*Natrix natrix*	WCA, UKBAP, LBAP	1995	ST210456	Hinkley	0.6 ESE
			1995	ST210455	Hinkley	0.7 ESE
			1996	ST207458	Hinkley	0.3 E
Vascular plants						
Adder's-tongue	*Ophioglossum vulgatum*	LBAP	1993 - 1994	ST214458	Hinkley	1 E
			1998	ST206462	Hinkley	0.5 NNE
Broad-leaved Spurge	*Euphorbia platyphyllos*	LBAP	01-Sep-92	ST196458	Knighton	0.8 W
Common Cudweed	*Filago vulgaris*	LBAP	1998	ST209456	Hinkley	0.5 ESE
Shepherd's-needle	*Scandix pecten-veneris*	UKBAP, LBAP	06-Jul-91	ST201453	Shurton, Hinkley Point	0.6 SSW
Slender Tare	*Vicia parviflora*	LBAP	20-Sep-93	ST209457	Hinkley	0.5 ESE
			1993	ST207460	Hinkley	0.4 ENE
			1993 - 1994	ST207458	Hinkley	0.3 E

Key:

LBAP: Species subject of a Species Action Plan (SAP) or Group SAP in one of the current Local Biodiversity Action Plans (LBAP) in Somerset.

UKBAP: Species listed in the United Kingdom Biodiversity Action Plan (UKBAP)

Habs Regs Sch 2: Species protected under Schedule 2 of the Conservation of Habitats and Species Regulations 2010.

WCA: Species listed under Schedule 1 and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended)

Common Name	Latin Name	Rationale for Species Importance	Location			Distance (km) & Direction from Site
			Date of Record	NGR	Site Name	

BA: Species is protected under the Protection of Badgers Act 1992

NB: Notable bird species or populations determined based on county data and local habitat characteristics

APPENDIX 20P: HIGHWAY IMPROVEMENTS BASELINE INFORMATION

Appendix 20P - Highway Improvements Baseline Information

1 Introduction

EDF Energy is seeking to construct a new nuclear power station (hereafter referred to as 'HPC') on land to the west of the existing Hinkley A and B stations. As part of the suite of associated development sites necessary to support the construction of HPC, EDF are proposing a programme of highway improvements (herein referred to as 'schemes') to a number of key junctions located on the main access routes to the HPC site.

This technical note presents the results of the baseline ecological work completed for the schemes, comprising; a desk study and an extended Phase 1 survey. The methodology for the desk study and extended Phase 1 Habitat survey and an assessment of the potential effects of the development proposals, is reported in the accompanying Environmental Statement (EDF, 2011).

2 Results

The results of the desk study completed for each of the highway improvement sites is provided in **Table 2.1.**

The results of the extended Phase 1 Habitat survey completed at each site are provided in **Table 2.2.**

Table 2.1 Desk Study Information for the Highway Improvement Sites

Scheme	Designated Sites with 500m of the Site	Protected and Notable Species Records within 500m of the Site (provided by SERC)
A38 Bristol Road/The Drove	None	There are records of the following species from the area of green urban space and housing directly to the east of the A38 and adjacent to the site. They are: • tawny owl (*Strix aluco*); • kingfisher (*Alcedo atthis*); and • spotted flycatcher (*Muscicapa striata*).
A38 Taunton Road/Broadway	Brownes Pond County Wildlife Site (CWS) is located 300m to the south west of the scheme. It has been designated as it supports legally protected species.	SERC provided records of kingfisher and merlin (*Falco columbarius*) from within 500m of the site (both 380m to the south-east)
A38 Bristol Road/Wylds Road	None	None
Wylds Road/The Drove	None	None
A39 Sandford Corner	None	SERC provided a single record of brown hare (*Lepus europeaus*) from within 500m of the site (320m to the east)
M5 Junction 23 (Including Dunball Roundabout)	South Hills Woods CWS is located 300m to the south-east of the scheme. It is an area of ancient semi-natural broad-leaved woodland and species-rich grassland.	SERC provided records of hen harrier (*Circus cyaneus*) and badger (*Meles meles*) adjacent to the site
Washford Cross Roundabout	Furzy Ground Plantation CWS is an area of semi-natural broad-leaved woodland on a tithe-map woodland site. It is located 500m to the north of the scheme. Puthills Copse CWS is an area of ancient semi-natural broad-leaved woodland. It is located 500m to the west of the scheme.	None
Junction improvements at Clayland Corner	The Claylands Corner Verge CWS is located within the red line boundary of the scheme. This area comprises species-rich unimproved neutral grassland, supporting diverse invertebrate fauna, and flanked by tall hedge/tree-belt and mature scrub.	SERC provided records of the Somerset Notable species slender tare (*Vicia parviflora*) and grass vetchling (*Lathyrus nissolia*) from Claylands Corner CWS.

Scheme	Designated Sites with 500m of the Site	Protected and Notable Species Records within 500m of the Site (provided by SERC)
	Stockland Moor Wood CWS is located 140m to the south-east of the site. It is an area of ancient semi-natural broad-leaved woodland with an area of swamp and carr woodland. New Barn Wood CWS is located 420m to the north east of the site. It is an area of ancient semi-natural broad-leaved woodland.	
C182 Farringdon Hill Lane Horse Crossing	Mud House Copse CWS is located adjacent to the boundary. It is an area of ancient semi-natural broad-leaved woodland. Wick Park Covert CWS is located 180m to the south-east of the scheme. It is an area of ancient semi-natural broad-leaved woodland. Bridgwater Bay SSSI is located 330m to the north of the scheme. The site has been designated for the following habitats and species: • mudflats; • saltmarsh; • shingle beach; • grazing marsh; • internationally and nationally important numbers of wintering and passage wildfowl including (in addition to species cited in other designations) black-tailed godwit (*Limosa limosa*), teal (*Anas crecca*) and grey plover (*Pluvialis squatarola*); • a diverse invertebrate fauna of ponds and ditches; • the ecological link to the Somerset Levels and the position of the area in the context of the Severn Estuary	SERC provided records of merlin, grey partridge (*Perdix perdix*) and nightingale (*Luscinia megarhynchos*) within 500m of the site (between 350 and 450m from the site). Otter (*Lutra lutra*) and brown hare have also been recorded within the study area (both 370m to the north). Greater butterfly orchid (*Platanthera chlorantha*) and bluebell (*Hyacinthoides non-scripta*) have been recorded within Mud House Copse.
Cannington High street	Cannington Brook CWS is located 260m to the south of the scheme. It has been designated for supporting otter.	SERC provided records of common pipistrelle (*Pipistrellus pipistrellus*), otter, grass snake (*Natrix natrix*) and slow-worm (*Anguis fragilis*) from with the study area. Kingfisher, peregrine and spotter flycatcher have also been recorded within 100m of the site.

Scheme	Designated Sites with 500m of the Site	Protected and Notable Species Records within 500m of the Site (provided by SERC)
Huntworth Roundabout	J24 Embankment CWS is located partly within the southern area of the red line boundary to the south-west of the scheme. , It has been designed for supporting Roesel's bush cricket (*Metrioptera roeselii*), Stockmoor CWS is located 370m to the west of the scheme. It has been designated for the interconnecting rhyne network containing legally protected species and nationally rare and nationally scarce invertebrates	A cluster of existing species records (from SERC) is located approxaimtely 400m to the west of the site. It appears that these records all relate to Stockmoor CWS, but that they may have been recorded elsewhere on this widespread CWS. The records include various bat species, water vole (*Arvicola amphibious*), otter and great silver water beetle (*Hydrophilus piceus*). Serc also provided three records of barn owl (*Tyto alba*) within 500m of the site.

Table 2.2 Extended Phase 1 Habitat Survey Results for the Highway Improvement Sites

Scheme	Flora	Fauna
A38 Bristol Road/The Drove	This scheme is located in central Bridgwater and is bounded by a mixture of residential houses and commercial properties. The area within the red line boundary comprises hardstanding (highway and pavement), a small area of garden at the fronts of 131, 133, 135 and 137 Bristol Road (all of which are predominately laid to lawn and bordered by small ornamental hedges and fences) and a small area of specie- poor amenity grassland verge outside of the commercial property at 139 Bristol Road.	No evidence of protected or notable species was found during the survey. Based on the poor quality habitats that are present it is unlikely that any such species occur on the site.
A38 Taunton Road/Broadway	The scheme is located in the centre of Bridgwater and is bordered by commercial properties, with associated car parks, residential properties and directly to the north by a small park with mature trees around its boundary. The area inside of the red line boundary comprises predominantly hardstanding (highway and pavement) although there are small areas of amenity grassland, dominated by species such as perennial rye-grass (*Lolium perenne*), and ornamental shrub landscape planting. At 6 Taunton Road (Malvern Court) a mature small-leaved lime (*Tilia cordata*) is located on the boundary of the scheme.	No evidence of protected or notable species was found during the survey. Based on the poor quality habitats that are present it is unlikely that any such species occur on the site, with the potential exception of breeding birds in the landscape planting. The lime tree at 6 Taunton Road does not support features which could be used by roosting bats.
A38 Bristol Road/Wylds Road	The scheme is located in central Bridgwater and is bordered by a mixture of commercial properties and residential houses.	No evidence of protected or notable species was found during the survey. Based on the poor quality habitats that are present it is unlikely that any such species

Scheme	Flora	Fauna
	The area within the red line boundary comprises hardstanding (comprising highway and pavement) and species-poor amenity grassland verge, dominated by perennial rye-grass and cock's-foot (*Dactylis glomerata*), with scattered landscape planting (mainly whitebeam - *sorbus spp.*) and ruderal vegetation.	occur on the site, with the potential exception of breeding birds in the landscape planting. The trees within the site do not support features which could be used by roosting bats.
Wylds Road/The Drove	This scheme is located in the centre of Bridgwater and is bordered by commercial properties, with associated car parks, and an area of brownfield land (located on the corner between Wylds Road and the Northern Distributor Road). The area within the red line boundary comprises predominantly hardstanding (highway, pavement and car parks). There are also small areas of species-poor amenity grassland verge, dominated by perennial rye-grass and cock's-foot, ornamental shrub landscape planting and young broad-leaved trees such as ash (*Fraxinus excelsior*). In addition, there is a small extent of ephemeral/short perennial vegetation dominated by gravel and species such as buddleia (*Buddleja davidii*), scentless mayweed (*Tripleurospermum inodorum*) and perennial sow thistle (*Sonchus arvensis*). This area does not support a diverse 'mosaic' type assemblage of flora or faunal species and may be relatively young in age.	No evidence of protected or notable species was found during the survey. Based on the poor quality habitats that are present it is unlikely that any such species occur on the site, with the potential exception of breeding birds in the landscape planting. The trees within the site do not support features which could be used by roosting bats.
A39 Sandford Corner	Sandford corner is located outside of Bridgwater and is bordered by arable fields and hedgerows. The area inside of the red line boundary comprises hardstanding (highway, pavement and a culvert), semi-improved rough grassland verge, trees, fences, hedgerows and scrub habitat. The semi-improved, rough grassland verge is moderately species-diverse (although it is regularly mown), comprising species such as false oat-grass (*Arrhenatherum elatius*) and cock's-foot, with herb species such as meadow vetchling (*Lathyrus pratensis*), bush vetch (*Vicia sepium*) and birds-foot trefoil (*Lotus corniculatus*) also present. Two semi-mature ash trees are present adjacent to the culvert in the eastern part of the site. The largely intact hedgerows which border the rough grassland, and which are present along the B3339, are dominated by species such as elder (*Sambucus nigra*), dogwood (*Cornus sanguinea*), bramble (*Rubus fruticosus agg.*) and hawthorn (*Crataegus monogyna*). These would not qualify as ecologically important under the Hedgerows Regulations 1997.	No evidence of protected or notable species was found during the survey. Based on the generally poor quality habitats that are present there is limited potential for any such species to occur on the site, with the exception of the following • small number of reptiles could occur in the rough grassland verge and scrub; • the trees and hedgerows could provide habitat for breeding birds; • the hedgerows may be used by commuting bats, but the provides very limited foraging opportunities and no suitable roosting habitat; and • due the presence of water features (drains) within 500m of the site, which are not separated from the site by barriers to movement, great crested newts could utilise the hedgerows and grassland verge habitat in their terrestrial phase.
M5 Junction 23 (Including	This scheme is located on the outskirts of Bridgwater and is bordered by farmland in mixed pastoral and arable use.	No evidence of protected or notable species was found during the survey.

Scheme	Flora	Fauna
Dunball Roundabout)	The area inside of the red line boundary comprises hardstanding (highway and pavement), semi-improved species-poor grassland and improved grassland verge, young trees, fences, and scrub habitat	Based on the poor quality habitats that are present it is unlikely that any such species occur on the site, with the potential exception of breeding birds in the landscape planting. The trees within the site do not support features which could be used by roosting bats.
Washford Cross Roundabout	The Washford Junction is located 1.5km to the west of Williton and is bordered by arable fields, hedgerows and buildings. The area inside of the red line boundary comprises hardstanding (highway) and a mixture of amenity grassland, rough semi-improved grassland verge, and hedgerows adjacent to the arable fields. The species-poor amenity grassland is regularly maintained by mowing. The rest of the verge habitat within the red line boundary comprises semi-improved rough grassland dominated by grass species, such as false oat-grass and cock's-foot, and common herb species such as doves-foot crane's-bill (*Geranium molle*) and common toadflax (*Linaria vulgaris*). The hedgerow along the northern edge of the junction is species-poor and defunct in places. It has also been heavily flailed to increase visibility at the junction. Species present include bramble, hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*) and elder, as well as hart's-tongue fern (*Phyllitis scolopendrium*) and honeysuckle (*Lonicera periclymenum*). A further section of hedgerow is present to the east of the junction. This hedgerow is intact and is dominated by English elm (*Ulmus minor var. vulgaris*). Neither hedgerow would qualify as ecologically important under the Hedgerow Regulations 1997. There are also a number of semi-mature, broad-leaved trees within the red line boundary. Species present include ash (*Fraxinus excelsior*) and sycamore (*Acer pseudoplatanus*).	No evidence of protected or notable species was found during the survey. Based on the generally poor quality habitats that are present there is limited potential for any such species to occur on the site, with the exception of the following • small number of reptiles could occur in the rough grassland verge and scrub; • the trees and hedgerows could provide habitat for breeding birds; and • the hedgerows may be used by commuting bats, but the provides very limited foraging opportunities and no suitable roosting habitat. Although there are water features within 500m of the scheme, these are isolated from the site by busy roads and large areas of intensively farmed arable land. Similarly the water features at the aquarium are separated from the scheme footprint by large areas of hardstanding (e.g. car parks and buildings). Therefore, if great crested newts are present in these water features they will not be present in the scheme's footprint.
Junction improvements at Clayland Corner	Clayland Corner is located approximately 2km to the east of Stogursey. It is bordered by fields and a house with gardens. The area inside of the red line boundary comprises hardstanding (highway), semi-improved rough grassland and neutral grassland verge (Claylands Corner CWS) bordered by hedgerows. The grassland within the CWS is botanically diverse and supports a mixture of unimproved neutral grassland species. This is bordered by a tall hedgerow and a section of mature bramble scrub.	No evidence of protected or notable species was found during the survey. Based on the small area of the site there is limited potential for any such species to occur on the site, with the exception of the following • small number of reptiles could occur in the rough grassland verge and scrub; • the trees and hedgerows could provide habitat for breeding birds; • the hedgerows may be used by commuting bats, but the provides very limited

Scheme	Flora	Fauna
	The areas of semi-improved rough grassland verge, outside of the CWS, also support a diversity of grassland species, including agrimony (*Agrimonia eupatoria*) and tufted vetch (*Vicia cracca*), but are more impoverished, probably due to a more intensive mowing regime. The intact hedgerows which border the junction are dominated by species such as hawthorn, backthorn (*Prunus spinosa*), hazel and bramble. None are considered to be ecologically important under the Hedgerows Regulations 1997. There are several small trees, including oak (*Quercus robur*), ash (and English elm associated with the hedgerows. A number of the elm trees are dead.	foraging opportunities and no suitable roosting habitat; and • due the presence of water features within 500m of the site, which are not separated from the site by barriers to movement, great crested newts could utilise the hedgerows and grassland verge habitat in their terrestrial phase.
C182 Farringdon Hill Lane Horse Crossing	The scheme is located on the C182 on the main access road HPC. It is bordered by fields in arable use and hedgerows. The area inside of the red line boundary comprises hardstanding (highway) and semi-improved, rough, grassland verge bordered by hedgerows. The existing horse crossing point is characterised by scrub, dominated by bramble, and young broad-leaved trees such as field maple (*Acer campestre*) and hazel. Semi-improved rough grassland dominates the verge habitat bordering the existing crossing point. Species present include hedge bedstraw (*Galium mollugo*), ribbed melilot (*Melilotus officinalis*), tufted vetch and meadowsweet (*Filipendula ulmaria*). The hedgerows which border the scheme are largely intact and are frequently associated with banks or dry ditches. Hedgerow species include hawthorn, field maple (*Acer campestre*), hazel and elder. Young field maple trees are located along the hedgerow to the west of the junction. None of the hedgerows present within the red line boundary would qualify as ecologically important under the Hedgerow Regulations 1997.	No evidence of protected or notable species was found during the survey. Based on the small area of the site there is limited potential for any such species to occur on the site, with the exception of the following • small number of reptiles could occur in the rough grassland verge and scrub; • the trees and hedgerows could provide habitat for breeding birds; • the hedgerows may be used by commuting bats, but the provides very limited foraging opportunities and no suitable roosting habitat; and • due the presence of water features within 500m of the site, which are not separated from the site by barriers to movement, great crested newts could utilise the hedgerows and grassland verge habitat in their terrestrial phase.
Cannington High Street	Cannington High Street is located in the centre of Cannington village. It is bordered on all sides by buildings within the village. Cannington High Street comprises a mixture of houses and shops along the main road through the village.	No evidence of protected or notable species was found during the survey. Based on the poor quality habitats that are present it is unlikely that any such species occur on the site.

Scheme	Flora	Fauna
Huntworth Roundabout	This scheme is located on the outskirts of Bridgwater and is bordered by a business park, farmland in mixed pastoral and arable use, and a newly constructed housing estate. The area inside of the red line boundary comprises hardstanding (highway and pavement), improved grassland verge, young trees and fences. The improved grassland verge is routinely kept short through mowing. Species present include cock'sfoot, Yorkshire-fog, false oat-grass and a mixture of herb species including yarrow (*Achillea millefolium*), ribwort plantain (*Plantago lanceolata*), creeping cinquefoil (*Potentilla reptans*) and selfheal (*Prunella vulgaris*). A small extent of verge to the south of the roundabout is less frequently managed and supports a small area of tufted hair-grass (D*eschampsia cespitosa*). Planted over a bund, to visually screen the business park, are young broad-leaved trees such as hawthorn, blackthorn and sycamore (*Acer pseudoplatanus*).	No evidence of protected or notable species was found during the survey. Based on the poor quality habitats that are present it is unlikely that any such species occur on the site, with the potential exception of breeding birds in the landscape planting. The trees within the site do not support features which could be used by roosting bats.

APPENDIX 20Q: SHELDUCK SURVEY BASELINE INFORMATION

Appendix 20Q - Shelduck Survey Baseline Information

1. Introduction

AMEC Environment & Infrastructure UK Ltd. was commissioned in July 2011 to undertake a survey of the rafting behaviour of shelduck (*Tadorna tadorna*) using Bridgwater Bay in the vicinity of Hinkley Point. The main aim was to ascertain how the area in the vicinity of the proposed jetty development, which forms part of the development proposals for Hinkley Point C, is used by rafting shelduck, with reference to tidal movements and disturbance.

2. Methodology

The surveys were carried out for three weeks within the peak period of use of the area by moulting adult birds. The dates on which the surveys were carried out, including relevant start times and states of tide are presented in **Annex A**.

Each survey started at a high or a low tide and was carried out for a period of six hours within an area that was visible from a vantage point close to the location of the proposed jetty development. The area that was surveyed is referred to in this report as the 'viewshed' (see **Figure 20Q.1**). Data were plotted on 1:10,000 scale maps showing 400m grid squares. Weather data, including cloud cover, and wind speed and direction, were recorded at the start and updated with any changes that occurred during the survey period.

The area visible from the viewshed was scanned with binoculars and a telescope in order to detect any groups of shelduck. Approximate distances were recorded by plotting compass bearings on the survey maps and relating them to markers (notably the existing Hinkley Point water intake - 'the water intake'). When flocks were detected, their location was recorded on a survey map and a reference number was assigned to each; also noted was other relevant information, including the number of individuals and what they were doing, using the following categories:

- roosting – birds with head under wing;
- loafing – birds scattered, pointed in different directions;
- swimming – birds all pointing in similar direction; and
- feeding – birds observed with heads up before brief 'dabbling behaviour'.

Every five minutes the location of the flock and all other data were updated. However, if the flock numbers had not changed, or if no new birds were recorded within a five minute period, no update record was made. If the original flock was joined by other individuals, the total count was updated. If during the five minute interval the flock split into smaller flocks, the largest was counted and followed and its new location was noted. Over each six hour period, the peak count of shelduck was also recorded, which included any scattered individuals within the viewshed, which did not constitute a discrete flock, as well as any flocks that were present.

During the survey period, any recorded disturbance was noted and plotted on the survey map. Causes of disturbance included the presence of boats, walkers on the beach and helicopters using the firing range to the west.

3. Results

3.1 Shelduck Vantage Point Surveys

Fourteen vantage point surveys were undertaken between 19/07/11 and 05/08/11. The results are set out in **Annex A**, which includes data on the flocks that were being observed at each survey time and a maximum number of birds that were recorded within the viewshed during each survey visit. Summary descriptions of shelducks' rafting behaviour for each survey visit are presented below.

Survey Visit 1: 19/07/11

During the survey period, a peak count of approximately 250 birds was recorded, comprising scattered birds and discrete flocks within the viewshed; a peak flock count of approximately 120 shelduck was recorded. Birds were largely grouped in six discrete flocks (A-F) throughout the survey period, although the flocks often fluctuated in size and sometimes became disaggregated. Over the period, birds were recorded drifting and occasionally swimming westwards with the tide, from approximately due west and immediately to the north of the water intake. From these areas, birds were recorded moving with the tide over a distance of between 450 – 1,400m. Birds were recorded no closer than 190m from the proposed jetty location (these birds were loafing).

Survey Visit 2: 20/07/11

During the survey period, a peak count of approximately 1,100-1,300 birds was recorded, comprising all scattered birds and discrete flocks within the viewshed; a peak flock count of approximately 450 shelduck was recorded. Most birds were recorded loafing further than 700m from the proposed jetty location. During the early part of the survey period, birds were recorded drifting and swimming with the tide for up to 1,800m, whereas later, as the tide was going out, some flocks were also recorded swimming with as well as against the tide. Throughout much of the survey, birds were grouped in scattered flocks (A-C), swimming gradually westwards from north of the water intake. Birds were recorded no closer than 440m from the proposed jetty location (these birds were swimming westwards).

Survey Visit 3: 21/07/11

During the survey period, a peak count of approximately 150 birds was recorded, comprising all scattered birds and discrete flocks within the viewshed; a peak flock count of approximately 115 shelduck was also recorded. This flock was recorded 200-400m beyond the water intake and located approximately 1.1km to the north-west of the proposed jetty location. A second flock of 30 birds was recorded gradually drifting westwards from the larger group, before swimming back eastwards, which was likely to be a result of the slackening tide. Birds were recorded no closer than 480m from the proposed jetty location (these birds were loafing).

Survey Visit 4: 22/07/11

During the survey period, a peak count of approximately 265 shelduck was recorded, mainly comprising three discrete flocks (A-C) in addition to scattered birds; a peak flock count of 95 birds was recorded. All three flocks were observed loafing and drifting gradually westwards with the tide. Birds were recorded no closer than 1km from the proposed jetty location (these birds were loafing).

Survey Visit 5: 25/07/11

During the survey period, a peak count of 16 shelduck was recorded, with this also being the peak flock count of birds recorded during the survey. This single small group of birds drifted into view from the east, before gradually swimming eastwards against the tide (although the water was probably quite slack at this stage) and out of view again. Birds were recorded no closer than 1.75km from the proposed jetty location (these birds were loafing).

Survey Visit 6: 26/07/11

During the survey period, a peak count of one shelduck was recorded during the survey. This was a juvenile bird that flew eastwards along the shoreline without landing.

Survey Visit 7: 27/07/11

No shelduck were recorded during the survey.

Survey Visit 8: 28/07/11

During the survey period, a peak count of approximately 50 shelduck was recorded, with this also being the peak flock count of birds recorded during the survey. This single discrete group of birds was recorded loafing approximately 600m due north of the water intake and either drifting or swimming gradually eastwards with the high tide out of viewing range. Birds were recorded no closer than 2km from the proposed jetty location (these birds were loafing).

Survey Visit 9: 29/07/11

During the survey period, a peak count of three shelduck was recorded, with this also being the peak flock count of birds recorded during the survey. However, these birds were not mapped due to their range of approximately 1-1.5km.

Survey Visit 10: 01/08/11

During the survey period, a peak count of approximately 1,700 birds was recorded, comprising scattered birds and discrete flocks; a peak flock count of 190 shelduck was recorded. Over this period, these birds were grouped loosely into six discrete flocks (A-F), all of which were recorded drifting gradually westwards with the tide. Overall, the birds ranged over an area from

300m north-east of the water intake extending 2.5km to the west of the intake. Birds were recorded no closer than 390m from the proposed jetty location (these birds were loafing).

Survey Visit 11: 02/08/11

During the survey period, a peak count of approximately 500 birds was recorded comprising all scattered birds and discrete flocks within the viewshed; a peak flock count of 50 shelduck was recorded. Four discrete flocks (A-D) were observed during the survey period, each of which was recorded rapidly drifting westwards with the wind and tide. Similar to the survey on 01/08/11, the overall area where shelduck were mapped comprised a location approximately 250m to the north-east of the water intake extending approximately 2.5km to the west. Birds were recorded no closer than 650m from the proposed jetty location (these birds were loafing).

Survey Visit 12: 03/08/11

During the survey period, a peak count of approximately 500 birds was recorded, comprising scattered birds and discrete flocks; a peak flock count of 50 shelduck was recorded. Five discrete flocks (A-E) were observed during the survey period, all of which were recorded drifting with the tide gradually westwards. The overall area where shelduck were mapped comprised a location to the north-east of the water intake extending approximately 3km to the west. Birds were observed feeding around a location approximately 600-800m to the north and north-east of the proposed jetty location, with the closest record to the jetty location being of loafing birds no closer than 540m away.

Survey Visit 13: 04/08/11

During the survey period, a peak count of approximately 400 birds was recorded comprising scattered birds and discrete flocks; a peak flock count of approximately 60 shelduck was recorded. Six discrete flocks (A-F) were observed during the survey period, all of which were recorded gradually drifting westwards with the tide. The overall area where shelduck were mapped comprised a location 400m to the east of the water intake extending approximately 3.5km to the west. Birds were recorded no closer than 400m from the proposed jetty location (these birds were loafing).

Survey Visit 14: 05/08/11

During the survey period, a peak count of approximately 600-700 birds was recorded, comprising scattered birds and discrete flocks; a peak flock count of approximately 60 shelduck was recorded. Five discrete flocks (A-E) were observed during the survey period, all of which were recorded gradually drifting westwards with the tide. The overall area where shelduck were mapped comprised a location approximately 600m to the east of the water intake extending approximately 3.5km to the west. Birds were recorded no closer than 520m from the proposed jetty location (these birds were loafing).

3.2 Recorded Numbers and Behaviour

3.2.1 Shelduck Numbers

The peak flock count during the survey period was approximately 450 birds; flock numbers ranged from 3-450 but generally comprised between 50-100 birds. Flock numbers tended to be very loose, with discrete flocks often merging or breaking up. The greatest daily peak counts of shelduck within the viewshed comprised approximately 1,700 birds on 01/08/11 and 1,100-1,300 birds on 20/07/11.

3.2.2 Rafting Behaviour

During ten of the fourteen survey visits, shelduck were recorded loafing and generally drifting out with the tidal current in a westerly direction. Discrete flocks and scattered aggregations were most often recorded due east of the water intake to approximately 3km to the west. On one occasion, during a low to high tide survey, a flock was recorded drifting in with the tide, approximately 500m to the north-east of the water intake. In addition, on several occasions, small groups of shelduck were recorded actively swimming against the tide or slack water.

Aggregations of birds were recorded feeding over an area of approximately 2km and between 500 – 700m from the mean low water mark (MLW).

3.2.3 Birds Recorded Rafting within 500m of the Proposed Jetty

Rafting shelduck were recorded within 250m of the proposed development site on one occasion (19/07/11), when there were 21 birds approximately 190m to the north-west of the proposed jetty. In addition to this record, birds were recorded rafting within 500m of the proposed development site on two occasions during the survey period. There were two birds approximately 375m to the north-west of the proposed jetty on 01/08/11 and eight birds approximately 450m north of proposed jetty on 04/08/11.

3.2.4 Recorded Effects of Localised Disturbance

On several occasions, dog-walkers with several dogs as well as sporadic Land Rover activity were recorded along the shoreline. However, on each occasion, loafing birds (which at that time were situated more than 500m offshore), exhibited no disturbance behaviour. On one occasion (Survey 10 – 01/08/11), a yacht was recorded heading in a southerly direction, shortly after appearing to have passed through a line of shelduck, with there no evidence of the bird having been disturbed.

4. Conclusions

The vantage-point surveys of rafting shelduck in July and August 2011 demonstrated that the majority of activity recorded was at a considerable distance offshore. Aggregations of birds were most regularly recorded approximately 500-800m from the MLW, and approximately 500m beyond the proposed development site. A flock of 21 rafting birds was recorded within 250m of the proposed jetty location on one occasion. In addition to this flock, there were only two occasions when rafting birds were recorded within 500m of the proposed jetty location.

The majority of activity was recorded in a wide arc, which extended from the front of Hinckley Point B (approximately 0-100m from MLW), approximately 4km westwards. Within this area, flocks were often diffuse and numbers constantly changed, with individuals flying to/from flocks regularly (i.e. not all birds present were in moult). A peak flock count of 450 birds was recorded, although the majority of discrete flocks numbered less than 100 individuals. Rafting birds spent most time drifting in the same direction as the tidal current but on occasion swam against the tide up to 500m.

There was no evidence of shelduck being disturbed by the small number of potential disturbance events that were recorded.

Annex A
Survey Data

22 Pages

SURVEY VISIT 1: 19/07/11, 1020 – 1620, Wind: 2/3; Cloud Cover: 4; HW Time: 10.15

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1305	28	Loafing, swimming	
A2	1310	28	Loafing, swimming	
A3	1315	28	Loafing, swimming	
A4	1320	28	Loafing, swimming	
B5	1323	95	Loafing, swimming	
B6	1327	95	Loafing, swimming	
B7	1330	95	Swimming	
B8	1335	95	Swimming	
B9	1340	50	Swimming	
C10	1347	35	Loafing	
C11	1352	35	Loafing	
C12	1357	35	Loafing	
C13	1402	35	Loafing	
C14	1407	22	Loafing	
D15	1419	15	Loafing	
E16	1423	21	Loafing	
E17	1428	21	Loafing	
E18	1433	21	Loafing	
E19	1438	21	Loafing	
E20	1443	21	Loafing	2x dogwalkers, 3x dogs
E21	1448	21	Loafing	
E22	1453	21	Loafing	
E23	1458	21	Loafing	
E24	1503	21	Loafing	
F25	1507	35	Loafing, swimming	
F26	1512	55	Swimming	

SURVEY VISIT 1: 19/07/11, 1020 – 1620, Wind: 2/3; Cloud Cover: 4; HW Time: 10.15

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
F27	1517	120	Swimming	
F28	1522	60	Swimming	
F29	1527	60	Swimming	4x Land Rovers along clifftop
F30	1532	75	Swimming	
F31	1537	75	Loafing	
F32	1542	75	Loafing	
F33	1547	75	Loafing	
F34	1552	90	Loafing	
F35	1557	105	Loafing	
F36	1602	105	Loafing	
F37	1607	105	Loafing	
F38	1612	105	Loafing	
F39	1617	105	Loafing	
F40	1620	105	Loafing	

Peak count of birds within study area during survey period: 250

SURVEY VISIT 2: 20/07/11, 1030 – 1630, Wind: Calm; Cloud Cover: 8-1; High to Low Tide; HW Time: 10.44

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1345	165	Swimming, loafing	Boat at anchor, still.
A2	1350	165	Swimming, loafing	
A3	1355	165	Swimming, loafing	
A4	1400	165	Swimming, loafing	Boat moved but shelduck did not move in response.
A5	1405	165	Swimming, loafing	
A6	1410	170	Swimming, loafing	
B7	1415	60	Swimming, loafing	
B8	1420	60	Swimming, loafing	
C9	1425	220	Swimming, loafing	
C10	1430	230	Swimming	
C11	1435	250	Swimming	
C12	1440	300	Swimming	
C13	1445	350	Swimming	
C14	1450	350	Swimming	
C15	1455	350	Swimming	
C16	1500	450	Swimming	Very little movement, mostly loafing, birds no closer than 700m from proposed jetty location, mostly paddling against the tide.
C17	1505	450	Swimming	
C18	1510	450	Swimming	
C19	1515	450	Swimming	
C20	1520	450	Swimming	
C21	1525	450	Swimming	
C22	1530	450	Swimming	
Peak count of birds within study area: 1100 - 1300				

SURVEY VISIT 3: 21/07/11, 1120 – 1720, Wind: 2-4 WNW; Cloud Cover: 4-8; High to Low Tide; HW Time: 11.03

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1440	110	Loafing	Flock very distant and dispersed, difficult to count in choppy sea and to estimate range accurately.
A2	1455	110	Loafing	
A3	1505	90	Loafing	
A4	1520	90	Loafing	
A5	1530	115	Loafing	
B6	1535	30	Loafing	Switched observation to more discrete sub-flock
B7	1540	28	Loafing	
B8	1545	30	Loafing	
B9	1550	30	Loafing	
B10	1555	28	Loafing	In addition, 70+ more distant birds, hence approximately 100 birds in all viewshed.
B11	1600	31	Loafing	
B12	1605	30	Loafing	
B13	1610	31	Loafing	
B14	1615	30	Loafing	
B15	1620	29	Loafing	
B16	1625	30	Loafing	
B17	1630	29	Loafing	
B18	1635	30	Loafing	
B19	1640	30	Loafing	
B20	1645	27	Loafing	
B21	1650	29	Loafing	Still approximately 50 shelduck more distant to the north-east
B22	1655	25	Loafing	
B23	1700	25	Loafing	
B24	1705	25	Loafing	
B25	1710	25	Loafing	Birds likely to be swimming east, as tide is slack.
B26	1715	25	Loafing	
B27	1720	25	Loafing	

SURVEY VISIT 3: 21/07/11, 1120 – 1720, Wind: 2-4 WNW; Cloud Cover: 4-8; High to Low Tide; HW Time: 11.03

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes

Peak count of birds within study area: 150

SURVEY VISIT 4: 22/07/11, 1140 – 1740, Wind: 0-1 ENE; Light Showers; Cloud Cover: 8-3; High to Low Tide; HW Time: 11.33

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
-	1325	-	-	First appearance of shelduck (140) in distance >1km east of intake.
A1	1425	42	Loafing	
A2	1430	42	Loafing	
A3	1435	42	Loafing	
A4	1440	42	Loafing	
A5	1445	42	Loafing	
A6	1450	42	Loafing	
A7	1455	42	Loafing	
A8	1500	42	Loafing	
A9	1505	42	Loafing	
A10	1510	40	Loafing	
A11	1515	42	Loafing	
A12	1520	42	Loafing	
A13	1525	41	Loafing	
B14	1530	60	Loafing	Switched to larger flock. Now c185 within viewshed.
B15	1540	60	Loafing	
B16	1545	60	Loafing	
B17	1550	95	Loafing	Target flock merged with smaller flock
B18	1555	60	Loafing	Split again (now c130 birds in 3 close flocks); flocks poorly defined, total c265 in viewshed.
B19	1600	60	Loafing	
B20	1605	61	Loafing	Birds clearly drifting west move slowly in last hour (often static)
B21	1610	81	Loafing	
B22	1615	65	Loafing	
B23	1620	65	Loafing	
B24	1625	93	Loafing	Flock size constantly changing.
B25	1630	91	Loafing	
B26	1635	81	Loafing	
B27	1640	84	Loafing	

SURVEY VISIT 4: 22/07/11, 1140 – 1740, Wind: 0-1 ENE; Light Showers; Cloud Cover: 8-3; High to Low Tide; HW Time: 11.33

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
B28	1645	84	Loafing	
B29	1650	65	Loafing	
C30	1655	80	Loafing	Switched flocks. Still c250 in viewshed.
C31	1700	80	Loafing	
32	1705	-	NB. Surveyor asked by security personnel to end watch at 1700hrs and accompany them back to reception. This was due to 'discontinuity in cover by emergency co-ordinator'.	
33	1710	-		
34	1715	-		
35	1720	-		
36	1725	-		
37	1730	-		
Peak count of birds within study area: 265				

SURVEY VISIT 5: 25/07/11, 1400 – 2000, Wind: 3-4 W; Cloud Cover: 3; High to Low Tide; LW Time: 14.12.

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1905	16	Loafing	Drifted in from east.
A2	1910	16	Loafing	Flock splitting up and moving east.
A3	1915	16	Loafing	
A4	1920	16	Loafing	Moving around Hinkley Point, out of view.
A5	1925	16	Loafing	

Peak count of birds within study area: 16

SURVEY VISIT 6: 26/07/11, 0845 – 1445, Wind: 0-1 E; Light Showers; Cloud Cover: 7; Low to High Tide; LW Time: 09.14

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
-	1215	1	Flying	Juvenile bird flew past to east.

Peak count of birds within study area: 1

SURVEY VISIT 7: 27/07/11, 1040 – 1640, Wind: 2 ENE; Cloud Cover: 4-8; Low to High Tide; LW Time: 10.28.

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
-	No shelduck recorded during survey period.			

Peak count of birds within study area: 0

SURVEY VISIT 8: 28/07/11, 1120 – 1720, Wind: 3-4 W by N; Cloud Cover: 8; Low to High Tide; HW Time: 17.50

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1120	50	Loafing	Accurate count impossible due to range and choppy seas.
A2	1125	50	Loafing	
A3	1130	50	Loafing	
A4	1135	50	Loafing	
A5	1140	50	Loafing	
A6	1145	50	Loafing	
A7	1150	50	Loafing	
A8	1155	50	Loafing	
A9	1200	50	Loafing	Flock barely visible, no longer countable, drifting or swimming outside the viewshed.
-	1300	-		
-	1430	-		
-	1530	-		
-	1600	-		
-	1615	-		

Peak count of birds within study area: 50

SURVEY VISIT 9: 29/07/11, 1230 – 1830, Wind: 2-3 NE; Light Showers; Cloud Cover: 8; Low to High Tide; HW Time: 18.42

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
-	1230	3	Loafing	Birds beyond range of viewshed, therefore not plotted on map.
-	1300	3	Loafing	

Peak count of birds within study area : 3

SURVEY VISIT 10: 01/08/11, 0840 – 1440, Wind: 1-2 SE; Cloud Cover: 8; High to Low Tide; HW Time: 08.40

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	0955	9	Loafing	
A2	1000	9	Loafing	
A3	1005	2	Loafing	
A4	1010	2	Loafing	
A5	1015	2	Loafing	
A6	1020	2	Loafing	
A7	1025	2	Loafing	
A8	1030	2	Loafing	
A9	1035	2	Loafing	
A10	1040	2	Loafing	
A11	1045	2	Loafing	
A12	1050	2	Loafing	
B13	1055	5	Loafing	
B14	1100	5	Loafing	
C15	1105	60+	Loafing	
C16	1110	60+	Loafing	
C17	1115	65	Loafing	
C18	1120	71	Loafing	
C19	1125	71	Loafing	
C20	1130	71	Loafing	
C21	1135	71	Loafing	
C22	1140	72	Loafing	
C23	1145	71	Loafing	
C24	1150	71	Loafing	
C25	1155	70	Loafing	
D26	1210	160	Loafing	
D27	1215	160	Loafing	
D28	1220	188	Loafing	
D29	1225	190+	Loafing	
D30	1230	190+	Loafing	
D31	1235	195	Loafing	

SURVEY VISIT 10: 01/08/11, 0840 – 1440, Wind: 1-2 SE; Cloud Cover: 8; High to Low Tide; HW Time: 08.40

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
D32	1240	195	Loafing	
E33	1245	22	Loafing	Switched to the only discrete flock; most birds in one large open flock, gradually becoming more scattered.
E34	1250	22	Loafing	Birds which had drifted furthest west were on a bearing of 300 degrees; range 2km.
E35	1255	22	Loafing	
E36	1300	22	Loafing	
F37	1305	69	Loafing	
F38	1310	71	Loafing	
F39	1315	71	Loafing	
F40	1320	63	Loafing	
F41	1325	64	Loafing	
F42	1330	63	Loafing	
F43	1335	63	Loafing	
F44	1340	63	Loafing	
F45	1345	63	Loafing	
F46	1350	70	Loafing	
F47	1355	70	Loafing	
F48	1400	70	Loafing	
F49	1405	74	Loafing	
F50	1410	63	Loafing	Yacht c2km to WNW; heading south, seen shortly after it had apparently passed through a line of shelduck. No evidence of birds being disturbed
F51	1415	63	Loafing	
F52	1420	51	Loafing	Flock size continued to change as birds drifted away from or into group.
F53	1425	51	Loafing	
F54	1430	57	Loafing	
F55	1435	48	Loafing	
F56	1440	49	Loafing	

Peak count of birds within study area: 1700

SURVEY VISIT 11: 02/08/11, 0925 – 1525, Wind: 4-5 W; Cloud Cover: 8-6/8; High to Low Tide; HW Time: 09.25.

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
-	0952	10	Flew E	
-	1145	-	-	
A1	1155	34	Loafing	
A2	1200	34	Loafing	
A3	1205	34	Loafing	
A4	1210	37	Loafing	
A5	1215	37	Loafing	
A6	1220	37	Loafing	
A7	1225	37	Loafing	
A8	1230	37	Loafing	
A9	1235	37	Loafing	
A10	1240	37	Loafing	
-	1245	-	-	
B11	1300	20	Loafing	
B12	1305	25	Loafing	
B13	1310	25	Loafing	
C14	1315	50	Loafing	
C15	1320	50	Loafing	
C16	1325	53	Loafing	
C17	1330	53	Loafing	
D18	1335	50	Loafing	
D19	1340	50	Loafing	
D20	1345	50	Loafing	
D21	1350	50	Loafing	
D22	1355	52	Loafing	
D23	1400	52	Loafing	
D24	1405	50	Loafing	
D25	1410	50	Loafing	
D26	1415	50	Loafing	
D27	1420	55	Loafing	
D28	1425	55	Loafing	

SURVEY VISIT 11: 02/08/11, 0925 – 1525, Wind: 4-5 W; Cloud Cover: 8-6/8; High to Low Tide; HW Time: 09.25.

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
D29	1430	55	Loafing	
D30	1435	55	Loafing	
D31	1440	55	Loafing	
D32	1445	55	Loafing	
D33	1450	50	Loafing	
D34	1455	50	Loafing	
D35	1500	50	Loafing	
D36	1505	50	Loafing	
D37	1510	50	Loafing	
D38	1515	50	Loafing	
D39	1520	50	Loafing	
D40	1525	50	Loafing	
Peak count of birds within study area: 500				

SURVEY VISIT 12: 03/08/11, 1005 – 1605, Wind: 4-5 W; Cloud Cover: 8-6/8; High to Low Tide; HW Time: 10.05

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1155	14	Loafing	First flock drifting into viewshed.
A2	1200	14	Loafing	
A3	1205	14	Loafing	
A4	1210	14	Loafing	
A5	1215	14	Loafing	
A6	1220	14	Loafing	
A7	1225	14	Loafing	
A8	1230	14	Loafing	
A9	1235	14	Loafing	
A10	1240	14	Loafing	
B11	1245	28	Loafing	Switch to larger flock.
B12	1250	28	Loafing	
B13	1255	28	Loafing	
B14	1300	28	Loafing	
B15	1305	28	Loafing	
B16	1310	28	Loafing	
B17	1315	28	Loafing	
B18	1320	25	Loafing	
C19	1325	50	Loafing	Switch to larger flock.
C20	1330	50	Loafing	
C21	1335	50	Loafing	
C22	1340	?	?	
D23	1350	25	Loafing	One possibly feeding on patch of seaweed.
D24	1355	25	Loafing	
D25	1400	27	Loafing	
D26	1405	30	Loafing	
D27	1410	30	Loafing	
D28	1415	28	Loafing	
D29	1420	30	Loafing and feeding	
D30	1425	30	Loafing and feeding	

SURVEY VISIT 12: 03/08/11, 1005 – 1605, Wind: 4-5 W; Cloud Cover: 8-6/8; High to Low Tide; HW Time: 10.05

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
D31	1430	30	Loafing and feeding	Flock boundaries breaking down – too difficult to follow, therefore switched flocks.
E32	1440	29	Loafing and feeding	
E33	1445	29	Loafing and feeding	
E34	1450	29	Loafing and feeding	
E35	1455	29	Loafing and feeding	
E36	1500	29	Loafing and feeding	
E37	1505	38	Loafing and feeding	
E38	1510	38	Loafing and feeding	
E39	1515	38	Loafing and feeding	
E40	1520	35	Loafing	
E41	1525	35	Loafing	
E42	1530	35	Loafing	
E43	1535	35	Loafing	
E44	1540	35	Loafing	
E45	1545	35	Loafing	
E46	1550	35	Loafing	
E47	1555	35	Loafing	
E48	1600	35	Loafing	Flock now starting to move back east very slightly.
E49	1605	35	Loafing	
Peak count of birds within study area: 500				

SURVEY VISIT 13: 04/08/11, 1045 – 1645, Wind: 4-5 W; Cloud Cover: 8-6/8; High to Low Tide; HW Time: 10.24

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
A1	1230	30	Loafing	
A2	1235	30	Loafing	
A3	1240	30	Loafing	
A4	1245	30	Loafing	
A5	1250	30	Loafing	
A6	1255	40	Loafing	
A7	1300	40	Loafing	
A8	1305	40	Loafing	
A9	1310	40	Loafing	
A10	1315	40	Loafing	
B11	1325	60	Loafing	Switched flock. Flock 1 very difficult to follow at distance on rough sea.
B12	1330	60	Loafing	
B13	1335	60	Loafing	
B14	1340	?	Loafing	Flock very hard to see now on rough sea. No further observations of this flock.
-	1345	-	-	
C15	1350	8	Loafing	
C16	1355	8	Loafing	
C17	1400	8	?	
C18	1405	8	Feeding	
C19	1410	8	Feeding	
C20	1415	8	Feeding	
C21	1420	8	Feeding	
C22	1425	8	Feeding	
C23	1430	8	Feeding	
D24	1440	10	?	
D25	1445	10	Some feeding	
D26	1450	10	Some feeding	
D27	1455	10	Some feeding	
D28	1500	10	Loafing	

SURVEY VISIT 13: 04/08/11, 1045 – 1645, Wind: 4-5 W; Cloud Cover: 8-6/8; High to Low Tide; HW Time: 10.24

Flock Reference Number	Time	No. of Individuals within Discrete Flock	Activity	Notes
D29	1505	10	Loafing	
D30	1510	10	Loafing	
D31	1515	10	?	Views too difficult to determine activity now.
D32	1520	10	?	
D33	1525	10	?	
D34	1530	10	?	
D35	1535	10	?	
E36	1545	8	?	Switch flocks (flock 4 no longer possible to follow).
E37	1550	10	?	
E38	1555	10	?	
E39	1600	10	?	
F40	1615	18	?	Lost track of flock 5.
F41	1620	20	?	Birds now moving east.
F42	1625	20	?	
F43	1630	20	?	
F44	1635	20	?	
F45	1640	20	?	
F46	1645	20	?	

Peak count of birds within study area: 400

SURVEY VISIT 14: 05/08/11, 1135 – 1735, Wind: 3 WNW; Cloud Cover: 2-6/8; High to Low Tide; HW Time: 11.25

Flock Ref Point	Time	No. Individual	Activity	Notes
A1	1255	10	?	First shelduck to appear.
A2	1300	10	?	
A3	1305	10	?	
A4	1310	10	?	
A5	1315	10	?	
A6	1320	18	?	Flock likely to have merged with previously unseen flock.
A7	1325	18	Some feeding	At least some appear to be feeding
A8	1330	18	Mainly feeding	Mainly feeding
A9	1335	15	Some feeding	Some feeding
A10	1340	15	Mainly feeding	
A11	1345	15	Mainly loafing	
A12	1350	15	Mainly loafing	
A13	1355	15	Mainly loafing	
A14	1400	15	Mainly loafing	
A15	1405	15	Mainly loafing	
B16	1415	21	?	Switched flock
B17	1420	21	?	
B18	1425	15	Some feeding	
B19	1430	15	Some feeding	
B20	1435	18	Mainly loafing	
B21	1440	17	Mainly feeding	
B22	1445	15	Mainly feeding	
B23	1450	15	Mainly feeding	
B24	1455	16	Some feeding	
B25	1500	20	?	
B26	1505	15	?	
C27	1510	10	?	
C28	1515	10	?	
D29	1520	12	?	
D30	1525	14	Some feeding	
D31	1530	14	Some feeding	

SURVEY VISIT 14: 05/08/11, 1135 – 1735, Wind: 3 WNW; Cloud Cover: 2-6/8; High to Low Tide; HW Time: 11.25

Flock Ref Point	Time	No. Individual	Activity	Notes
D32	1535	14	Some feeding	
D33	1540	14	Loafing	
D34	1545	14	Loafing	
D35	1550	8	Loafing	6 birds split off west end of flock.
D36	1555	8	Some feeding	
D37	1600	8	Loafing	
D38	1605	11	Loafing	3 birds joined flock
D39	1610	12	Loafing	
D40	1615	13	Loafing	
D41	1620	13	Loafing	
D42	1625	13	Loafing	
D43	1630	20	Loafing	
D44	1635	20	Loafing	
D45	1640	20	Loafing	
D46	1645	19	Mainly loafing with two feeding	
D47	1650	19	Loafing	Flock fragmenting and difficult to observe – switched observations to another flock.
D48	1655	19	Loafing	
D49	1700	20	Loafing	
D50	1705	9	Loafing	Lost birds to other flocks nearby
D51	1710	40	Loafing	Several groups merged
D52	1715	50	Loafing	Flock fragmenting and difficult to observe – switched observations to another flock.
E53	1720	48	Loafing	
E54	1725	60	Loafing	
E55	1730	60	Loafing	
E56	1735	60	Loafing	NB. By 1740hrs flock moving more rapidly east.

Peak count of birds within study area: 600-700

APPENDIX 20R: EXISTING, LOST AND FUTURE HABITAT AREAS WITHIN THE HPC DEVELOPMENT SITE

Appendix R
Existing, Lost and Future Habitat Areas within the HPC Development Site

Habitat Type	Existing Areas	Areas Lost	Areas once Site is Operational*
Broad-leaved woodland (not plantation)	3.5ha	3.3ha	39.7ha (of which 39.5ha are to be created)
Plantation broad-leaved woodland	3.5ha	3.5ha	n/a
Scrub	1.1ha	1.1ha	0.9ha
Calcareous grassland	1.2ha**	1.2ha**	17.7ha
Agriculturally improved grassland	30.6ha	30.6ha	n/a
Species-poor semi-improved grassland	16.1ha	16.1ha	n/a
Species-rich hay meadow	n/a	n/a	30.9ha
Arable	97.6ha	97.6ha	3.8ha (Farmland Birds Annual Cover Crop)
Agricultural land	(included within Arable/ Agriculturally improved grassland/ Species-poor semi-improved grassland above)	(included within Arable/ Agriculturally improved grassland/ Species-poor semi-improved grassland above)	16.0ha
Wetland (including ponds)	<0.01ha	<0.01ha	0.43ha
Linear Features	**Existing Length**	**Length Lost**	**Length once Site is Operational***
Species-rich hedgerow	7.7km	5.8km	13.1km (of which 11.2km are to be created)
Species-poor hedgerow	3.4km	3.4km	n/a
Watercourses (excluding Bum Brook and including Holford Valley ditches)	2.0km	2.0km	1.2km

* All areas of habitat that are included in this column of the table are newly created unless otherwise noted. The areas of restored habitat have been measured within the HPC development site boundary up to the HPC permanent development security fence.

** Bishop's Wood (area 2.3ha) supports calcareous grassland but has been included within this table as woodland (this is because, in the absence of the development, woodland would be the dominant vegetation type)

APPENDIX 21A: ENVIRONMENTAL IMPACT ASSESSMENT RADIOLOGICAL TECHNICAL NOTE

Environmental Impact Assessment Radiological Technical Note

May 2011

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EXECUTIVE SUMMARY

Électricité de France (EDF) proposes the construction and operation of a power station based on two European Pressurised Water Reactors (UK EPRs) at Hinkley Point, near Bridgwater in Somerset. The total electrical output of 3,300 MW(e) will be enough to supply the needs of approximately 5 million homes and a range of shared facilities. The planned site is adjacent to the existing Hinkley Point 'B' (HPB, an operational AGR power station, due to close in 2016) and Hinkley Point 'A' (HPA, a Magnox reactor power station, currently in decommissioning). The new twin EPR power station will be designated as Hinkley Point 'C' (HPC).

This EIA Technical Note summarises the radiological assessments carried out in support of the environmental permitting of the HPC EPRs, as required under the 2010 Environmental Permitting Regulations. The main assessment deals with the prospective radiation doses to infants, children and adults in two 'candidate critical groups' who are exposed to continuous, routine gaseous radioactive discharges (to the atmosphere) and liquid radioactive discharges (to the Bristol Channel) from the two EPRs over an operational life of 60 years. The discharge values used in the dose assessment are derived from operational feedback from current PWRs (of similar design to the UK EPR) and are appropriate for carrying out a site-specific radiological assessment for the HPC development. The assessment includes the impact of direct radiation due to on-site facilities used for the storage of spent fuel and intermediate level waste (ILW).

Together, these assessments allow the Critical Group for the HPC development to be identified (the primary regulatory requirement to support an application for the authorisation of radioactive discharges).

There are separate assessments covering i) possible short-term discharges (one months' routine discharge in a single day); ii) the transport of a range of radioactive materials onto and off the HPC site; iii) future impacts due to potential build-up of nuclides in the environment off-site after 60 years operation of the two EPRs; iv) an assessment of the collective dose to the UK, European and World populations and v) an assessment of impacts on non-human species in four representative habitats around the site, including site specific species (bats and badgers).

The dose to members of the public during the construction phase of HPC and due to any potential pre-existing radioactive contamination in soil or water in the construction area is also considered.

The assessments include prospective radiation doses, were the HPA and HPB sites to continue to discharge radioactive liquids and gases at their current authorised limits, in parallel with those from the future EPRs planned by EDF. In view of the planned closure of HPB in about 2016 (which will then enter a decommissioning phase) with HPA being further advanced in its current decommissioning programme, this is an unlikely scenario. Furthermore, neither HPA nor HPB has, to date, discharged at the authorised limits assumed in this part of the assessment. The scenarios covered prospective doses to the candidate critical groups (above) a collective dose assessment and that due to build-up from all three reactors. This part of the assessment is completed with an estimate of the Total Dose for the

Hinkley Point site, that is, the dose that might be received by a member of the public close to the site and due to discharges from the HPA, HPB and HPC reactors and those due to historic, off-site man-made sources of activity.

All of the prospective radiation doses for the scenarios considered are estimated using standard UK protocols and take full account of local conditions that could affect the final doses received. Generally, the conditions assumed provide for a bounding assessment of prospective doses due to either HPC alone or those due to discharges from the Hinkley Point site as a whole. The prospective doses estimated are then compared against a range of UK-specific dose limits and guidelines (recommended by the Environment Agency in their guidance on the assessment of public doses). Where applicable, they are also compared with the public dose limit for radiation from man-made sources (1,000 μSv y^{-1}, but which excludes that from medical exposures) the local and UK average natural background radiation dose and with man-made background (that all represent involuntary sources of risk) and with some sources of radiation exposure that represent voluntary sources of risk.

The main assessment considers three age groups (adult, child infant) in each of two candidate critical groups i) a Fishing Family who consume large amounts of locally caught seafood (and are therefore exposed to liquid discharges from the EPRs that will pass to sea) but who also eat locally grown produce (so are also exposed to gaseous discharges to the atmosphere) and ii) a Farming family who eat locally grown produce but also locally caught seafood. The food consumption patterns, location and other habits assumed for the people within each of these 'candidate critical groups' ensures they are 'representative persons' subject to the highest exposure to liquid and gaseous radioactive discharges from the HPC EPRs which bounds any that could occur during normal operations (that is operation at power to generate electricity and short periods when the reactors may be shutdown for refuelling). Both groups are also assumed to be exposed to a direct radiation ('shine') due to a proposed Interim Storage Facility for Spent Fuel (and one for Intermediate Level Waste) on the HPC site.

The highest prospective doses due to the HPC routine continuous discharges at the values used (plus that due to direct radiation due to waste stores) are 4.5 μSv y^{-1} to the infant and 2.5 μSv y^{-1} to the child in the '**Farming Family with marine and gaseous exposures**' which is therefore considered the **Critical Group for the proposed HPC EPRs**. These doses (and therefore those to all other members of the candidate critical groups) are well below the relevant dose criterion, that is, the 'new source constraint' of 300 μSv y^{-1} (and also well below a separate recommendation of 150 μSv y^{-1})[a].

[a] Based on ICRP's new recommendations on radiological protection, the UK's Health Protection Agency (HPA-RPD) proposes that for new nuclear power stations and waste facilities the constraint should be reduced (from the previously recommended value of 300 μSv y^{-1}) to some value less than 150 μSv y^{-1}. This remains a recommendation.

The prospective doses due to discharges from HPC are dominated by those due to C-14 (mainly in gaseous discharges and responsible for at least 90% of the dose to all members in both critical groups) with the remainder of the prospective dose (up to about 7%) being due to discharges of I-131 and H-3 (all other nuclides in the discharges each contribute to less than 1% of the prospective doses). Techniques have been optimised (and continue to be refined) in the design of the EPR and will be exercised during operation, to minimise gaseous and liquid radioactive discharges at source, ensure efficient abatement and therefore minimise the impacts of the discharges on the environment and ensure compliance with BAT (Best Available Techniques)[b].

The highest prospective doses due to planned short-term gaseous releases from an individual EPR on the HPC site are estimated to be up to 0.45 μSv per discharge to an infant (in a specific and separate critical group most exposed to the short-term discharges; doses to the 'candidate critical groups' are much less). This is less than the relevant regulatory dose criterion of 300 μSv y^{-1} (or the limit of 1,000 μSv y^{-1} for all man-made sources). All liquid discharges pass to the main cooling water system so that short-term liquid discharges from the EPRs will not occur and do not need to be considered in the assessments.

Radiation doses due to transport of radioactive materials to and from HPC considers low and intermediate level waste, new fuel and spent fuel. Depending on the transport scenario considered, the estimated doses to members of the public on the transport routes are in the range of 0.06 to 2 μSv y^{-1}. They are therefore much lower than the relevant dose criterion for this scenario, which is the public dose limit from man-made sources of 1,000 μSv y^{-1}. The scenarios modelled make a number of conservative assumptions about the proximity of the public to the transport operations. Together with the planned store for spent fuel on the HPC site (which will avoid the need for off-site transport of fuel until an extended period of cooling has been achieved) it is therefore unlikely that even these small assessed doses would be realised in practice.

The prospective dose to a member of the public walking past the HPC site and close to this spent fuel store and the store for ILW (based on a typical daily 20 minute recreational walk outside the site boundary and a conservative store design, which assumes the public dose limit on its outside walls) is estimated as 1.5 μSv y^{-1} which, again, is much less than the relevant dose criterion (the public dose limit from man-made sources of 1,000 μSv y^{-1}). Doses to occupants in the dwelling currently situated closest to the planned ISF are estimated as less than 0.002 μSv y^{-1} (and are even less for those in the two candidate critical groups).

[b] The UK Government's Department of Energy and Climate Change has recently issued statutory guidance stating that, where the prospective dose to the most exposed group of members of the public from discharges from a site at its current discharge limits is below 10 μSv y^{-1} the Environment Agency should not seek to reduce further the discharge limits that are in place, provided that the holder of the authorisation applies and continues to apply Best Available Techniques (BAT).

The *per caput* collective doses to the UK, European and World populations (truncated at 500 years) due to liquid and gaseous discharges from HPC are all of the order of a few nSv y^{-1}. They are therefore in the range of a few nSv y^{-1} that, in the Environment Agency interim guidance document on the assessment of prospective public doses, are stated "*should be ignored in the decision making process, as the associated risks are 'miniscule' with the contribution to total doses to individuals being insignificant*". C-14 accounts for between 95% and 100% of the collective dose to all of the populations considered, but all the collective doses (expressed as total Man Sv or the *per caput* doses to individuals) due to HPC discharges are much lower than those due to naturally occurring C-14 to the UK population alone.

Analysis of soil and groundwater and surface water from the construction area for the planned HPC EPRs shows naturally occurring nuclides at typical UK background values. Very small amounts of tritium were identified in some groundwater samples, but at concentrations below those allowed for in UK drinking water. A formalised public dose assessment due to HPC construction has therefore not been carried out. However, fugitive emissions of soil or water from construction or off-site transport or disposal of surplus soil would not be expected to give rise to radiological impacts any greater than those associated with any other form of large-scale construction project in the Hinkley Point area.

Doses due to build-up in the environment and those to non-human species due to HPC discharges are very small (and therefore summarised together with those due to cumulative Hinkley Point Site impacts, below).

The highest prospective dose due to HPC routine, continuous liquid and gaseous discharges, plus those from HPA and HPB (at their current authorised limits) was assessed as 17.2 µSv y^{-1} to the infant in the '**Farming Family with marine and gaseous exposures**' which is therefore considered the **Critical Group for the Hinkley Point site**. This prospective dose (and therefore those to all other age groups in both candidate critical groups) is well below the relevant regulatory dose criterion, that is, the 'site constraint' of 500 µSv y^{-1}. At least 47% of the cumulative site doses assessed are due to discharges from the HPB reactor. When this ceases operation in 2016 and enters its decommissioning phase, gaseous and liquid discharges from this part of the site will decrease appreciably. The cumulative Hinkley Point site doses assessed here (and the collective doses as well) will also therefore decrease. At this future juncture, realistically, only the small assessed doses due to the operational HPC EPRs would need to be considered for the site as a whole.

The prospective doses due to the build-up of activity in the environment due to discharges from either the Hinkley Point site as a whole or from HPC alone (the more realistic scenario) are estimated as between 0.018 µSv y^{-1} (to a possible future off-site construction worker) to 2.8 µSv y^{-1} (to a user of the marine environment).

The Total dose for a member of the public at the Hinkley Point site due to discharges from HPA, HPB and HPC and direct radiation and that due to off-site sources (such as those further up the Bristol Channel) is estimated as 61 $\mu Sv\ y^{-1}$ which is significantly less than the relevant dose criterion, that is the public dose limit for all sources of man-made radiation of 1,000 $\mu Sv\ y^{-1}$.

Overall, not only are all the prospective doses to individual members of the candidate critical groups due to HPC discharges (or those from the Hinkley Point site as a whole) below the relevant regulatory constraints (notably the site and source constraints laid down by the Environment Agency) but they are also all significantly less than the public dose limit of 1,000 $\mu Sv\ y^{-1}$. All of the individual doses assessed to the candidate critical groups or those from specific scenarios (such as transport or build-up) are much smaller than the average background dose from other man-made sources in the UK, that is about 410 μSv y-1 (nearly all of which is due to medical exposures). All of the assessed doses are also either comparable in magnitude to, or smaller than, those due to radiation doses from individual medical procedures (such as a dental or chest X-ray) or for, example, those received on a single aircraft flight (which is due to exposure to cosmic radiation at altitude).

The assessed doses to all organisms in all four of the representative habitats around the site and due to discharges from either the Hinkley Point site as a whole or from HPC alone (the more realistic scenario) are all less than 10 $\mu Gy\ h^{-1}$. This is a value below which the relevant guidance states that no further or more detailed assessments are required and which implies no measurable harm on any of these organisms due to liquid or gaseous discharges from either HPC alone or the cumulative discharges from the Hinkley Point site as a whole.

1.0 INTRODUCTION

This EIA Technical Note examines the potential impacts, and where required, mitigation of radiological discharges and exposure, during the construction and operational phases of the proposed development of the two European Pressurised Water Reactors (UK EPRs) at the Hinkley Point Site near Bridgwater in Somerset, to be known as Hinkley Point C (HPC). The total electrical output of the two EPRs will be 3,300 MWe which is sufficient to supply the needs of approximately 5 million homes and a range of shared facilities. The operational design life of the power station is 60 years.

A location map of the site is shown in Figure 1. The HPC site is adjacent to the existing Hinkley Point A (Magnox) and Hinkley Point B (AGR) nuclear power stations and lies on the south side of Bridgwater Bay that forms part of the Bristol Channel. The planned site for HPC spans two areas of land, the largest currently consisting of agricultural land, the other smaller part being within part of the existing Hinkley Point Power Station Complex.

The Hinkley Point B (HPB) site is occupied by an AGR power station that is in operation, with a power output of 860 MWe. HPB is due to cease operation in 2016 after which it will enter a phase of decommissioning. The Hinkley Point A (HPA) site is occupied by a Magnox power station that ceased operation in 1999 and is currently being decommissioned, completion of which is due in about 2085-2100. Both of these reactor sites currently release liquid and gaseous radioactive discharges to the environment (the Bristol Channel and the atmosphere respectively) under authorisations issued by the Environment Agency of England and Wales.

The HPC EPRs (designated EPR West and EPR East) will use seawater cooling drawn from and then returned to the Bristol Channel, a route that will also serve for treated liquid radioactive discharges. Each EPR will have a single main stack for treated gaseous discharges, from various plant areas into the atmosphere. Minor gaseous discharges may occur from the turbine hall, maintenance facilities and store for spent fuel.

This EIA Technical Note covers:

- The legislation and regulatory background to radiation protection and control of radioactive discharges in the UK. This provides the background from which limits and guidelines used in the assessment are drawn.
- Methodology for the assessment. This also covers the risk assessment methodology and criteria against which the radiological impacts are to be assessed.
- The mitigation measures already in place in the UK EPR reactor design.
- Assessment of the residual impacts due to discharges specifically for the HPC site. The scope of impacts covered is described in the rest of this introduction (see below).

1.1 Scope of the Radiological Assessment

This EIA Technical Note describes the methods used for the radiological impact assessment and presents the results for the main phases of the proposed HPC development, as outlined in the Sections 1.1.1 and 1.1.2 below and the overall impact of the Hinkley Point Site.

1.1.1 Radiological Assessment of Impact of Construction Phase

This EIA Technical Note summarises the results of the radiological surveys that have been carried out on the proposed construction area for HPC, covering direct radiation, soil surveys and the analysis of surface water and groundwater. On the basis of the results obtained, it provides an assessment of potential radiological impacts on the public due to the construction phase itself that could be due to off-site fugitive emissions of dust from soil disturbance or discharge of water from, for example, dewatering operations.

1.1.2 Radiological Assessment of Impact of Operational Phase for HPC

Operational phase assessments for HPC (East and West) include radiological impacts on humans and non-human species due to liquid discharges to the Bristol Channel and gaseous discharges to the atmosphere. The main assessment deals with the annual prospective doses to two candidate critical groups exposed to direct radiation and due to liquid and gaseous discharges from HPC. There are separate assessments for prospective doses to other members of the public who may be exposed to short-term gaseous discharges (from a single EPR) or to the transport of radioactive materials on to and off the site and those to future off-site users (that are due to potential build-up of nuclides in the environment over the operational life of HPC). There is also an assessment of the prospective collective doses to the UK, European and World populations. Impacts to non-human species cover four separate habitats around the site.

1.1.3 Cumulative Hinkley Point Site Impacts

The Technical Note assesses the overall radiological impacts due to current liquid and gaseous discharges from the existing HPA and HPB reactor sites and thus the cumulative future impacts from the operation of all three licensed sites. For Hinkley Point A and Hinkley Point B, the assessment is based on discharges at the current authorised limits. The cumulative impacts estimated in the current report assume that discharges from these facilities continue for the next 50 years, and in parallel with those from the proposed Hinkley Point C EPRs. This leads to some uncertainties and probably conservatism in the final doses estimated, since during the next 50 years, Hinkley Point A and B Units will be in advanced stages of decommissioning and, in any case, have never discharged at their authorised limits.

Cumulative impacts cover the candidate critical groups, a collective dose assessment and that due to build-up.

1.1.4 Radiological Assessment of Impact of the Decommissioning Phase

The current Environmental Impact Assessment (EIA) does not address radiological impacts during future decommissioning of the EPR. These would be addressed under a separate EIA carried out under the separate legislative framework of the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations (SI, 1998)[1].

2.0 LEGISLATION

The following sections provide an overview of the principle sources of legislation that apply to radiological protection, starting with international agreements and protocols and then describing how these cascade down through European legislation and are eventually implemented in the United Kingdom. A central requirement of much legislation centres on maintaining doses to members of the public and workers to ensure they are As Low As Reasonably Achievable (ALARA) or As Low As Reasonably Practicable (ALARP). The latter is specifically applied in the UK and requires the employer (or operator of a nuclear facility) to provide systems (engineered means, operational means and protective equipment) to reduce the radiation dose until the cost of implementing those measures (in time, trouble or money) is considered to be grossly disproportionate to the radiation risk averted. Both terms are, however, used in published UK regulatory guidance, ALARP generally by the Nuclear Installations Inspectorate (NII) and ALARA by the Environment Agency (in accordance with the Basic Safety Standards Directive (IAEA, 1996)[2].

2.1 International Legislation, Guidance and Recommendations

2.1.1 Human Radiological Protection Principles

The framework for radiation protection worldwide is based on the International Atomic Energy Agency (IAEA) Basic Safety Standard (BSS)[2]. Although the IAEA BSS has no legal standing *per se*, it is used by Member States as a basis for their legal radiological protection systems.

The scientific basis of the BSS[2] is based on the recommendations of the International Commission on Radiation Protection (ICRP). Its latest published recommendations are ICRP 103 (ICRP, 2007)[3]. However, the recommendations in current use within the BSS[2] are ICRP 60 (ICRP 1990) [4] owing to the time taken for the recommendations to become legally adopted in those States where they are applied. It is likely that the 2007 recommendations will be in place in the UK once HPC is operational.

Other organisations provide input into the IAEA BSS[2], including the Food and Agriculture Organisation of the United Nations; the International Labour Organisation; the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development; the Pan American Health Organisation and the World Health Organization.

The principles for radiation protection described in the ICRP 60[4] recommendations and developed in the ICRP 103[3] recommendations are those of:

- Justification: Any decision that alters the radiation exposure situation should do more good than harm;
- Optimisation of protection: The likelihood of incurring exposures, the number of people involved and the magnitude of their individual doses

should all be kept as low as reasonably achievable, taking into account economic and societal factors; and

- Dose limitation: The total dose to any individual from regulated sources in planned exposure situations, other than medical exposure of patients, should not exceed the appropriate limits recommended by the ICRP.

2.1.2 Non-Human Radiological Protection

In the past, non-human species have been considered to be adequately protected by the radiation protection systems developed for the protection of humans. For example, ICRP 60[4] states that:

"*The Commission believes that the standard of environmental control needed to protect man to the degree currently thought desirable will ensure that other species are not put at risk. Occasionally individual members of non-human species might be harmed but not to the extent of endangering whole species or creating imbalance between species.*"

More lately, ICRP Publication 91 describes a framework for assessing the impact of ionising radiation on non-human species (ICRP, 2003)[5]. This was designed to harmonise with the existing ICRP approach to the protection of human beings, but not to set regulatory standards. It sets out a systematic, risk-based approach to assessing radiological impacts on non-human species. This approach has been reiterated in the ICRP 103[3] recommendations. Other organisations have developed assessment tools to determine the risk of radiation exposure to non-human species. These are described in later sections of this Technical Note.

Note the IAEA[2] and ICRP[3, 4] documents have no legal standing in their own right. However, they do influence the development of the legal system for radiation protection internationally.

2.1.3 Transport

The IAEA formulates regulations for the Safe Transport of Radioactive Materials that give standards of safety for radiation, criticality and thermal hazards to persons, property and the environment due to the transport of radioactive materials. The regulations were first published in 1961 and have been subject to periodic reviews, the latest of which were published in 2009 (IAEA, 2009)[6]. The IAEA also publish supporting advisory material and guidance.

In Addition, the United Nations publish Recommendations on the Safe Transport of Dangerous Goods known as the "Orange Book" (UN, 2009)[7] where goods are divided in to nine classes, Class 7 being radioactive materials. An expert group of the Economic and Social Council of the United Nations issued a resolution that entrusted the task of establishing recommendations for the safe transport of radioactive materials to the IAEA thus ensuring compatibility between IAEA regulations[6] and the "Orange Book"[7].

2.2 European Legislation, Guidance and Recommendations

2.2.1 Human Radiological Protection

The Euratom Treaty (EURATOM, 1957)[8] came into force on 1st January 1958 and established a European Atomic Energy Community, widely known as Euratom. Under Articles 31 and 32 of the Treaty, the Commission of the European Communities is required to develop radiological protection standards for application in Member States in three formats:

- Regulations - Apply directly to Member States;
- Directives and Decisions of Council - Set goals and standards that must be translated into Member States legislation; and
- Recommendations and communications – These are not mandatory.

Central to these and implementing the IAEA BSS (Section 2.1.1.) is Council Directive 96/29/Euratom BSS dated 13th May 1996, which lays down basic safety standards (BSS) for the protection of health of workers and the general public against the dangers from ionising radiations. This Euratom BSS[9] also provides the dose coefficients required to calculate doses to members of the public from intakes of radionuclides.

2.2.2 Non-Human Radiological Protection

In Europe, there are no regulations for the protection of non-human species from radiation hazards. However, the Habitats and Birds Directives (EC, 1992)[10] covers general requirements for the protection of non-human species (plants, animals) and their habitats. The regulators in the UK (the Environment Agency, Scottish Environment Protection Agency and Northern Ireland Environment Agency, 'the Environment Agencies') have a duty to comply with the implementation of these, in particular covering:

- Existing authorisations, consents, licences and permissions or variations for discharges of chemicals; and
- Ensuring that no Agency-authorised activity or permission results in an adverse effect, either directly or indirectly on the integrity of identified European sites (Natura 2000 sites).

2.2.3 Transport

In Europe, the IAEA Regulations for the Safe Transport of Radioactive Materials[6] have been implemented into separate regulations and agreements depending on the mode of transport. These are the "International Regulations Concerning the Carriage of Dangerous Goods by Rail" (RID) (UN, 2009)[11]; the European agreement for the "International Carriage of Dangerous Goods by Road" (ADR), (UN, 2009)[12] and the European agreement for the "International Carriage of Dangerous Goods by Inland Waterways" (ADN) (UN, 2009)[13].

2.3 UK Legislation, Guidance and Recommendations

2.3.1 Human Radiological Protection

A number of Acts and Regulations govern the exposure or potential exposure of workers and the general public to ionising radiations. The principle ones (that are supported by a wide range of Codes of Practice and guidance) are outlined below, together with their principal requirements.

The Nuclear Installations Act 1965

The Nuclear Installations Act 1965 (amended 1969)[14] governs nuclear installations in the UK by the issue of site licences by Her Majesty's Nuclear Installations Inspectorate (HMNII, now part of the Nuclear Directorate of the Health and Safety Executive). The licenses cover a standard set of 36 detailed requirements to be addressed by a site licensee covering, for example, management systems; safety cases, plant safety; construction; plant modifications; operations, accumulation/disposal of radioactive waste and decommissioning[15].

Ionising Radiations Regulations 1999;

Radiation exposure of the worker and the general public is regulated by the Ionising Radiations Regulations 1999 (IRR99) (SI, 1999)[16]. These regulations were made under the Health and Safety at Work, etc. Act 1974 and implement the Euratom Basic Safety Directive 96/29/Euratom. The regulations define the dose limits that meet the requirements of the ICRP and also specify that radiation exposures are as low as reasonably practicable (ALARP). The duty is on the employer or operator to ensure that these requirements, amongst others, are complied with. In the case of the general public, the effective dose limit is 1 mSv per annum from man-made sources.

Radioactive Substances (Basic Standards)(England and Wales) Direction 2000;

The Radioactive Substances (Basic Standards)(England and Wales) Direction 2000[17] implements the obligations of Euratom BSS Directive in England and Wales. The principle aims of the Direction require the Environment Agency in England to ensure, when exercising its duties and functions under the Environmental Permitting Regulations that:

- All public ionising radiation exposures from radioactive waste disposal are kept ALARA;
- The sum of doses arising from such exposures does not exceed the individual public dose limit of 1 mSv y^{-1};
- The individual dose from any single site does not exceed 0.5 mSv y^{-1} and;

- The individual dose received from any new discharge source since the 13th May 2000 does not exceed 0.3 mSv y^{-1}.

Note that these requirements are now subsumed into the more recent Environmental Permitting Regulations (see below).

Environmental Permitting Regulations

The use, accumulation, storage, disposal and discharge of radioactive materials in the UK was regulated via authorisations issued under the Radioactive Substances Act 1993 (RSA 93)[18] but together with Basic Standards Direction[17], more recently updated under the Environmental Permitting Regulations 2010[19]. These require that a person must not operate a regulated facility except under the authorisation of an Environmental Permit issued by the relevant regulatory body. This includes undertaking activities with radioactive substances, where a person uses premises for the purposes of an undertaking and that person disposes of radioactive waste from those premises.

The Environmental Permitting Regulations are regulated by the Environment Agency in England and Wales. It is the primary regulatory framework under which permits to make radioactive discharges (gas, solid or liquid) to the environment are issued to operators of premises, including licensed nuclear sites. On a Nuclear Licensed Site, the accumulation of radioactive waste is regulated by HMNII under a section of the Nuclear Installations Act[14], specifically site License Condition 32. A 'Memorandum of Understanding' between the Environment Agency and the HMNII ensures a consistent and seamless approach between the control of the radioactive wastes on the sites and any subsequent discharge or disposal.

Permits to discharge radioactive waste are only granted after a rigorous assessment process which includes a requirement to complete a prospective assessment of the radiological impacts on the public. More recently this has been extended to impacts on non-human species. The prospective dose assessments are determined using modelling. This is because it is not practicable to measure exposure directly (or in advance of the operations of the plant) and it is essential to show that any doses received would be below regulatory guidelines and also in accordance with the principles of ALARA (outlined above). Once these and other assessments are completed, there is a period of consultation on the Environment Agency's proposed decision as to whether to grant a permit (previously termed 'authorisation' under the previous regulatory framework). The permit will also impose a wide range of requirements to protect the public and environment by the permit holder. After issue, the permits will also subject to periodic reviews.

2.3.2 Best Practical Means (BPM) Environmental Optimisation and Best Available Techniques (BAT)

Schedule 23, Part 3 of the Environmental Permitting Regulations 2010[19] implements the relevant requirements of the Basic Safety Standards (BSS) Directive[9], namely that in relation to radioactive waste, all exposures to ionising radiation of any member of the public and of the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable, economic and social factors being taken into account (ALARA).

"Best Available Techniques" (BAT) are the means an operator uses in the design and operation of a facility to deliver an optimised outcome i.e. in order to reduce exposures to ALARA. The fundamental aim in the application of BAT is to prevent and, where not practicable, minimise waste generation and discharges to the environment[20].

Importantly, the application of BAT is not merely concerned with abatement and other "end of pipe" controls. BAT applies across the whole life cycle of the plant from design, through procurement, construction, operation and final decommissioning. BAT applies to the operation, maintenance, testing, calibration, sampling, measuring, and analysis of relevant plant, systems and equipment. It also relates to the procedures and management systems that may impact on environmental performance.

Prior to the introduction of the Environmental Permitting Regulations under the UK's regulatory framework, authorisations granted in England and Wales for the discharge of radioactive waste required implementation of the Best Practicable Environmental Option (BPEO) and Best Practicable Means (BPM) as the means by which environmental optimisation was achieved. The application of BAT provides no different test with respect to environmental optimisation. Indeed, the Environment Agency has stated:

> "*We believe BAT to be broadly the same concept as best practicable environmental option (BPEO) and best practicable means (BPM) and to deliver the same level of environmental protection....We also consider that the process for assessing BAT is the same as that for BPEO/BPM*"[21]

BAT may be determined by comparison against international best practice and operational experience or through an optioneering process where meaningful alternatives are compared and will remain a requirement in the issue of permits under the new regulations[19].

As part of the Generic Design Assessment (GDA) of candidate nuclear power plant designs, the Environment Agency has published a Process and Information Document (PID) (Environment Agency, 2007)[22] requesting Parties provide information demonstrating that the design of the proposed facility has been optimised with respect to the environment and which includes:

- Significant waste generating and management process; description of the methods implemented to minimise waste arising and discharged or disposed of, along with a demonstration that they are the best practicable;

- Minimisation of arisings and disposal of waste during operation of the reactor; review of the design features;

- Forward planning and minimisation of the waste arising from decommissioning activities; review of the features of the particular candidate design;

- Methods of determination of discharges by demonstrating that the techniques and systems proposed for measurement and assessment of discharges and disposal of radioactive waste represent the best practicable means for such analyses; and

- Arisings, management and disposal of liquid waste streams, providing a demonstration that BAT and good practices are used to prevent direct or indirect discharges to groundwater, prevent or minimise emissions of pollutants from each significant effluent stream along with consideration of the means of control in the event of detection of unplanned radioactive or other contamination of the discharge.

As part of the GDA for the UK EPR, extensive demonstration of the use of BAT for abatement of discharges has already been achieved (see the Fundamental Safety Overview, Volume 3, D.7.4, 2008)[23] and further developed in the Pre-construction Environmental Report (UK EPR, Chapter 8, BAT sub-chapter 8.2)[24]. Demonstrating application of BAT is a pre-requisite to demonstrating that doses to the public and workers will be ALARA. It will remain an on-going consideration throughout the rest of the design, operational (and eventually, decommissioning) phases of the UK EPR[24]

NNB GenCo will be applying for a permit to dispose of radioactive waste from the proposed facilities of Hinkley Point. The submission that supports the permit will need to demonstrate that environmental optimisation through the application of BAT has been achieved. The permit requires the case that supports the application of BAT is maintained, reviewed and updated.

2.3.3 Radiological Protection due to Radioactive Transport in the UK

In the UK, the ADR[12] and RID[11] have been adopted in the Carriage of Dangerous Goods and the Use of Transportable Pressure Equipment Regulations 2009 (OPSI 2009) [25]. These regulations apply to the transport of radioactive materials by road and rail and detail any UK specific derogations. Dose limitation is enforced through the IRR99[16] for both members of the public and workers.

2.3.4 Radiological Protection of Non-Human Species in the UK

As for European legislation, in the UK there are no specific regulations for the protection of non-human species from radiation sources. However, UK regulations are in place to enforce the European Directives in the UK, the main one being Conservation (Natural Habitats) Regulations (SI, 1994)[26]. These implement the Habitats Directive (1992) in the UK and require steps to maintain and restore to favourable conservation status the habitats and species of EU Community level interest.

In the GDA Process & Information Document[22] the Environment Agency requires that an assessment of the likely impact of the radioactive discharges on non-human species be carried out. They refer to Environment Agency R&D Publication 128 (EA, 2002)[27] and make recommendations for carrying out generic radiation dose assessments. This was an interim publication, whilst a more comprehensive European model was in development. The modelling code ERICA, (Beresford, 2007)[28] funded under EURATOM within the EC 6th Framework Programme, was published in 2007.

3.0 METHODOLOGY

The following sections describe the methodology adopted for assessing the potential radiological impacts from the HPC development.

3.1 Summary of Approach

European and UK legislation outlines the requirements for an EIA and Environmental Statement to support planning for certain developments. This includes European Community Directive (85/337/EEC as amended by 97/11/EC, 1997)[29] 'On the Assessment of the Effects of Certain Public and Private Projects on the Environment' and the Town & Country Planning (Environmental Impact Assessment) (England & Wales) Regulations (1999)[30] and, more specific to the proposed HPC development, the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations[1] and Electricity Works (Environmental Impact Assessment (England and Wales) 2000 regulations[31].

However, there is currently no statutory defined method for carrying out Environmental Impact Assessment (EIA) in the UK and in particular for assessing radiological impacts. General guidelines are available in, for example, the Department of the Communities and Local Government, 1999[32], IEMA, 2006[33], Environment Agency, 2002[34] and EIA, 2006[35]. Using these guidelines, the approach adopted in this EIA Technical Note is based on the following steps:

- Definition of the current baseline: For the radiological assessment for HPC, this consists of the average background radiation levels in the UK from all sources and the existing site specific radiation impacts, including those due to the HPA site (currently being decommissioned) and the HPB site (currently operating but due to enter its own decommissioning phase in about 2016);

- Impact assessment: This covers the prospective (broadly equivalent to predicted) radiological impacts from the HPC site and assessment of these against recognised radiological protection standards for a specified range of human and non-human receptors. The method assumes discharges from two UK EPRs on the Hinkley Point C site (designated for the purposes of this Technical Note as EPR East and EPR West). The discharge values used in the dose assessment are derived from operational feedback from current PWRs (of similar design to the UK EPR) and are appropriate for carrying out a site-specific radiological assessment for the HPC development. The discharges are assumed to be continuous, uniform, routine releases over an operational life of 60 years (excepting for the assessment of short-term gaseous releases). The discharges contain a specific range of radionuclides, the subsequent movement of which through the environment (air, water, soil) and into the food chain is predicted using a range of industry-standard computer models. The model parameters (wind direction etc.) are specific to the HPC site. The human receptors are formulated to be bounding in terms of the exposure pathways due to HPC discharges and their food consumption patterns, thus the levels of nuclides they are eventually exposed to and the doses they receive. Non-human species cover a generic range plus site-specific ones, based on ecological surveys;

- Proposed mitigation measures; and
- Assessment of any residual impacts after implementation of mitigation.

At the impact assessment stage, the development proposals are compared to the findings of the baseline environmental surveys and baseline data, to predict the potential impacts that may result from the development. This quantitative assessment will determine the overall level of significance of radioactive discharges on the populations and is considered in several stages:

- Step 1: Standard set of descriptions for each identified potential impact (spatial extent, i.e. site specific or wider impacts, beneficial, adverse, direct, indirect, temporal extent, reversible or irreversible, secondary or cumulative);
- Step 2: Assessment of the scale of the potential impact, the value and sensitivity of the receiving environment and the likelihood of the impact occurring; and
- Step 3: Determination of the degree of significance of the potential impact, using an impact assessment matrix (IAM) moderated by professional judgement where appropriate.

Once identified and described, the evaluation of the degree of significance of each potential impact is based on (1) the assessment of the value and sensitivity of the receptor and (2) the magnitude of the impact. This evaluation process provides a level of significance for each potential impact. Specific criteria for the assessment of each potential impact have been developed for EIAs, giving due regard to the following:

- Values of the receptor / resource (e.g. international, national, regional, and local importance);
- Sensitivity of the receptor; and
- Extent and magnitude of the impact, be it beneficial or adverse.

3.2 Definition of the Current Baseline

The baseline is defined by looking at existing environmental records for the area around the existing Hinkley Point Site and background doses received by the general population of the UK. This is discussed in more detail in Section 4.

3.3 Construction Phase Assessment

This will address the generic approach for scenarios and methods for assessing prospective dose to construction workers from potential man-made radioactive contamination present on-site during the construction phase.

3.4 Operational Phase Assessment

This section will address the human and non-human impacts for the operational phase assessment.

3.4.1 Human Impacts

3.4.1.1 Human Health Impacts, Dose Limits and Criteria

It is normal convention in the context of dose assessments to define a set of characteristics for a hypothetical group of people whose habits would result in them being subject to the highest exposure to radioactive discharges from a source (or site). The hypothetical group of people following these habits has been termed the Critical Group. This approach continues to be endorsed by the International Commission for Radiation Protection, although the term “representative person” is now used in place of Critical Group to avoid any potential misunderstanding arising from the terminology. However, since this is a relatively recent change in terminology, many of the references cited within this assessment use the phrase Critical Group, therefore the term is retained in this assessment. To determine the Critical Group for HPC and the Hinkley Point Site, an initial range of ‘candidate critical groups’ has been identified, that covers individuals with habits, (especially food consumption patterns), that might potentially result in them having the highest exposures to discharges and direct radiation. The subsequent assessments then allow those who are predicted to receive the highest dose (the Critical Group) to be identified.

Reference 2.7 of the Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs[22] requires a prospective dose assessment to be carried out for a generic site for the proposed nuclear new build. The dose assessment for the generic site should include:

- Prospective annual dose to the candidate critical groups exposed due to liquid discharges to the marine environment;
- Prospective annual dose to the candidate critical groups exposed due to gaseous discharges to the atmosphere;
- Prospective annual dose to the candidate critical groups exposed due to all discharges from the facility;
- Prospective annual dose from direct radiation to the most exposed member of the public;
- Identification of the Critical Group for the facility with prospective doses to the most exposed age group for the purposes of determining discharge authorisations;

- Potential short-term doses, including via the food chain, based on the maximum anticipated short-term gaseous discharges from the facility in normal operation;
- A comparison of the calculated prospective doses with the relevant dose constraints; and
- An assessment of whether the build-up of radionuclides in the local environment of the facility based on the anticipated lifetime discharges might have the potential to prejudice future legitimate uses of the land or sea.

Regulatory dose constraints for the public

Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000 implements the obligations of the Euratom BSS[2] Directive in England and Wales. The principal aims of the Direction are to require the Environment Agencies to ensure, when exercising their duties and functions under the RSA 93 and more recently the EPRs (see Section 2.3.1).

These principles have been incorporated into the most recent Environmental Principles issued by the Environment Agency in support of their Radioactive Substances Regulation (Environment Agency, 2009)[36].

In its recent responses to the most recent recommendations of the ICRP, the UK Health Protection Agency (HPA-RPD) continues to recognise the dose constraint of 0.3 mSv y^{-1} but considers more challenging dose constraints may be applicable where appropriate. On this basis, they have proposed a dose constraint for members of the public due to new nuclear power stations of 0.15 mSv y^{-1} (HPA-RPD, 2009)[37]. Application of this to other new facilities is the subject of further consultation.

The Government has stated in the UK Strategy for Radioactive Discharges 2001-2020[38] that, as a result of reductions in radioactive discharges, there will be a progressive reduction of human exposure to ionising radiation. It is expected that members of a 'local critical group' of the general public in the UK will be exposed to a dose of no more than 0.02 mSv y^{-1} from authorised radioactive discharges to the aquatic environment from 2020 onwards. This Strategy was recently updated in July 2009 and reiterates the objective for a progressive reduction in discharges and public doses but without stating the specific dose target of 0.02 mSv y^{-1} (Department of Energy and Climate Change, 2009)[39].

In the UK Government Command Paper Cm 2919 (HMSO, 1995)[40] the Government introduced a lower bound public individual dose of 0.02 mSv y^{-1} (20 µSv y^{-1}) due to radioactive discharges. This was consistent with the Health and Safety Executive's (HSE) 1992 Safety Assessment Principles for New Nuclear Facilities. The current edition of the HSE Safety Assessment Principles for Nuclear Facilities (HSE, 2006)[41] gives a basic safety objective (BSO) of 0.02 mSv y^{-1} for any person outside a nuclear licensed site during normal operation. A BSO forms a benchmark that reflects modern nuclear safety standards and expectations.

The dose constraint of 20 µSv y^{-1} is also noted in the Interim Guidance on the Principles for the Assessment of Prospective Public doses issued by a consortium of the Environment Agency, Scottish Environment Protection Agency, Department of Environment, Northern Ireland, National Radiological Protection Board and Food Standards Agency in 2002. It is a dose below which it is stated that regulators should not seek to secure further reductions in the exposure of members of the public, provided that they are satisfied that the operator is using Best Practical Means (BPM) to limit discharges (paragraph 38 in Environment Agency, 2002)[42].

This guidance document[42] also notes widespread international agreement that doses to members of the public of the order of 0.01 mSv y^{-1} (10 µSv y^{-1}) or less are sufficiently low to be of 'no regulatory concern'. However, in paragraph 40, it notes that:

"All doses to members of the public, including those below 0.01 mSv y^{-1} remain subject to the ALARA requirement under directions placed on the Environment Agency and SEPA. This is achieved primarily through the application of best practicable means (and BAT) to limit and control authorised discharges of radioactive waste to the environment."

More recently, in 2009, DECC and the Welsh assembly government issued statutory guidance to the Environment Agency for England and Wales (DECC and Welsh Assembly, 2009)[43] with the overall objective of implementing the UK's Strategy for Radioactive Discharges[38]. With respect to the dose value of 10 µSv y^{-1} in paragraph 22, this statutory guidance states that:

"Where the prospective dose to the most exposed group of members of the public from discharges from a site at its current discharge limits is below 10 µSv y^{-1} the Environment Agency should not seek to further reduce the discharge limits that are in place, provided that the holder of the authorisation applies and continues to apply BAT".

Note that this wording suggests that the guidance applies to '*discharge limits that are in place*' but is assumed to apply equally to limits that are being applied for.

Since advice regarding the use of the 10 µSv y^{-1} (0.01 mSv y^{-1}) criterion is relatively recent, older documents and assessment statements will necessarily make comparison to a 20 µSv y^{-1} criterion. In either case, Best Available Techniques continue to apply. Hence, there is no real difference in the level of radiological protection required in seeking permission for the discharge of effluents associated with the operation of a new nuclear power station.

The table of dose criteria below (Table 1) has been taken from guidance on Principles for the Assessment of Prospective Public Doses for the Authorisation of Discharges of Radioactive Waste to the Environment published by a consortia of UK environment agencies[42], statutory guidance published by DECC and Welsh Assembly Government and recent HPA-RPD guidance (HPA-RPD, 2009)[44] and summarises these UK human dose criteria (to facilitate comparison with the small assessed doses for HPC and HP site, the regulatory dose criteria in Table 1 and subsequently, are expressed in µSv y^{-1}, units that are a thousand times smaller than mSv y^{-1}).

Radiological impacts on humans need to be assessed against the absolute values of these regulatory requirements (derived from the ICRP recommendations) and accepted or rejected as acceptable on the basis of these, with additional assessment on whether they meet the requirements of being ALARA.

Table 1: Summary of human dose criteria considered in the assessment

Criteria	Quantity µSv y^{-1}	Source of Radiation for Site Considered	
		Future Discharges	Future Direct Radiation
Dose Limit due to man-made sources (excluding medical)	1,000	✓ (& includes historic discharges)	✓
Site Constraint	500	✓	-
Source Constraint	300	✓	✓
New Build Source Constraint	150[c]	✓	✓
Screening criterion for detailed assessments.	20	✓	✓
Continued reduction in discharge limits will not be pursued, subject to demonstration of application of BAT to minimise discharges.	≤10	✓	✓

Radiological assessment due to gaseous and liquid discharges and direct radiation from HPC and the Hinkley Point Site:

On the basis of the discussions above (and Table 1) the radiological impacts to the Critical Group due to gaseous and liquid discharges and also direct radiation from the proposed HPC and the Hinkley Point site (that is HPC plus effects of HPA and HPB) are therefore assessed against the following dose criteria:

- The source dose constraint from a single new source (300 µSv y^{-1}) which applies to the dose from proposed discharges and direct radiation. Because the two EPRs at HPC will be regulated under a single permit under the Environmental Permitting Regulations[19], together, they constitute a single new source[d].
- The site dose constraint (500 µSv y^{-1}) which applies to the cumulative dose from the discharges from all sources at a single location (but direct radiation is not included). Together, the Hinkley Point A and B reactors and

[c] New source constraint of 150 µSv y^{-1} is based on recent HPA-RPD Guidance, (HPA-RPD, 2009)[44]
[d] The EA interim guidance on prospective doses states that a single new source be defined as "*a facility or group of facilities which can be optimised as an integrated whole in terms of radioactive disposals*" The two UK EPRs at HPC can be considered to meet this requirement.

the proposed HPC EPRs will form a contiguous set of site operations and therefore constitute a single site[e].

For impacts due to HPC discharges, there is also assessment against the 10 µSv y^{-1} criterion, below which the UK Government states that the Environment Agency should not seek to further reduce the discharge limits that are in place, provided that the holder of the authorisation applies and continues to apply BAT[42].

In the discussion of the results, the prospective doses for HPC are also compared against baseline doses resulting from natural and man-made background sources that constitute both voluntary and involuntary sources of exposure.

Future potential public doses due to build-up are assessed against a range of criteria, including the local terrestrial background and those relevant to radiological protection objectives for contaminated land. Those to the public and due to radioactive materials in soil and water that may arise in the HPC construction phase are assessed against relevant standards, in particular the Radioactive Substances Act[18] and UK drinking water standards (World Health Organisation, 2004[45], European Union, 1998[46], SI, 1998[47]) although there is no intention that water from the site should be used for the supply of drinking water.

Radiological impacts from transport

Construction and operation of the HPC EPR will involve transport of some radioactive materials by road and rail for which a specific dose assessment has been carried out. The doses are due to direct radiation (or “shine”) from the conveyance. The relevant limit against which these doses can be assessed is the public dose limit of 1,000 µSv y^{-1} as given in IRR99[16].

Collective dose assessment criteria

There is no legal dose limit on collective doses. However, the International Atomic Energy Agency presented dose criteria which are considered sufficiently low that doses arising from sources or practices that meet these criteria may be exempted from regulatory control. One of these criteria is that collective dose should be less than about 1 man Sv per year of practice (paragraph 145 in Environment Agency

[e] Note that in earlier issues of this EIA Technical Note a matrix of impacts using the above dose criteria and analogous to that applied in the other EIA Technical Notes (viz ‘minor’, ‘major, ‘negligible’) was established. The dose criteria for humans (above) are not, however amenable to this form of impact classification and for this reason, radiological impacts are based on whether they remain below the constraints given above (site or source) with consideration of additional guidelines (notably 10 µSv y^{-1}) where applicable, plus assessment against other man-made sources of exposure.

principles for assessment of public doses[42]). For a nuclear power station, a year of practice may be taken to be equivalent to a year of routine continuous operation[f].

The EA interim guidance document for the assessment of prospective public doses principles[42] (paragraph 152) states that for collective doses:

"*Calculated average annual individual doses for a population group (doses per head of population or per caput doses) in the nanosievert (nSv y^{-1} of discharge) range or below should be ignored in the decision making process as the associated risks are 'miniscule' and the contribution to total doses to individuals will be insignificant. Higher annual doses, up to say a few microsieverts (µSv y^{-1} of discharge) can be considered 'trivial' but may require some consideration particularly if at the higher end of the range. Calculated annual average individual doses in excess of these values should prompt careful consideration of the discharge options being considered*".

In guidance by the European Commission (European Commission, 2007)[48] it is stated that per caput individual doses of less 10^{-5} Sv represent a 'trivial' level of individual risk. 10^{-5} Sv is equivalent to 10 µSv and therefore consistent with 'a few microsieverts' (above).

Note that the terms 'miniscule' and 'trivial' used in the subsequent assessments are those used in the guidance quoted above. Collective doses are also compared with those from industry as a whole and those due to C-14 to the dose from this naturally occurring long-lived radionuclide.

Short-term releases

The EA interim guidance document for the assessment of prospective public doses principles[42] (paragraph 142) states that short-term releases should be compared with the source constraint (300 µSv y^{-1}) and the public dose limit (1,000 µSv y^{-1}) taking into account other relevant contributions.

Total dose

The Total Dose assessed dose includes that from HPA and HPB (assuming discharges at their authorised limits) plus that from HPC and that from historic man-made off-site sources. It is compared with the dose limit for members of public (1,000 µSv y^{-1}) which includes all man made sources of radiation but excludes direct medical exposures.

[f] There is no question here of claiming that, if collective dose is below 1 Man Sv y^{-1}, discharges should be considered as outside regulatory control. The 1 Man Sv y^{-1} collective dose is simply a useful guideline from the relevant Environment Agency guidance on the assessment of public doses.

3.4.1.2 Specific Assessment Methodology for Impacts During Operation – Continuous releases

In order to determine the significance of the radiological impact of HPC discharges it is necessary to assess the dose uptake from these releases by critically exposed members of public and non-human species populations in the local vicinity. The methods for assessing doses to human and non-human populations are described in the sections below.

Initial Radiological Assessment Methodology – for Human Impacts

The Environment Agency has provided a methodology for carrying out an Initial Radiological Assessment or IRA (Environment Agency, 2006)[49]. This methodology document consists of two parts: A user report containing an overview of the methodology and tables of "dose per unit release" (DPUR[g]) for a large number of radionuclides; and a methods and input data report.

The purpose and scope of the initial assessment methodology is to provide a system for undertaking an initial cautious prospective assessment of the dose arising from sources of radioactive discharges to the environment, and to identify those sources of discharges for which a more detailed assessment should be undertaken. The assessment consists of up to three stages:

- In the first stage the Initial Radiological Assessment is carried out using default data as defined in the IRA methodology. If the assessed dose is greater than 20 µSv y^{-1} then a Stage 2 Assessment must be completed;

- A Stage 2 Assessment uses refined data, as defined in the IRA methodology, which is more suited to the site in question. Again, if assessed doses are greater than 20 µSv y^{-1} then a Stage 3 Assessment must also be completed;

- A Stage 3 Assessment is a separate site-specific assessment.

Completion of an IRA assessment in application for authorisation (and any future permit) to discharge is deemed to be sufficient by the Environment Agency, providing the relevant assessment stages have been completed.

Exposure Groups and Pathways Considered (IRA Methodology)

In the Initial Radiological Assessment (IRA) the Environment Agency states that if direct radiation exposure of the public from sources on a site is known to occur, an

[g] In Calculating the DPURs, discharges are assumed to be continuous, uniform routine releases that continue for 50 years. Dose assessment calculations are carried out at the 50th year.

assessment of direct radiation dose should be made. The IRA identifies two local candidate critical groups for assessment. These are:

- Releases to Air - Local Resident Farming family; and
- Releases to Coastal Water – Fisherman family.

Stage 1 IRA using Default Data – as calculated for Generic Design Assessment (GDA)

A Stage 1 IRA was completed for a single EPR unit as part of the Pre-Construction Environment Report (PCER) for the UK-EPR design. The stage one assessment used unmodified DPUR values. In the GDA, results are presented in Chapter 11 of the PCER document[50]. Using the generic stage 1 assumptions, doses were greater than 20 µSv y^{-1} and therefore a Stage 2 assessment was completed.

Stage 2 IRA using Refined Data - as calculated for GDA

A Stage 2 IRA was completed for a single EPR unit as part of the PCER for the UK-EPR design. Here an effective stack height of 30m and a local marine compartment volumetric exchange rate of 126 $m^3 s^{-1}$ (representing the lowest exchange rate of the existing UK reactor sites) were assumed for the revised calculations. All other assumptions and parameters remained unchanged from the Stage 1 assessment. As the discharge point for the liquid discharges was assumed to be close to the site (within a few hundred metres) it was necessary to combine the results for the two exposure groups as both exposure groups could be exposed to both releases.

The results of the Stage 2 assessment for a single EPR showed doses above the dose of 20 µSv y^{-1} so that a Stage 3 detailed site specific assessment was necessary.

Stage 3 'envelope site' IRA - as calculated for GDA

The Stage 3 'site specific' GDA assessment defined an envelope site derived from the most conservative characteristics of the environment around existing UK nuclear sites under consideration for future EPR reactors. PC CREAM 98 (Mayall, 1997)[51] was used to calculate individual doses from routine releases. The Stage 3 critical group (all discharges) doses for the generic site for a single EPR reactor were calculated to be 21, 9.1 and 9.3 µSv y^{-1} to adults, children and infants respectively.

As the Stage 2 IRA assessment, when completed for the GDA, resulted in doses greater than 20 µSv y^{-1}, a detailed site specific assessment has been completed for HPC (EPR East and EPR West). The general methodology for this is introduced below and discussed in more detail in Section 5.2.

Hinkley Point Site-Specific Assessment Methodology for Impacts on Humans

This section presents a summary of the methodology used for the assessment of the impact on the human population of Hinkley Point C discharges. The same method has been used to assess doses from HPA and HPB reactor discharges in order to determine the cumulative dose from the Hinkley Point Site. These methods are consistent with the general methods developed for the GDA.

HPA and HPB and the proposed HPC are assumed to discharge into the local marine compartment and the local terrestrial environment and give rise to exposures via the same exposure pathways. Discharges for each source were modelled separately and in combination in order to produce results for each source and to give a cumulative predicted dose for the entire Hinkley Point Site. Cumulative doses and impacts and assessment against dose criteria are discussed in Section 7.

Assessment methodologies have been developed to assess the impacts from a number of scenarios. These are for:

- The assessment of individual doses as a result of continuous releases of gaseous and liquid discharges to the environment;
- The assessment of direct dose;
- Annual dose assessment of the critical group;
- The assessment of collective doses;
- The assessment of individual doses as a result of short-term gaseous releases to the environment, and
- The assessment of individual doses as a result of build-up of radioactive materials in the environment.

Details of each methodology, parameters and results of calculations undertaken to determine the effect that routine and planned radioactive discharges may have on the surrounding human population at Hinkley Point are presented in Section 5.2.

Methodology for the Prediction of Dispersion of Gaseous Discharges from the Proposed Site

The EPR stack height is determined by different design criteria such as civil engineering, environmental (atmospheric dispersion and associated ground deposition) and impacts on the visual landscape. For atmospheric dispersion, the ADMS dispersion model was used to predict dispersion factors for routine releases for a range of possible stack heights (CERC, 2007)[52].The stack height must, at a minimum, be equal to the height of the UK EPR Reactor Building (60 m) and modelling has shown that at stack heights more than 70 m, the dispersion and deposition factors do not decrease significantly. The established heights of the stacks on each EPR are 70 m and form the basis of establishing the impacts of gaseous radioactive discharges from each of the HPC EPRs in the current assessment.

The ADMS model takes account of plume rise and building wake on the discharges from the stack. However, in PC CREAM 98 (used to calculate doses) these factors are not included and the input parameter required is the effective, not actual, stack height. The 2/3rd reduction method is used for estimating this. It results in an effective stack height of 23.3 m. This method equates to using a conservative assumption for the EPR stack height for the purposes of estimating impacts of gaseous radioactive discharges. Further details of input parameters are given in Section 5.2.

Methodology for the Assessment of Individual Doses as a Result of Continuous Releases to the Environment

In order to complete an assessment of dose to members of the public, it is necessary to determine which individuals would have the highest exposure to each of the sources of radioactivity. To do this, an initial range of 'candidate critical groups' is identified, that covers individuals with habits (especially food consumption patterns) that might potentially result in their receiving the highest exposure to discharges and direct radiation. The subsequent assessments then allow those who are predicted to receive the highest dose, the Critical Group, to be identified.

Two sources of information are available to aid the generation of habitat data and food intake patterns that lead to ingestion dose. The 2006 CEFAS report covers a survey conducted around Hinkley point in 2006 and is based on food consumption rates and occupancy factors taken from raw data (CEFAS, 2007)[53] . More generalised patterns are available from an NRPB report NRPB-W41 (Smith, 2003)[54]. The CEFAS report represents more local specific data and a previous review suggested it also gives more conservative consumption patterns. In order to perform a Hinkley Point specific assessment, local data from the CEFAS report are therefore preferred, whenever possible. Details of the input data and calculations based on this source are given in the sections below.

The dwelling where airborne and deposited activity concentrations would be highest (of all local dwellings) for HPC discharges[h] has been used as the receptor location, in combination with the generalised critical group habit data from the CEFAS[53] study data, to create a hypothetical critical group, members of which

[h] The critical group dwelling selected for HPC is not the point of highest concentration for HPA or HPB discharges. However, in order to determine a baseline, and to complete a cumulative dose assessment for HPC, it was necessary to select a single receptor point for atmospheric discharges. As this is an assessment to determine the impact of HPC discharges, the receptor location that could give the highest exposures for HPC discharges has been selected.

would receive the highest potential dose due to gaseous discharges from HPC to the atmosphere.

There is evidence in the CEFAS[53] report for Hinkley Point of commercial fishing activities and subsequent consumption of catches in the village of Stolford, to the west of the HPB reactor site. These critical habit pathways were used to determine the hypothetical persons most exposed to marine discharges based on critical exposure and ingestion rates given in CEFAS[53].

These two hypothetical resident human receptor groups were then used as the basis for determining two candidate critical groups exposed to all HPC discharges:

i. It was assumed that a farming family living near the coast could be exposed to gaseous discharges through the terrestrial pathways of: a) ingestion of contaminated foodstuffs grown on the farm; b) inhalation of and external exposure to the plume and deposited radionuclides. The two foodstuffs[i] contributing the highest fraction of dose were assumed to be consumed at critical (97.5th percentile of all CEFAS observations for these food group) rates[j], and all other foodstuffs were assumed to be consumed at average rates (mean of all CEFAS observations for these food groups). This is known as the "Top Two" method. It ensures a realistically conservative estimate of ingestion dose and is consistent with the GDA study[50] method and other studies of this nature. It is also assumed they could be exposed to marine discharges through the marine pathways of ingestion of locally sourced seafood, external exposure to beach sediments and inhalation of sea-spray when spending recreational time on a local beach. Average (mean) consumption rates of fish and shell fish and recreational activity times were taken from the CEFAS[53] study to determine marine exposures to this 'Farming Family'. This candidate critical group is therefore referred to as the **'Farming Family with marine and gaseous exposure'**.

ii. It was assumed that a fishing family - exposed to liquid discharges through contact with contaminated fishing gear (adults only) and beach sediments, from ingestion of seafoods (at 97.5th percentile rates of all CEFAS observations for seafish, crustacea and mollusca) caught in the area and inhalation of sea-spray could live locally and would therefore be exposed to the same terrestrial pathways as the 'Farming Family' (item i. above). It was conservatively assumed that this family might live at the same location as the 'Farming Family with marine and gaseous exposures' (item i above) and thus also be exposed to the

[i] CEFAS labelled terrestrial foodstuffs were grouped as follows: green vegetables and other vegetables as green vegetables; root vegetables and potato as root vegetables; domestic fruit and wild/free fruits as fruit; milk as milk; butter, cream cheese and yoghurts as milk products; cattle meat as cattle meat and sheep meat as sheep meat.

[j] In order to determine the top two foodstuffs, an assessment was completed assuming all foodstuffs were consumed at critical (97.5th percentile) rates. The two foodstuffs that contributed the highest doses were then taken forward to be the top two foodstuffs. These were: root vegetables and milk for adults; and milk products and milk for children and infants.

‘highest’ airborne and deposited activity concentrations from gaseous discharges from HPC. It was also assumed that they would consume locally grown produce at average (mean of all CEFAS[53] observations for each terrestrial food group) rates. This candidate critical group is therefore referred to as the **‘Fishing Family with marine and gaseous exposure’**.

In each case, individual doses were calculated for three age groups: adult; a 10 year old child, and a 1 year old infant. Further details of the exposure routes and consumption patterns for these two candidate critical groups are given in Section 5.2.2.

The Health Protection Agency has provided recommendations on the in-utero exposure of the embryo and foetus. These recommendations state that in many exposure situations the explicit assessment of the dose to the embryo/foetus is not required. However, for the radionuclides P-32, P-33, Ca-45 and Sr-89 it is recommended that an assessment is made. As these radionuclides do not form part of the spectrum of radionuclides considered in this report or reported in EPR discharges (or in those from site facilities such as any proposed Interim Storage Facility for Spent Fuel) the dose to the embryo/foetus is not considered further.

The annual dose to the candidate critical groups due to gaseous discharges from HPC to the atmosphere (and HPA and HPB for the cumulative assessment) was assessed using the PLUME and ASSESSOR modules of PC CREAM 98[51].

The annual dose to the candidate critical groups from liquid discharges was assessed using the DORIS and ASSESSOR modules of the PC CREAM 98 suite.

Where non-standard radionuclides were assessed, e.g. Co-58, data was required to be generated using the GRANIS, RESUS and FARMLAND modules for use by PC CREAM in the ASSESSOR module.

3.4.1.3 Methodology for the Assessment of Direct Exposure of Humans Off-Site

Direct exposure to radiation (that is radiation ‘shine’) from the reactor building for members of the public will be negligible, as the shielding present will ensure contact dose rates for the building are below limits of detection, and would not be measurable at the site boundary.

Exposure to direct radiation from Intermediate Level Radioactive Waste (ILW) and any Spent Fuel stores serving the HPC EPRs will give the greatest direct radiation dose for a member of the public from HPC facilities. In the UK, assessments of direct radiation are usually carried out by monitoring radiation levels at the site boundary and at the nearest habitation. Estimates of direct radiation exposure for HPA and HPB are provided in Table A4.1 of Radioactivity in Food and the Environment (RIFE) 13[55]. A direct radiation dose of 0.004 mSv y^{-1} is given for local residents living within 1 km of the existing Hinkley Point Site.

The detailed design for the storage of spent fuel and ILW at HPC has not yet been finalised, and therefore building shielding and inventories are not available. Therefore, in order to complete a direct radiation assessment, basic assumptions have been made to determine source term characteristics. The methodology is discussed in Section 5.2.2.5. The doses were then added to those due to discharges and compared with the assessment criteria (notably source constraint) established in Section 3.4.1.1.

3.4.1.4 Collective Dose Resulting from Discharges

Collective doses from gaseous and liquid discharges were calculated using PC CREAM[51]. Grid data around the site and beyond are already defined for in-built sites in PC CREAM – including the existing HPA and B reactor sites. Population and agricultural product distribution within the European Community is provided for each site within the PC CREAM database, as is the regional marine compartment into which the discharge is released. This provides data on total annual food production in each annular segment of a polar grid centred on the site of interest and extending to cover the area of interest. Individual external and inhalation doses in each annular segment of the polar grid are scaled by the population in that segment.

For aerial discharges, PC CREAM requires an effective stack height. The effective stack height takes into account effects such as plume rise and building wake. Using the 2/3 reduction technique[56] for estimating effective stack height as a result of building wake effects from the UK EPR reactors at Hinkley Point would give an effective stack height of 23.3 m for a 70 m stack (Section 3.4.1.2).

Collective doses per year of discharge were truncated at 500 years as required by the Environment Agency in the PID[22]. The population groups to be considered are the UK, Europe and World.

It is possible to obtain an estimation of average individual doses ('per caput') for populations calculated in the collective dose assessment. This allows collective dose to be compared with collective dose guidance (Section 3.4.1.1) and link this calculation with design considerations. The population data for UK, Europe and World were assumed to be 55 million, 700 million and 10 billion respectively as these are the values used by PC CREAM 98[51] to estimate collective doses.

3.4.1.5 Potential Doses Resulting from Short-Term Gaseous Discharges

The prospective doses to three age groups in an off-site location have been calculated for a single short-term gaseous discharge (consisting of a monthly inventory) within 24 hours from a single EPR stack. Separate calculations were undertaken for potential single discharges from the EPR East (C1) and the EPR West (C2) stacks. The pattern of nuclides released was the same as for normal operational discharges, but with an altered ratio of isotopes to specifically reflect the source term associated with these short-term release events.

Potential short-term doses, including via the food chain are calculated for a local critical group based on the methods described in NRPB-W54 (Smith, 2004) [57]. This critical group was based on occupancy at a receptor point at which the highest 95th percentile air concentration and ground deposition rate is predicted to occur. The doses were then compared with the short-term assessment criteria established in Section 3.4.1.1.

Aqueous liquids, after treatment and testing, are stored in holding tanks prior to discharge into the main once-through sea water cooling discharge. Liquid discharges are therefore short-term discharges that occur throughout the year and flow into a continuous discharge route. They are therefore only modelled as continuous releases according to the methods in section 3.4.1.2.

3.4.1.6 Build-up of Nuclides in the Environment due to Discharges

The Environment Agency has highlighted that at the end of the life of any power station, the land may not be able to return to free and unrestricted use due to potential build-up of radionuclides. Currently in the UK, Article 53 of the Council Directive 96/29/EURATOM is enacted in the Radioactive Contaminated Land Regulations 2008 (SI, 2008)[58].

Build-up refers to the accumulation of radionuclides in environmental media due to discharges. It accounts for the effects of gradual accumulation of radionuclides in the environment over the operating life of a nuclear plant. A range of potential groups may then be exposed to these sources (see below).

In order to calculate activity concentrations in soil, activity concentrations in air must be calculated. The location of highest concentration outside the site boundary was determined to be 427 m from the Eastern HPC stack (C1) at a bearing of 105°. Activity concentrations in soil have been estimated using the FARMLAND module of PC CREAM.

In order to calculate activity concentrations in seawater and on the local beach, the DORIS module was used. The significance of the impact of the build-up of radioactivity will depend on the future use of the land and activities in the sea.

The doses associated with the potential build-up of radionuclides on land can be assessed using the methodology as described in NRPB-W36 (Oatway, 2003)[59] together with the activity concentrations as described above. NRPB-W36[59] provides a methodology for estimating doses to members of the public from future use of land previously contaminated with radioactivity. This report includes tables of doses per unit contamination for a number of possible use scenarios for the land for a range of radionuclides.

The dominant scenario for those radionuclides listed above, which are included in the NRPB-W36[59] assessments, is exposure during construction. This scenario was used for assessing doses to members of the public from future construction on land adjacent to the Hinkley Point Site following shutdown of the Hinkley Point EPR reactors. The construction scenario is discussed in Appendix D of NRPB-W36[59].

A review of potential uses of the sea has been carried out based on uses discussed in the CEFAS[53] study. Scenarios where occupancies are high and/or intakes of radionuclides occur will give the highest doses. Potential uses included:

- Water sports;
- Beach combing/walking;
- Hobby fishing (including consumption of catches);
- Commercial fishing, and
- Houseboat dwelling.

3.4.1.7 Transport of Radioactive Materials for HPC

It will be necessary to transport radioactive materials to and from a reactor site throughout its operational lifetime. Radioactive materials generally consist of sources for non-destructive testing (NDT) of plant and shielding, new and spent fuel, contaminated and activated materials and operational solid wastes. During transport, members of public may be externally exposed to the consignment as a result of direct radiation. The scenarios of exposure considered are discussed in Section 5.2.4.

3.4.2 Non-Human Impacts

The following describes the methodology for assessing radiological impacts on non-human species. This requires assessment of the dose and judgement as to the value and sensitivity of the habitats/species affected (in contrast to humans, for which universal accepted value of a life is applicable).

3.4.2.1 Dose Constraints (Non-Human Species)

US DoE Approach

The United States Department of the Environment (DoE) has produced a report *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota (*Domoter, 2000*)*[60]. This report provides methods, models and guidance for evaluating doses from ionising radiation to populations of aquatic animals, terrestrial plants and terrestrial animals using a graded approach. This recommends a dose threshold of 10 mGy d^{-1} for aquatic animals and terrestrial plants, and 1 mGy d^{-1} for terrestrial animals. This gives an equivalent hourly dose rate of 400 µGy h^{-1} for aquatic animals and terrestrial plants and 40 µGy h^{-1} for terrestrial animals. The DoE graded approach consists of a screening method followed by three more detailed levels of analysis if necessary. The screening method employs “Biota Concentration Guides”. These are conservative limiting concentrations of radionuclides in soil, sediment or water that would not cause these dose limits for the protection of populations of aquatic and terrestrial biota to be exceeded.

ICRP Guidance for Non-Human Species

The publication ICRP 91[5] proposes a framework which would work as a practical tool to provide high-level advice for regulators and operators. This report is just a first stage in developing an international tool for assessing the impact of ionising radiation on non-human species.

The 2007 Recommendations of the ICRP[3] do not give any criteria for determining environmental effects of radioactivity. They are in the process of developing reference animals and plants in order to develop recommendations for the protection of other species. National legislation is driven by ICRP recommendations.

Dose Criteria for Non-Human Species

A general conclusion of the 1992 IAEA technical report *Effects of Ionizing Radiation on Plants and Animals at Level Implied by Current Radiation Protection Standards* (IAEA, 1992)[61] was that there is no convincing evidence that chronic radiation dose rates below 1 mGy d^{-1} will harm animal or plant populations. This gives an equivalent hourly dose rate of 40 µGy h^{-1}.

The Environment Agency Report R&D 128[27] previously concluded that it is unlikely that there will be any significant effects in populations of freshwater and coastal organisms at chronic dose rates below 400 µGy h^{-1}; terrestrial plant populations at chronic dose rates below 400 µGy h^{-1}; and terrestrial animal populations at chronic dose rates below 40 µGy h^{-1}.

More recently, the Environment Agency (EA, 2010)[62] recommends that for non-human species, worst case dose rates should be estimated assuming the presence of reference organisms for the relevant ecosystem at the position of maximum environmental concentration due to discharges (usually close to the site boundary for the terrestrial ecosystem and close to the discharge for aquatic ecosystems). The calculated dose rates on all non-human species should then be assessed against a guideline value of 40 µGy h^{-1}.

The computer modelling code ERICA (Beresford, 2007)[28] and associated radiological effects database FREDERICA (Copplestone, 2008)[63] are EU funded assessment tools for predicting the dose and effects on non-human species from radioactivity in the environment. The ERICA default screening dose rate is 10 µGy h^{-1}. Therefore, assessments falling below this screening level would cause no measurable harm to non-human species. This bounds the Environment Agency requirements (above) and provides a more stringent value against which to carry out assessments of radiation impacts on non-human species.

Magnitude of Non-Human Radiological Impacts

Radiological impacts on non-human species, unlike those on humans, have no absolute regulatory or universal ‘value’. This is because different non-human species or their habitats have different perceived values depending on, for example, their rarity, sensitivity or location. There is therefore a need to consider these aspects of the species or habitat affected and draw a judgement on the radiological impact. The following sections provide an outline of the bases on which this was done:

Value and Sensitivity

The value and sensitivity of the receptor will be a function of a variety of factors e.g. biodiversity value, social / community value and economic value. The value or potential value of a resource or feature can be determined within a defined geographical context. The following hierarchy is recommended by IEMA (2006)[33]:

- International;
- UK;
- National (i.e. England/Northern Ireland/Scotland/Wales);
- Regional;
- County (or Metropolitan e.g. in London);
- District (or Unitary Authority, City or Borough);
- Local or Parish; and
- Within zone of influence (only might be the project site or a larger area).

Designated Sites

Some receptors have already been assigned a level of conservation value through designation. Internationally important sites include: Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. Candidate SACs, potential SPAs and proposed Ramsar sites should be given the same consideration as designated sites. Nationally important sites are designated as Sites of Special Scientific Interest (SSSI) in England, Scotland and Wales or as Areas of Special Scientific Interest (ASSI) in Northern Ireland. They may also be designated as National Nature Reserves. Local Authorities and The Wildlife Trusts have designated sites that are recognised as of importance at regional / county, district / borough, etc., levels. Whilst a variety of terms are used to describe these sites, they are now generally referred to collectively as Local Sites.

Where a feature has value at more than one level, its overriding value is that of the highest level. For example, a site designated both as an SPA for internationally important features and as an SSSI for nationally importance features should be considered as being internationally important. The features for which the site has been designated at each level may differ and should be valued accordingly. Features of the site that are not the reasons for its designation(s) should be assessed and valued according to their intrinsic value.

Secondary or Supporting Value

Some features or receptors that are currently of no particular interest in themselves may nevertheless perform an important environmental function, e.g. because they act as a buffer against negative impacts, or because they enable in some other way the effective conservation of a more valuable feature. For example, an area of scrub may be included in calcareous grassland SSSI to act as a buffer from agricultural spraying on adjoining farmland. In this instance, the scrub performs an important ecological function in protecting a feature of national importance.

People derive benefits from the environment in various ways, including:

- Formal recreational enjoyment;
- Health aspects;
- Informal recreational activity, e.g. countryside walks; and
- Use of habitat areas for the purpose of learning about wildlife.

Economic implications may result from impacts on certain ecological features and resources that are financially valuable, for example:

- Populations of cyprinid fish for angling;
- Populations of shell fish in estuaries;
- Rare breeding birds at publicly accessible breeding sites that attract large numbers of visitors, who bring economic benefits to the local economy; and
- Green space might play a valuable role in contributing to the health and wellbeing of local communities with consequent economic benefits.

Sensitivity is based on the assessment of intolerance against a benchmark level of change in an environmental factor, and the likely recoverability of the species population or biotope. In order to help define the level of 'Value and Sensitivity', the guidance in Table 2 has been adopted and is based loosely on the example given in (Scottish Natural Heritage, 2006)[64].

Table 2: Guidelines for the assessment of value and sensitivity

Value and Sensitivity	Guidelines
High	Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site / receptor e.g. Designated features of International / National designation / importance e.g., SSSI, Ramsar etc and receptor is identified as having very low capacity to accommodate proposed form of change i.e. is very highly sensitive. Feature / receptor possess very significant biodiversity, social/community value and / or economic value. Feature / receptor is extremely rare.

Table contd./

Value and Sensitivity	Guidelines
Medium	Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness, and character of the site / receptor type e.g. Designated features of International / National designation / importance e.g., SSSI, Ramsar etc. and receptor is identified as having low capacity to accommodate proposed form of change i.e. is highly sensitive. Feature / receptor possess significant biodiversity, social / community value and / or economic value. Feature / receptor is rare.
Low	Feature/receptor only possesses characteristics which are locally significant. Feature/receptor not designated or only designated at a local level. Feature / receptor identified as having some tolerance of the proposed change subject to design and mitigation etc i.e. is only moderately sensitive. Feature/receptor possesses moderate biodiversity, social / community value and / or economic value. Feature / receptor is relatively common.
Very Low	Feature / receptor characteristics do not make a significant contribution to the character or distinctiveness locally. Feature / receptor not designated. Feature / receptor identified as being generally tolerant of the proposed change i.e. of low sensitivity. Feature / receptor possess low biodiversity, social/community value and / or economic value. Feature / receptor is common.

3.4.2.2 Non-Human Species Radiological Assessment Methodology

The methodologies used for calculating dose to non-human species were EA Research and Development report R&D 128[27] and the EC Software ERICA[28]. These assessments deal with a range of generic habitats each containing a selection of generic species at different trophic levels. For the current assessment, the ERICA models were refined to accommodate site or locality specific species, notably badgers and bats. The additional requirements to accommodate these are due to their size, and habits. Once the initial radiological assessments were completed (based on the criteria in Section 3.4.2.1) judgements of sensitivity and species/habitat values were made to establish the magnitude of the final impacts.

The assessment for non-human species, like that for humans, requires selection of specific locations that should reflect, as far as possible, those where maximum doses will be received and also that cover a range of habitat types. For the current assessment, four habitats were selected representing terrestrial, marine, freshwater and coastal environments. The locations of these are shown in Figure 4 with further descriptive details in Section 5.2.3. The habitats will include all of the generic species covered in the EA R&D 128[27] and ERICA[28] methodologies plus the site-specific species of badgers and bats.

R&D 128[27]

R&D 128 describes the behaviour and transport of radionuclides in the terrestrial, coastal and freshwater environment and considers the impact of ionising radiation on wildlife in these environments. The report also makes recommendations on an approach for the impact assessment of ionising radiation on wildlife in England and Wales. Dose per unit concentration is calculated for a range of nuclides and for a number of species, based on a basic model for their size, uptake of radionuclides and external exposure in the environment. The dose calculations have been created on several spreadsheets which can be manipulated to use default values, modelled or measured concentrations in the different species or ecosystem compartments. This report was produced as an interim measure until European and International frameworks were developed.

***ERICA*[28]**

The ERICA[28] programme, funded by the European Commission was released in 2007. The ERICA Integrated Approach guides a user through developing the scenario, performing an impact assessment and evaluating the data produced. The ERICA assessment consists of three tiers:

- An initial Tier 1 screening assessment where, if the pass criteria are met, the user can exit the assessment process;

- A Tier 2 where more site-specific parameters can be used; and finally,

- A Tier 3 which consists of a probabilistic risk assessment and is used when the screening dose criteria are exceeded at Tiers 1 and 2.

ERICA recommends a default screening dose rate of 10 µGy h^{-1} based on chronic exposure data from the FREDERICA[63] database. The screening dose rate is used to calculate a risk quotient. This gives a numeric value to the level of risk. The risk quotient has a value of 1 if the assessed dose equals 10 µGy h^{-1}. It is intended that this will eventually replace the approach in R&D 128[27].

ERICA is unable to calculate doses to non-human species from noble gases. Therefore both ERICA and R&D128 have been used in the current non-human radiological impact assessments. This additional noble gas assessment was not completed during the GDA phase assessment nor was an assessment of dose to non-human species in a freshwater environment. The current Hinkley Point C Site assessment is therefore a progression of these studies.

3.5 Mitigation Measures

Once the impacts have been evaluated and their significance determined, mitigation measures are proposed which are designed to prevent and minimise all impacts. There are several options of mitigation:

- Prevention: Avoid, relocate, modify the design and/or do not carry out the development;

- Minimisation: Modify location, modify design, alter technology, reduce size and scale of development;

- Compensation / Remediation: Provide replacement elements for any lost environmental elements (e.g. open green spaces, public facilities, wildlife area etc) / habitat. When adverse impacts are unavoidable, it may be possible to limit the duration of an impact by undertaking remedial works. For example, the impact of mineral extraction on the landscape is largely unavoidable, but following the completion of extraction ,the affected land can be restored to complement or enhance the character of the landscape; and

- Enhancement: In addition to reducing the adverse impacts of a project, many proposals provide the opportunity for environmental improvement. Enhancement / net benefit / new benefit is the genuine enhancement of the environmental interest of a site or area because adverse impacts are limited in scope and scale, and the project includes improved management or new habitats or features, which are better than the prospective management, or the habitats or features present there now. This is particularly true for projects that may be located on brown field or contaminated sites. However, it should be borne in mind that enhancement cannot be insisted upon.

The preferred hierarchy of mitigation is prevention first, then minimisation and only as a last resort, compensation / remediation. The aim in all mitigation proposals is to reduce any significantly adverse impacts to acceptable levels. The purpose of mitigation measures is to limit, not necessarily to eliminate, the environmental impacts of the development.

3.6 Residual Impacts

The final step in the EIA process is the assessment of the residual impacts after the implementation (where necessary) of the proposed mitigation measures for the HPC UK EPRs. These are considered in Section 8.

3.7 Limitations and Assumptions

At the time of writing the current issue of the EIA Technical Note, some limitations and assumptions have been identified as follows:

- Construction and operational phase designs and plans for the HPC site are still in development, and have therefore not been finalised. It is considered unlikely, however, that the subsequent assessment of finalised design details will result in any significant changes to the conclusions drawn from the current radiological assessment.

- Further information on uncertainties in the methods used in the radiological assessments is given in Section 9.0.

4.0 BASELINE ENVIRONMENTAL CHARACTERISTICS

4.1 Sources of Radiation Exposure in the UK

All individuals in the UK are exposed to ionising radiation to a varying degree from natural and anthropogenic sources. The 2005 review of ionising radiation in the UK by the Health Protection Agency (HPA-RPD 2005[65]) evaluated the magnitude of exposure in the UK to ionising radiation. This document estimates individual doses based predominantly on data collected for the years 2001 to 2003.

The summated average annual dose to one individual was 2,700 μSv y^{-1}. A breakdown of the contribution of sources of ionising radiation to annual collective dose and average annual dose is provided in Table 3 below and graphically in Figure 5:

Table 3: Annual exposure of the UK population from all sources of ionising radiation[65].

Source	Annual collective dose (Man Sv)	Average individual annual dose (μSv)
Natural:		
Cosmic	19,400	330*
Gamma	20,600	350
Internal	14,700	250
Radon	76,400	1,300
Man-made:		
Medical	24,300	410
Occupational	385	6
Fallout	350	6
Disposals	50	0.9
Consumer products	4	0.1
Sum (rounded)	157,000 Man Sv	2,700 μSv^{-1}
*Includes 30 μSv from air travel		

Natural sources contribute significantly more to the annual dose than artificial sources. Natural sources contribute on average 2,230 μSv y^{-1}, which is about 84% of the summated annual individual dose. Within the natural sources of exposure, radon is by far the largest contributor and contributes on average 1,300 μSv y^{-1}, which is around 48% of the average annual dose. However, the dose from radon can vary widely with geographical location. Figure 6, taken from the Indicative Atlas of Radon in England and Wales (Miles et al, 2007)[66] shows that the Hinkley Point area is not one of concern for radon. The annual local dose from this natural source will therefore be below the UK average of 1,300 μSv y^{-1}. Other pathways of natural contribution to annual dose include cosmic radiation contributing on average 330 μSv y^{-1} (12% of the average annual dose). Gamma radiation from soils and other natural materials contribute on average 350 μSv y^{-1} (13% of the average annual dose). Internal sources due to intakes of radionuclides in foodstuffs and measured levels of naturally occurring K-40 in the body (for adults) contribute on average 250 μSv y^{-1} (9% of the average annual dose).

The cosmic radiation dose can also vary significantly from one individual to the next mainly due to the large increase in the amount of cosmic radiation experienced during any air travel. A long haul flight from London to Sydney will add 160 μSv per return journey and a short haul flight from London to Glasgow will add 6 μSv and London to Malaga will add 15 μSv. The average annual dose contribution from air travel is around 30 μSv y^{-1} which is about 9% of the overall average annual cosmic radiation dose of 330 μSv y^{-1}.

The highest anthropogenic contributor to dose is that due to medical exposures. This contribution has increased in recent years due to increased use of computed X-ray tomography and the number of nuclear medicine procedures performed. An intra-oral dental x-ray results in a dose of approximately 5 μSv per exposure and a chest x-ray gives a dose of 20 μSv per exposure. However, some procedures, such as CT scans, give higher doses to individual patients who are subject to these. Together with those from dental X-rays etc., this gives an average dose over the UK population due to medical procedures of 410 μSv y^{-1} per person (15% of the average annual total dose from all sources, see Figure 5).

The average annual dose due to radioactive discharges from nuclear facilities in the UK is low in comparison to that from the other man-made sources, that is only about 0.9 μSv y^{-1} compared to 410 μSv y^{-1} for medical exposures, 6 μSv y^{-1} for occupational exposures and 6 μSv y^{-1} as a result of fall-out from past nuclear weapons tests. Only the dose from consumer products such as smoke alarms and photographic lenses results in a lower man-made contribution of about 0.1 μSv y^{-1}. This dose contribution from radioactive discharges from nuclear facilities includes contributions from across the nuclear industry including uranium enrichment, nuclear power stations, fuel reprocessing, defence establishments, nuclear technology services, radionuclide production, research laboratories and disposals to the UK's Low Level Waste Repository in Cumbria. Other industrial sources of radioactive discharges in the UK are NORM industries and small users (such as schools or hospitals) and also originate from disposals of certain types of waste to landfill sites.

4.2 Existing Hinkley Point Monitoring Data

A significant contribution to the historic and potential future baseline for the discharges of artificial radionuclides around Hinkley Point, is due to the historical, current and potential future discharges from the HPA and HPB reactors that are already present on the Hinkley site.

HPA is a Magnox reactor power station with two reactors that has ceased operation and is now in decommissioning. HPB is an AGR reactor power station with two reactors in operation with a current planned closure date of 2016. Both sites have a set of authorisations for liquid and gaseous radioactive discharges into the surrounding environment (liquids to the Bristol Channel, gases to atmosphere). The authorisations have been issued after assessment of the impacts and effects and consultation. The predicted doses from HPA and HPB at the receptor locations that will be those most affected by potential future HPC discharges are presented in Section 7.

The Environment Agencies of the United Kingdom and Northern Ireland and the Foods Standards Agency have, since 1995, produced an annual Radioactivity in Food and The Environment (RIFE)[55, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78] reports that record the results of radiological monitoring of food and environmental sampling programmes in the UK, especially near licensed nuclear sites.

The RIFE reports present a retrospective dose assessment based on the measured activity concentrations in various foodstuffs farmed or caught local to Hinkley Point and on local occupancy and habit data. Table 4 summarises the reported individual annual radiation exposure to the highest exposed critical group used in the RIFE assessment for the Hinkley Point area. The increase in radiation exposure between the year 2005 and 2006 is mainly due to an increase in habits observed in the recent habits survey.

Table 4: Individual radiation exposure reported in RIFE reports for Hinkley Point

Year	Seafood consumers (mSv y^{-1})
2007[55]	0.029
2006[67]	0.040
2005[68]	0.018
2004[69]	0.017
2003[70]	0.013
2002[71]	0.015
2001[72]	0.014

4.2.1 Monitoring Data Presented in RIFE

The most recent RIFE reports (RIFE 8 to RIFE 13 inclusive) have been reviewed and data extracted and summarised for locations close to the Hinkley Point Site. The RIFE reports include an extensive list of nuclides, but only a few of which are actually reported as above detection or as less than a specified detection limit (< values). These are presented in Tables 5, 6 and 7 for drinking water, fresh water and seawater, respectively. Blanks indicate no reported data.

These data show that the radioactive content in drinking water in the reservoir closest to the Hinkley Point Site is low, with the only nuclide consistently positively detected being naturally occurring K-40. Similarly, the results for seawater show a consistent positive result for gross beta, with an average value of around 12 Bq l^{-1}. The gross beta results for seawater reflect the much higher levels of potassium (and therefore of naturally occurring K-40) than are typically present in freshwater (400 mg/l compared with around 10 or 20 mg/l in freshwater).

Other environmental media are also locally sampled and assayed for their radioactive content. These samples include mud sampled 1.6 km from the discharge pipeline, mud from Watchet and sediment from Stolford. These data are summarised in Tables 8, 9 and 10 respectively.

Table 5: **Measured activity concentrations in drinking water from the Ashford Reservoir, Bridgwater (reported data)**

Determinand	Units	RIFE 13[55]	RIFE 12[67]	RIFE 11[68]	RIFE 10[69]	RIFE 9[70]	RIFE 8[71]
		Table 8.15	Table 8.16	Table 9.15	Table 9.14	Table 9.14	Table 11.14
Gross Alpha (Am-241)	Bq l^{-1}	0.022	<0.021	0.020	<0.020	<0.032	<0.029
Gross Beta (as K-40)	Bq l^{-1}	0.061	0.082	0.071	0.082	0.077	0.11
Cs-137	Bq l^{-1}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
K-40	Bq l^{-1}	0.078	0.083	0.07	0.063	0.068	0.065
Ra-226	Bq l^{-1}	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
U-235	Bq l^{-1}	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
H-3 (as HTO)	Bq l^{-1}	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Sr-90	Bq kg^{-1}	0.0011	0.0017	<0.001	<0.0022	0.0017	0.0018
Po-210	Bq kg^{-1}	0.0099	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
U-234	Bq kg^{-1}	<0.010	<0.0010	<0.0010	<0.0010	0.098	<0.0095
U-238	Bq kg^{-1}	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Gross Beta (as Cs-137)	Bq kg^{-1}	0.086	0.12	0.10	0.13	0.091	0.13

Table 6 **Measured activity concentrations in freshwater from the Ashford Reservoir, Bridgwater (reported data)**

Determinand	Units	RIFE 13[55]	RIFE 12[67]	RIFE 11[68]	RIFE 10[69]	RIFE 9[70]	RIFE 8[71]
		Table 4.7(a)	Table 4.7(a)	Table 5.7(a)	Table 5.7(a)	Table 5.8(a)	Table 6.6(a)
Gross Alpha	Bq kg^{-1}	<0.025	<0.045	<0.034	0.029	<0.025	<0.026
Gross Beta	Bq kg^{-1}	<0.1	<0.17	<0.12	0.12	<0.10	<0.092
Cs-134	Bq kg^{-1}	<0.28			<0.35	<0.97	<0.60
Cs-137	Bq kg^{-1}	<0.26	<0.17	<0.25	<0.31	<0.86	<0.62
H-3 (as HTO)	Bq kg^{-1}	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
S-35	Bq kg^{-1}	<1.0	<1.3	<1.0	<1.0	<2.3	<2.5

Table 7 **Measured activity concentrations in seawater off Hinkley Point (C-14 and H-3 not reported)**

Determinand	Units	RIFE 13[55]	RIFE 12[67]	RIFE 11[68]	RIFE 10[69]	RIFE 9[70]
		Table 8.19	Table 8.19	Table 9.18	Table 9.17	Table 9.17
Gross alpha	Bq l^{-1}	<2.5	<2.0	<2.4	<2.2	<9.0
Gross beta	Bq l^{-1}	13	10	14	14	9.8
Am-241	Bq l^{-1}	<0.36	<0.46	<0.63	<0.56	<0.51
Co-60	Bq l^{-1}	<0.37	<0.18	<0.33	<0.41	<0.20
Cs-137	Bq l^{-1}	<0.29	<0.14	<0.24	<0.35	<0.59

Table 8: Measured activity concentrations in mud 1.6 km from pipeline

Determinand	Unit	RIFE 13[55]	RIFE 12[67]	RIFE 11[68]	RIFE 10[69]	RIFE 9[70]	RIFE 8[71]	RIFE 7[72]	RIFE 6[73]	RIFE 5[74]	RIFE 4[75]	RIFE 3[76]	RIFE 2[77]	RIFE 1[78]
Mn-54	Bq kg^{-1}				<0.74	<0.63	<0.61	<0.42				<0.67		
Co-60	Bq kg^{-1}				<0.71	<0.62	<0.56	<0.38				<1.3	0.48	0.52
Zn-65	Bq kg^{-1}				<1.6							<1.5	<1.5	<1.5
Zr-95	Bq kg^{-1}													0.9
Ru-106	Bq kg^{-1}												2.2	
Sb-125	Bq kg^{-1}				<1.9			<0.91						
Cs-134	Bq kg^{-1}				2.2	3.7	2.6	3.8				3.5	5.3	3.4
Cs-137	Bq kg^{-1}			<25	44	45	34	39				32	31	31
Ce-144	Bq kg^{-1}				<3.9			2.2		<2.7	<2.7	<3.1	<3.1	
Eu-155	Bq kg^{-1}				<2.1			2.5		<2.2	<2.2	<1.9	0.79	1.9
Am-241	Bq kg^{-1}				<2.9	<1.8	<1.7	0.51	<2.0			<1.5		

Table 9: Measured activity concentrations in mud from Watchet

Determinand	Units	RIFE 13[55]	RIFE 12[67]
		Table 4.7a	Table 4.7a
Co-60	Bq kg^{-1}	<0.52	<0.68
Sr-90	Bq kg^{-1}	<1.5	<1.0
Cs-137	Bq kg^{-1}	7.8	5.7
Am-241	Bq kg^{-1}	<0.76	<2.3

Table 10: Measured activity concentrations in sediment from Stolford

Determinand	Units	RIFE 13[55]	RIFE 12[67]	RIFE 11[68]	RIFE 10[69]	RIFE 9[70]	RIFE 8[71]
		Table 4.7a	Table 4.7a	Table 5.7a	Table 5.7a	Table 5.8a	Table 6.6a
Co-60	Bq kg^{-1}	<0.53	<1.2	<0.73	<0.79	<0.40	<1.1
Sr-90	Bq kg^{-1}	<2.0	<2.4	<1.7			
Cs-137	Bq kg^{-1}	20	27	7.2	25	7.7	<3.5
Am-241	Bq kg^{-1}	<1.1	<1.4	<1.0	<1.1	<0.66	<2.4
Total alpha	Bq kg^{-1}						570
Total beta	Bq kg^{-1}						920

The measured data for mud and sediment (Tables 8 to 10) show consistent positive results for Cs-134 and Cs-137. Information from the RIFE Reports suggest concentrations of these and of other man-made radionuclides in the aquatic environment of the Severn Estuary and Bristol Channel represent the combined effect of historic releases from HPA and HPB, plus other establishments, notably GE Healthcare at Cardiff (mostly tritium) and Berkeley and Oldbury power stations, with smaller, mostly historic, contributions from Sellafield and fall-out from historical weapons testing and from Chernobyl.

Measurements of the external gamma radiation dose rate are also reported in the RIFE reports. These results are summarised in Table 11 below:

Table 11 Averaged gamma dose rate at locations at and around Hinkley Point

Location	Units	RIFE 13[55]	RIFE 12[67]	RIFE 11[68]	RIFE 10[69]	RIFE 9[70]	RIFE 8[71]	RIFE 7[72]	RIFE 6[73]	RIFE 5[74]
		4.7b	4.7b	5.7b	5.7b	5.8b	6.6a	6.6b	6.6b	6.6b
Weston-Super-Mare	µGy h^{-1}	0.064	0.067	0.069	0.065	0.063	0.076			
Burnham	µGy h^{-1}	0.062	0.062	0.065	0.063	0.061	0.076		0.068	
River Parrett	µGy h^{-1}	0.081	0.073	0.078	0.076	0.071	0.072	0.071	0.071	0.072
Steart Flats	µGy h^{-1}	0.076	0.08	0.086	0.07	0.069	0.075			
Stolford	µGy h^{-1}	0.09	0.095	0.07	0.083	0.068	0.080			
Hinkley Point	µGy h^{-1}	0.098	0.091	0.082	0.077	0.07	0.078			
Kilve	µGy h^{-1}	0.081	0.089	0.074	0.079	0.071	0.078			
Watchet Harbour	µGy h^{-1}	0.103	0.102	0.089	0.093	0.088	0.10			
Blue Anchor Bay	µGy h^{-1}	0.073	0.069	0.077	0.071	0.07	0.086			

The RIFE reports state these gamma dose rates were barely above the limits of detection (for the survey equipment used)[55]. Most of the gamma flux is probably due to naturally occurring K-40.

All of the RIFE reports include extensive assessments of doses to critical groups due to radioactivity in these solid and liquid environmental media, currently due to discharges from HPA and HPB, discharges from more distant sources (e.g. Oldbury, GE Healthcare at Cardiff) fallout and natural background. These doses are assessed in RIFE using an empirical method involving habits and food consumption patterns coupled with dose per unit intake factors as well as direct measurements. All of these assessed doses are small and all are quoted as being equivalent to only a few percent of the public dose limit of 1,000 µSv y^{-1}.

4.3 Environmental Setting for HPC (site specific investigations)

A summary of findings of recent surveys undertaken on behalf of EDF is provided in the following sections, although some are on-going and results may be revised in the future. Selected graphical data for the results are shown in Appendix A and discussed below.

4.3.1 Marine Monitoring Campaign and Results

A marine monitoring campaign has been carried out to identify background levels of radioactivity in the Bristol Channel in the vicinity of the HPC site. The first campaign of marine surface water quality sampling took place on the 27th and 28th January 2009. The second campaign of marine surface water quality monitoring took place on the 1st and 2nd May 2009. The third monitoring campaign took place on 27th to 28th June 2009, and the fourth campaign on 12th to 13th September 2009. Samples of seawater were scheduled for the following radiochemical analysis suite:

- High Resolution Gamma Spectrometry (HRGS);
- Gross alpha (calibrated with Am-241) and gross beta, (calibrated with K-40);
- Tritium (as tritiated water); and
- Carbon-14.

The majority of the radiochemical analysis results were reported as below detection limits or, if a positive concentration was found, at very low levels marginally above the detection limit. All values measured for anthropogenic radionuclides are very low, consistent with those reported elsewhere and would not present a hazard to human and non-human health or be of regulatory concern.

4.3.2 Groundwater Monitoring Campaign and Results

Groundwater monitoring has been carried out on the Built Development Area West, Built Development Area East and Southern Construction Phase Area. Boreholes were drilled and developed, and samples were collected and analysed for the following radiochemical analysis suite:

- High resolution gamma spectrometry (HRGS);
- Gross alpha (calibrated with Am-241) and gross beta (calibrated with K-40);
- Tritium (as tritiated water); and
- Carbon-14.

The suite was selected to provide a general screen for alpha, beta and gamma-emitters and to provide information with regard to soft beta-emitters (tritium and carbon-14). The inclusion of gross alpha, gross beta and tritium also meets the requirements for drinking water monitoring. The inclusion of gamma spectrometry provides quantitative data with regard to a range of natural and anthropogenic radionuclides.

Five groundwater sampling campaigns were carried out from boreholes drilled in the Built Development Area West, covering the period December 2008 to June 2009. Four sampling campaigns were carried out from boreholes drilled in the Built Development Area East and Southern Construction Phase Area covering the period June 2010 to December 2010.

The gross alpha, gross beta and tritium results for the Built Development Area West are presented graphically in Figures A1 to A3. The gross alpha, gross beta and tritium results for the Built Development Area East are presented graphically in Figures A4 to A6. The gross alpha, gross beta and tritium results for the Southern Construction Phase area are presented graphically in Figures A7 to A9.

The results of the groundwater monitoring showed that no artificial radionuclides measureable by gamma spectrometry were detected. There were a number of examples of sampling locations where, on average, gross beta results were apparently above standards for drinking water. However, these elevated gross beta values were due to the presence of the naturally occurring radionuclide, potassium-40, which is excluded from consideration in standards for drinking water.

Tritium was detected in the water from three boreholes in the north-east of the Built Development Area East close to the Hinkley Point A site boundary. The levels of tritium found were above those typically found in the Hinkley area but below the standards for drinking water (Section 3.4.1.1[45,46,47])[k].

4.3.3 Surface Water Monitoring Campaign and Results

A monitoring campaign was commissioned to investigate background levels of radioactivity in the surface freshwater features (field ditches and a stream) within the site that will be occupied by the planned HPC development and construction areas. Samples were collected from ten monitoring sites during six separate monitoring campaigns covering the period January 2009 to July 2009. The samples were scheduled for the following radiochemical analysis suite:

- HRGS;
- Gross alpha (calibrated with Am-241) and gross beta (calibrated with K-40);
- Tritium (as tritiated water); and
- Carbon-14.

The results of the surface water monitoring campaigns are presented in Figures A10 to A12. The results have shown no significant radiochemical contamination of surface waters and the measured values across all campaigns are below regulatory concern from the standpoint of drinking water standards[k].

4.4 Soil Monitoring Campaign and Results

A survey was carried out to investigate the radiological contamination status of the Built Development Area West. The first stage took place during July 2008 and comprised a ground surface radiological survey of direct gamma radiation using hand-held monitoring equipment. In addition, near surface soil samples (including those from within any “made-ground” that is, material subject to previous disturbance) were collected from across the site (<0.3 m below ground level) and radiochemical analysis was carried out, covering: gross alpha; gross beta; HRGS; and tritium.

[k] Under current radioactive substances regulation there is no *de-minimus* for man-made radionuclides such as tritium in aqueous solutions. However, this legislation is due to change in the near future (expected October 2011). It will then be likely that levels of tritium found in water pumped from these areas, and needing to be considered as waste, will become exempt from radioactive substances regulation. In the mean time, comparison of the levels of tritium found against drinking water standards is considered to be a sufficiently robust assessment of risk.

The second stage of the soil monitoring campaign was undertaken during October 2008 and investigated levels of contamination of deeper soils, between 0.55 m and 5.0 m below the surface. The soil samples were analysed for gross alpha, gross beta, HRGS, C-14 and tritium.

From the data presented in the Baseline Radiological Survey it can be concluded that the levels of radioactivity in the near surface soils in Built Development Area West are similar to background levels found throughout the UK and do not present any radiological hazard above natural background. The levels of Cs-137 are consistent with fallout from atmospheric weapons testing carried out in the 1950's to 1970's and the Chernobyl accident in 1986. No radiological activity values in excess of statutory guidance levels were found. The Phase 1 study concluded that the near surface site soils do not pose an unacceptable risk to human health via direct contact, ingestion or inhalation based on a commercial/industrial end use development.

A survey, including a radiological walkover survey and environmental gamma dose rate measurements, was carried out in October 2009 to investigate the radiological contamination status of the Built Development Area East and Southern Construction Phase Area. The results of the walkover survey and gamma dose rate measurements were generally consistent with background levels. The radiological survey did, however, identify an area of elevated radiation readings close to the eastern boundary of the Built Development Area East land adjacent to the existing Hinkley Point Power Station Complex. This was attributed to radiation gamma shine from a rectangular building situated just inside the Hinkley Point A site boundary and which, at the time of the survey, was being used to store active waste in ISO freight containers.

Following the survey, soil samples were collected from the Built Development Area East and Southern Construction Phase Area and these were analysed for: gross alpha; gross beta; HRGS; C-14 and total tritium. Overall, the radiochemical analysis results for the soil samples collected from the Built Development Area East and Southern Construction Phase Area land provided no evidence of significant contamination with anthropogenic radionuclides and the levels of radionuclides present were generally consistent with background levels. A small area of the Built Development Area East, which was the site of a former sewage works, was found to contain elevated levels of natural uranium, which was associated with granitic material observed in this area. The levels found were below the limit specified in The Radioactive Substances (Phosphatic Substances, Rare Earths etc.) Exemption Order (Statutory Instrument, 1962, No.2648)[79] and would not be of regulatory concern.

In summary, no soil samples (including those from within previously disturbed ground) were found to be "radioactive" as defined by the relevant legislation[18,19,79] nor, in the majority of cases, in excess of normal background levels found in soils in the UK. The site in question is, therefore, not subject to regulatory controls for radioactive substance regulation. Implications for this are discussed in Section 5.1.1.1.

5.0 ASSESSMENT OF IMPACTS

5.1 Key Development Characteristics

5.1.1 Sources of Radiation Exposure to the Public During Construction

5.1.1.1 Potential Radioactive Contamination in Land and Water

Potential sources of exposure of members of the public during the construction phase of HPC include the dispersion of potentially contaminated soils during excavation. If contaminated soil is present on the site the potential exists for the generation of dust during the excavations that will occur during site preparation works. This contaminated dust could then be carried off-site by the wind resulting in the exposure of members of the public who are living or working near the site.

Data for the soils surveys and walkover surveys carried out on the Southern Construction Phase Area, Built Development Area East and the Built Development Area West are described in Section 4.4. The results for the Southern Construction Phase Area and the Built Development Area West showed levels of radionuclides below relevant regulatory criteria, reflecting the past agricultural history of these areas of the HPC site. Desk studies had shown the Built Development Area East as having some potential contaminative uses. However, the soil studies have shown again, no contamination by radionuclides above relevant regulatory levels[18,19,79].

The results found have therefore not warranted a formal radiological public dose assessment. The field and analysis data and the fact that levels of nuclides are below relevant regulatory criteria, make it highly unlikely that construction works on these areas would present a radiological hazard to members of the public adjacent to the works (e.g. from wind-blown soil dust or from soil materials taken off site) over and above that due to any large construction project carried out in the Hinkley Point area.

With respect to ground and surface waters, the measured values for the Southern Construction Phase Area, Built Development Area East and Built Development Area West are below drinking water standards[45,46,47] and therefore would not present a radiological hazard any members of the public in the unlikely event of their coming into contact with ground or surface waters from the site.

5.1.2 Sources of Radiation Exposure During Operation of HPC

An operating nuclear power station will make very small discharges of radioactive material to the environment. These releases are subject to permitting by the regulatory body[19]. In the case of Hinkley Point, this is the Environment Agency of England and Wales. The permit issued will impose various conditions on the discharge including limits, including the volume and activity of the discharge on an annual and possibly quarterly basis, requirements for reporting and commitments by the operator to use best available techniques (BAT) to minimise the discharges. The operator must also report any instances of limits being exceeded with an assessment of the consequences of such events and procedures put in place to prevent their reoccurrence.

Discharges of radioactive materials will occur by the release of radioactive liquids to the marine environment (liquid discharges) and by the release of gaseous radioactive material to the atmosphere. Any particulate material is mostly removed by filters etc, and the amounts of particulates released in gaseous streams are therefore extremely small. Estimates of the liquid and gaseous discharges resulting from normal operations at HPC (EPR East plus EPR West) have been made and are discussed below.

5.1.2.1 Liquid Discharges from HPC

The liquid discharges are carried out in the form of batches from holding tanks but take place at the outlet of the main turbine cooling water culverts, so are subject to immediate dilution with a flow of seawater of the order of 130 $m^3 s^{-1}$ before entering the final outfall system, where thorough mixing takes place prior to the discharged material finally entering the Bristol Channel.

The activity values in liquid discharges and used in the dose assessment are derived from operational feedback from current PWRs (of similar design to the UK EPR) and shown in Table 12. These are appropriate for carrying out a site-specific radiological assessment for the HPC development.

Table 12: Activities for liquid discharges from HPC appropriate to assess radiological impacts[50]

Radionuclide	Annual liquid discharges GBq y^{-1}
H-3	150,000
C-14	190
Cs137	1.89
Ag-110m	1.14
Mn-54	0.54
Sb-124	0.98
Sb-125	1.63
Te-123m	0.52
Cr-51	0.12
Co-58	4.14
Co-60	6.0
Cs-134	1.12
Ni-63	1.92
I-131	0.1

The table shows these HPC liquid discharges consist of the following nuclides (this is a simplified outline of the sources; further details are given in the Chapter 8 of the PCER[24]):

- Tritium: Some tritium is formed within the fuel but contained by the fuel cladding (and therefore removed during refuelling). The rest of the tritium is formed by the neutron capture reaction by Boron (B-10) added for reactivity control and also from Lithium (Li-6). The later is present as an impurity in the Li-7 hydroxide that is added to the coolant to control pH. Tritium can also form in certain operational components in the reactor core (control rods etc.). Most tritium from these sources occurs as tritiated water (^3H_2O) in the coolant. As this flows into other plant systems (particularly during refuelling shutdowns) tritium eventually moves into the liquid radioactive effluent treatment systems and some is eventually discharged.

- C-14: This is formed mainly by activation of oxygen (present as H_2O) and nitrogen (present as a dissolved impurity) in the reactor coolant. As coolant needs to be directed to downstream systems, C-14 passes into these and eventually into liquid discharges that need to be made for operational reasons.

- Activation products of certain metals such as Co-58 and Co-60: These are formed by irradiation of structural materials in the reactor circuit, such as steel (that contains manganese, chromium etc). As water flows around the circuit, some of these 'activation products' can be released and travel around the circuit and pass into other plant systems. Only very minor amounts pass through the radioactive waste treatment systems and eventually into liquid discharges.

- Fission products such as caesium and iodine isotopes: These are formed by fission of fuel in the fuel pins. Some can escape and move through the circuit with the activation products as above. Some are volatile and partition into the radioactive gaseous discharge streams (see below).

The minimisation of these radioactive constituents (and chemical ones as well) in liquid discharges from the UK EPR centres on the following design and management features. Further details are provided in the PCER[50] but since C-14 and tritium dominate doses from HPC to the candidate critical groups, specific details for these two isotopes are given in Section 6, which addresses the mitigation of impacts.

- Minimisation at source. This includes ensuring the leak-tightness of the fuel pins to minimise release of fission products such as iodine into the reactor coolant and controlling the pH of the coolant to minimise corrosion effects that could give rise to Co-60 etc;
- Recycling and reuse of liquids, where possible, in the reactor systems; and.
- Clean-up and abatement of discharges using combinations of filters, ion exchange resins and evaporators that remove activity from the effluents to convert them into more compact and easily managed solid waste forms.

Once the aqueous liquids have been treated they will be directed to a series of hold-up tanks for monitoring and discharge. The tanks have monitoring and sampling systems and also final filter/strainers. Discharges will take place only after suitable monitoring and management checks, and in accordance with conditions that will be laid down in the relevant permit issued under the requirements of the RSR.

5.1.2.2 Gaseous Discharges from HPC

All gaseous discharges from each EPR will be directed to a gaseous discharge stack serving each reactor for monitoring, recording and discharged to the atmosphere. Policy is to direct all discharges to the stacks and minimise fugitive emissions from other sources; any other minor routes are discussed below. The height of the stack on each EPR has been optimised for the Hinkley Point Site to ensure dispersal under all prevailing local weather conditions with minimal grounding of any plume.

The activity values in gases and used in the dose assessment are derived from operational feedback from current PWRs (of similar design to the UK EPR) and shown in Table 13. These are appropriate for carrying out a site-specific radiological assessment for the HPC development. The table shows the discharges consist of the following:

- Rare gas isotopes with mostly short half-lives viz Xe-133 ($t_{1/2}$ = 5.27 days) Xe-135 ($t_{1/2}$ = 9.2 hours), Ar-41 ($t_{1/2}$ = 1.86 hours), Xe-131m ($t_{1/2}$ = 11.96 days): These are formed as fission products in the fuel but small amounts can escape from the fuel and pass into the reactor coolant. As this passes into downstream systems (especially at refuelling) out-gassing occurs and the gases pass into the radioactive gaseous treatment or plant ventilation systems;

- Tritium and C-14: Formation of these takes place mainly in the liquid coolant as described above. Some tritiated water evaporates in downstream plant systems and passes into the gaseous treatment systems and ventilation systems. C-14 is present mainly as CO_2 and methane that out-gas from the coolant in the downstream systems of the plant; and

- Volatile fission products: Predominantly iodine isotopes and some caesium isotopes.

Table 13: Activities for gaseous discharges from HPC appropriate to assess radiological impacts [50]

Radionuclide	Annual gaseous discharges GBq y^{-1}
H-3	6,000
C-14	1,400
Kr-85	6,260
Xe-133	28,400
Xe-135	8,920
Ar-41	1,306
Xe-131m	135
I-133	0.436
I-131	0.364
Co-58	0.0612
Co-60	0.0722
Cs-134	0.0562
Cs-137	0.0504

The minimisation of these radioactive constituents in gaseous discharges from each EPR unit will centre on the following design and management features. Further details are provided in the PCER[50] but since C-14 and tritium dominate estimated doses from HPC to the candidate critical groups, more specific details for these two isotopes are given in this current technical note in Section 6, which addresses mitigation.

- Minimisation at source: The minimisation of gaseous activity at source relies on the same basic principles as for the liquids, especially maintaining the leak-tightness of the fuel pins, since this is the main source of gaseous and volatile fission products in gaseous discharges from any PWR;
- Recycling gases where possible; and
- Treatment and abatement: The main feature of the EPR for treatment and abatement of gaseous discharges is a system that uses catalytic recombination of tritium gas with oxygen. This ensures that tritium and iodine isotopes are retained mainly in an aqueous phase which is returned to the non-recyclable liquid effluent system for final clean-up and discharge in liquid form. There is also a waste gas recirculation line with three activated charcoal beds/hold up tanks. This provides for hold-up and delay for short-lived isotopes of krypton and xenon, sufficient to ensure that only very low levels of these are finally discharged to atmosphere via the central stack.

In the EPR, the design and operation of the heating, ventilation and air conditioning (HVAC) systems that extract air from potentially active areas throughout the plant follows a common approach based on currently accepted international methods used in all nuclear facilities:

- Pre-filters remove the bulk of the active and inactive airborne particulates;
- High efficiency particulate arrestor (HEPA) filters provide the bulk of the particulate decontamination of the extract air. Pre-filters and HEPA filters are disposable and designed to allow minimisation in the volumes of solid radioactive waste they produce. HEPA filters have remote change systems to ensure worker doses are ALARP (worker dose control being under the remit of the NII); and;
- For certain plant areas there are iodine charcoal filter to remove inorganic (and some organic) iodine species.

There is a minor gaseous discharge outlet from the proposed Interim Storage Facility for Spent fuel serving both UK EPR reactors on the HPC site. Gaseous discharges from this are small (an estimate shows it is less than 5% of the values used in the assessment). The gaseous discharge value for HPC (in Table 13) used in the radiological impact assessment implicitly includes a contribution from this facility and therefore no extra headroom in discharges is needed to take account of it.

In keeping with the practical situation on other nuclear sites and consistent with other permits and authorisations, there may be other very minor outlet routes for gases. These include louvers, small vents, windows and doors associated with Controlled areas or laboratories, the turbine hall and small storage areas not specifically listed above.

5.1.2.3 Direct Radiation

In addition to the discharge of radioactive material to the environment, radiation will also be emitted by sealed radioactive sources present on the HPC site. These radioactive sources include the reactor core, spent fuel and contained intermediate and low level radioactive waste. This direct radiation principally comprises gamma photons emitted from these sources in waste stores on-site. The design will ensure that gamma photons will be heavily shielded by the reactor pressure vessel, the walls of the reactor building and the design of the waste stores. The direct radiation doses from HPC are assessed in Section 5.2.2.5.

5.2 Operational Phase Impacts

5.2.1 Stack Height

The ADMS dispersion model was used to predict dispersion and deposition factors for routine releases from a stack height for each EPR at Hinkley point of 70 m (Section 3.4.1.2). The ADMS model used took account of forecasted hourly meteorological conditions from 1st January 2004 to 31st December 2008, generated using the United Kingdom Meteorological Office (UKMO) Numerical Weather Prediction model for the Hinkley Point Site. Figure 2 presents the wind rose based on the meteorological data for 2004 to 2008 that formed the basis for the calculations. The wind rose shows that wind is blowing predominantly from the 290^{o} quadrant and therefore from the northwest to the southeast.

Figure 3 presents a graphical representation of the resultant estimated 5 year average of Total Integrated Activity Concentration (Bq m^{-3}) for a release of all radionuclides (Tables 12 and 13) from HPC West (C2) and from HPC East (C1) for a stack height of 70 m.

This stack height is used in the next stage of modelling in PC CREAM98. In this, the required input parameter is called the “effective stack height”. This is routinely calculated by assuming the effective stack height is 1/3rd of the true or actual stack height. This gives a conservative assumption for the stack height from which gaseous emissions take place and the associated dispersion factors.

5.2.2 Assessment of Radiological Impact on Humans

5.2.2.1 Individual Doses Resulting from Continuous Discharges

The radiological impact was assessed by the calculation of prospective doses incurred by various critical groups using PC CREAM98. A summary of the input parameters for this assessment are shown in Appendix B. The PC CREAM programme uses the most recent metrological data from 1999 to 2008.

The assessment considered separate candidate critical groups exposed to discharges to the terrestrial and marine environments. The highest predicted exposures were found for the following two candidate critical groups; a fishing family living and working in the vicinity of the site thereby exposed to both liquid discharges to the marine environment and gaseous discharges to atmosphere (the 'Fishing Family with marine and gaseous exposure') and a farming living in a nearby dwelling who also consume locally sourced seafoods and spend recreational time on a local beach, again exposed to both marine and gaseous discharges (the 'Farming Family with marine and gaseous exposure'). These have already been identified in Section 3.4.1.2.

5.2.2.2 'Farming Family with marine and gaseous exposure'

This family represents the candidate critical group who may be exposed to gaseous discharges from the proposed HPC EPRs and via liquids discharged to marine pathways. It is firstly assumed that this family lives at the location where the highest predicted air and ground activity concentration occurs due to HPC discharges. The radiation exposure to three age groups via this first route was determined; an Infant representing the age range 1-2 years; a Child representing the age group 7 to12 years of age and an Adult representing individuals greater than 17 years of age.

For the purposes of this assessment, it is assumed that the 'Farming Family' consumption rates (based on the most recent CEFAS[53] consumption data for the Hinkley Point Site) for terrestrial foods are calculated based on the 'Top Two' approach. In the 'Top Two' approach, the two foodstuffs, that result in the highest ingestion dose (when all foodstuffs are modelled as consumed at critical rates), are assumed to be consumed at critical rates and all other foodstuffs at average rates. In this instance, the 'Top Two' foodstuffs were found to be: milk and root vegetables for adults, and milk and milk products for child and infant age groups. These foods are assumed to be consumed at the critical rate corresponding to the 97.5th percentile rate and the remaining foodstuffs consumed at mean rates. Where appropriate ratios were not present in the CEFAS report, ratios of adult to child and adult to infant ingestion rates were calculated from generalised habit data[54].

This family is also assumed to consume locally sourced sea-food at mean CEFAS[53] ingestion rates. It is assumed that members of this family can also be exposed to marine discharges through external exposure to beach sediments and the inhalation of sea-spray, whilst spending time recreationally on the beach at Stolford. It is assumed that these individuals do not participate in fishing and therefore are not exposed through the handling of fishing gear exposure pathway.

Occupancy rates for members of this family are given in Appendix B (Table B2) and are based on CEFAS data.

The predicted doses to this 'Farming Family with marine and gaseous exposure' were calculated to be 2.7, 2.5 and 4.5 µSv y^{-1} for the adult, child and infant respectively (the latter is the highest dose estimated for HPC discharges). A dose breakdown by exposure pathway for HPC discharges is presented in Table 14 for the three age groups.

Table 14: Breakdown of predicted doses to the 'Farming Family with marine and gaseous exposure', by exposure pathway, for HPC discharges (µSv y^{-1})

Pathway		Adult	Child	Infant
Terrestrial pathways	Ingestion terrestrial foodstuffs	$2.2\ 10^{0}$	$2.1\ 10^{0}$	$4.3\ 10^{0}$
	Inhalation plume	$1.3\ 10^{-1}$	$1.0\ 10^{-1}$	$7.2\ 10^{-2}$
	Cloud gamma	$3.2\ 10^{-2}$	$1.9\ 10^{-2}$	$1.5\ 10^{-2}$
	Deposited gamma	$1.9\ 10^{-2}$	$9.4\ 10^{-3}$	$6.4\ 10^{-3}$
	Cloud beta	$1.7\ 10^{-3}$	$1.7\ 10^{-3}$	$1.7\ 10^{-3}$
	Deposited beta	$1.1\ 10^{-3}$	$4.4\ 10^{-4}$	$2.2\ 10^{-4}$
	Inhalation re-suspended	$2.6\ 10^{-6}$	$3.3\ 10^{-6}$	$3.7\ 10^{-6}$
Marine pathways	Ingestion marine foodstuffs	$3.0\ 10^{-1}$	$2.9\ 10^{-1}$	$1.2\ 10^{-1}$
	Gamma (sediment)	$3.0\ 10^{-4}$	$1.4\ 10^{-4}$	$7.8\ 10^{-6}$
	Beta (sediment)	$9.4\ 10^{-8}$	$4.2\ 10^{-8}$	$2.4\ 10^{-9}$
	Inhalation sea-spray	$9.6\ 10^{-11}$	$5.2\ 10^{-11}$	$3.4\ 10^{-12}$
Sum for marine and terrestrial pathways for HPC		$2.7\ 10^{0}$	$2.5\ 10^{0}$	$4.5\ 10^{0}$

Overall, in this group, between about 89% (for the child and adult) and 98% (for the infant) of the prospective dose is due to exposure via terrestrial pathways and between about 2% (for the infant) and 11% (for the adult and child) is due to exposure via marine pathways.

5.2.2.3 'Fishing Family with marine and gaseous exposure'

This family represents the candidate critical group who may be exposed to radiation and radioactivity from discharges into the marine environment and via terrestrial pathways. The radiation exposure to the same three age groups as the 'Farming Family with marine and gaseous exposure' (above) was determined. As for that candidate critical group, exposure to gaseous discharges is calculated based on 100% occupancy at a dwelling coinciding with maximum airborne and deposited activity due to these discharges from HPC[l].

[l] This is a realistically conservative assumption because the family would be exposed to lower levels of radionuclides in the plume whilst fishing and spending recreational time on the beach at Stolford.

The family members consume seafood at the 97.5th percentile rates as calculated on all observations in the most recent CEFAS[53] survey of Hinkley Point habits and also consume terrestrial foodstuffs at average (mean CEFAS[53]) rates. For the child and infant consumption parameters, the same methods were used to determine consumption rates. However, in cases where there are no instances of a food group being consumed, child and infant data was derived from adult data using the method described in the CEFAS[53] report. Where appropriate ratios were not present in the CEFAS report, ratios of adult to child and adult to infant ingestion rates were calculated from generalised habit data[54]. Rates are given in Appendix B (Table B1)

There are some foodstuffs (marine plants and algae) consumed by members of the public in the CEFAS survey[53] which have not been included in the current assessment. This is because they are only consumed in small quantities by very few individuals and it is not possible to model these foodstuffs in PC CREAM 98.

The predicted doses to this 'Fishing Family with marine and gaseous exposure' were calculated to be 3.0, 2.3 and 3.6 $\mu Sv\ y^{-1}$ for the adult, child and infant members respectively. A dose breakdown by exposure pathway for HPC is presented in Table 15 below for the three age groups.

Table 15: Breakdown of predicted doses to the 'Fishing Family with marine and gaseous exposure', by exposure pathway, for HPC discharges $\mu Sv\ y^{-1}$

Pathway		Adult	Child	Infant
Marine pathways	Ingestion Marine Foodstuffs	$1.1\ 10^{0}$	$3.1\ 10^{-1}$	$1.2\ 10^{-1}$
	Gamma (sediment)	$1.5\ 10^{-3}$	$1.4\ 10^{-4}$	$7.8\ 10^{-6}$
	Gamma (fishing gear)	$1.2\ 10^{-5}$	-	-
	Beta (fishing gear)	$8.0\ 10^{-6}$	-	-
	Beta (sediment)	$4.6\ 10^{-7}$	$4.2\ 10^{-8}$	$2.4\ 10^{-9}$
	Inhalation Sea-spray	$8.6\ 10^{-10}$	$9.2\ 10^{-11}$	$5.4\ 10^{-12}$
Terrestrial pathways	Ingestion terrestrial Foodstuffs	$1.7\ 10^{0}$	$1.8\ 10^{0}$	$3.4\ 10^{0}$
	Inhalation plume	$1.1\ 10^{-1}$	$1.0\ 10^{-1}$	$7.2\ 10^{-2}$
	Cloud gamma	$3.2\ 10^{-2}$	$1.9\ 10^{-2}$	$1.5\ 10^{-2}$
	Deposited gamma	$1.9\ 10^{-2}$	$9.4\ 10^{-3}$	$6.4\ 10^{-3}$
	Cloud beta	$1.7\ 10^{-3}$	$1.7\ 10^{-3}$	$1.7\ 10^{-3}$
	Deposited beta	$1.1\ 10^{-3}$	$4.4\ 10^{-4}$	$2.2\ 10^{-4}$
	Inhalation re-suspended	$2.1\ 10^{-6}$	$3.3\ 10^{-6}$	$3.7\ 10^{-6}$
	Sum for marine and terrestrial pathways for HPC	$3.0\ 10^{0}$	$2.3\ 10^{0}$	$3.6\ 10^{0}$

Overall, between about 63% (for the adult) and 97% (for the infant) of the prospective dose is due to exposure via terrestrial pathways and between 3% (for the infant) and 37% (for the adult) is due to exposure via marine pathways. Thus, although described as a 'Fishing family', most of the prospective dose assessed to this candidate critical group due to HPC gaseous and liquid discharges is from terrestrial sources.

A separate assessment shows that discharges from the Interim Storage Facility for Spent Fuel have a negligible health impact, being less that 1% of the doses due to gaseous and liquid discharges from the UK EPRs at Hinkley Point.

5.2.2.4 Dose breakdown by Nuclides in the Candidate Critical Groups

The percentage contribution to these predicted doses (in Tables 14 and 15 above) from the individual nuclides in the discharges from HPC are summarised below (Table 16). The table only includes a breakdown where the contributions are greater than 1%.

Table 16: Dose breakdown as a percentage of summated predicted dose by radionuclide for HPC discharges

Nuclide	'Fishing Family with marine and gaseous exposure'			'Farming Family with marine and gaseous exposure'		
	Infant	Child	Adult	Infant	Child	Adult
C-14	90%	92%	94%	89%	92%	93%
I-131	7%	3%	1%	7%	3%	1%
H-3	3%	3%	2%	3%	3%	3%
Xe-135; Co-60; Ar-41; I-133; Cs-134; Cs-137; Xe-133; Co-58;Kr-85; Ag-110m; Sb-124;Te-123m;Sb-125;Xe-131m;Ni-63;Mn-54;Cr-51. Any one of these nuclides always contributes to less than 1% of the total dose due to HPC discharges to any individual (infant, child, adult) in either candidate critical group.						

This table shows that these estimated doses from the HPC EPRs are dominated by contributions from discharges of C-14, tritium and (for the infant and child) also by I-131.

5.2.2.5 Direct Exposure from the Waste Stores on the HPC Site

Any buildings on the HPC site are likely to be designed to ensure that dose rates outside (due to radioactive materials stored or used inside) remain below the public dose limit of 1,000 µSv y^{-1}. This, in turn, will ensure that the outside of the buildings can remain undesignated under the Ionising Radiation Regulations (IRRs), that is without controls on the access to these areas by non-radiation workers (for example, cleaners or site contractors). The radiation exposure will be required to be As Low As Reasonably Practicable (ALARP) and therefore, in practice, dose rates in such areas will lower than the public dose limit of 1,000 µSv y^{-1}. Nevertheless, in the absence of current definitive information on design or the inventory of materials stored, this limit (based on a 2,000 hour working year) forms a conservative basis for the maximum dose rate on the outside surface of the Interim Storage Facility for Spent Fuel and the ILW Store that are proposed to be situated on the periphery of the HPC site, but close to publicly accessible areas outside the site boundary. This equates to a dose rate of 0.5 µSv h^{-1}.

For simplicity, this dose rate is assumed to be at a distance of 1 m from the outer wall of these waste stores. The dose rate at a receptor point can then be approximately estimated using a 1/r relationship, which is appropriate for those in close proximity to a line source (like an elongated building). This becomes a $1/r^2$ relationship for a solid angle less than about 10^o, i.e. for those further away (and which for a notional store 150 m long equates to a distance >850 m).

Direct radiation dose to a walker or recreational user

For HPC, an ILW and a Spent Fuel building are planned to be located at a distance of approximately 40 m from the coastal footpath that runs parallel to the northern boundary of the Hinkley Point Site. The dose rate at this location is therefore:

$$D = \frac{0.5\mu Sv\,h^{-1} * 1m}{40m} = 0.0125\mu Sv\,h^{-1}$$

A standard scenario for this type of assessment of direct dose would be a member of the public walking their dog daily along this path of about 800 m long and back again. Walking at a rate of approximately 5 km h^{-1}, they could therefore spend about 10 minutes per day walking past the site in the vicinity of the waste stores. It is conservatively assumed that the dose rate along this 800 m walk remains constant at the peak rate of 0.0125 µSv h^{-1} calculated above. The direct dose received has been calculated to be 0.76 µSv y^{-1}. It might be assumed that they walk back along the same path each day (making a 20 minute walk) and would therefore receive this dose twice i.e. 1.5 µSv y^{-1}. This is a conservative estimate, as the dose rate would only be 0.0125 µSv h^{-1} whilst in the walker was in the immediate vicinity of the waste stores (~150 m long) and would drop-off at a rate of $^1/r^2$ along the rest of the path, resulting in dose rates of approximately a factor of 10 lower at the extreme ends of the path/walk.

Another scenario for this type of assessment would be a member of the public walking their dog but spending 2 hours per day stationary in the immediate vicinity of the waste stores. In this case, the calculated annual direct dose to this most exposed person would be 9.13 µSv y^{-1}. However, the assumption of spending 2 hours per day over a year standing at this location adjacent to the Spent Fuel and ILW waste stores on the HPC site is an overly conservative scenario.

Direct radiation dose to closest local residents

The nearest dwelling to the proposed ISF for spent fuel and ILW is at a distance of about 1.3 km from the where the stores would be located on the HPC site. A local resident spending the whole year in this nearest dwelling would receive the highest direct dose of all local residents due to direct radiation from the stores. The external dose here is equal to the dose rate multiplied by the exposure time but also taking into account the reduced dose rate indoors (due to shielding effects of the walls of the dwelling). Taking account of these factors, the annual dose for the nearest dwelling due to the waste stores is estimated from:

$$Dose = \frac{1}{r^2} D \times \left(LF_i \times O_i + LF_o \times O_o \right)$$

r = distance from the spent fuel/ILW waste store to the receptor point, m
D = dose rate at 1 m from the waste store wall, µSv h^{-1}

$LF_{i,o}$ = indoors and outdoors Location Factors
O_i = Indoors Occupancy h y^{-1} = fraction of time indoors x occupancy
O_o = Outdoors Occupancy h y^{-1} = fraction of time outdoors x occupancy

The estimated dose rate at the nearest dwelling at 1,300 m is just 0.3 pSv h^{-1}.

The dose to an adult spending 4,380 hours per year (50%) indoors and 4,380 hours per year outdoors is calculated as:

$$Dose = \frac{1}{1300^2} \times 0.5 \times (0.1 \times 4380 + 1 \times 4380) = 1.43 nSv\, y^{-1}$$ (0.0014 μSv y^{-1})

The dose to a child spending 7,008 hours per year (80%) indoors and 1,752 hours per year outdoors is calculated as:

$$Dose = \frac{1}{1300^2} \times 0.5 \times (0.1 \times 7008 + 1 \times 1752) = 0.73 nSv\, y^{-1}$$ (0.0007 μSv y^{-1})

The dose to an infant spending 7,884 hours per year (90%) indoors and 876 hours per year outdoors is calculated as:

$$Dose = \frac{1}{1300^2} \times 0.5 \times (0.1 \times 7884 + 1 \times 876) = 0.49 nSv\, y^{-1}$$ (0.0005 μSv y^{-1})

Direct radiation dose to members in the candidate critical groups

The dose rate at the more distant location assumed for the ‘Farming’ or ‘Fishing’ families with marine and gaseous exposure (Section 5.2.2.) due to the waste stores at HPC is estimated as 0.17 pSv h^{-1} (compared with 0.3 pSv h^{-1} at the closest dwelling). For adult occupancy, this is equivalent to an annual exposure of 0.82 nSv y^{-1} (compared to 1.43 nSv y^{-1} for the adult in the closest dwelling). Direct doses to the infant and child in the Farming or Fishing families would also be proportionately smaller than for those in the closest dwelling to the stores.

For individuals in these two candidate critical groups, the predicted doses due to direct radiation from the waste stores on the HPC site are therefore very significantly less than those due to gaseous and liquid discharges (Sections 5.2.2.2 and 5.2.2.3); they need not be considered in assessing the cumulative dose from the HPC EPRs to individuals within either of these two candidate critical groups.

Summary of direct radiation doses due to HPC waste stores and assessment against dose criteria

A summary of the predicted doses from direct radiation from the proposed Interim Storage Facilities for Spent Fuel and ILW on the HPC site periphery is shown in Table 17.

Table 17: Summary of predicted direct radiation doses to the public due to the waste stores

Scenario	Estimated dose μSv y^{-1}
Coastal path – moving receptor (walk)	1.5 μSv y^{-1}
Closest dwelling – worst case (adult spending 4,380 hours per year indoors and 4,380 hours per year outdoors)	0.0014 μSv y^{-1}
'Farming or Fishing Family with marine and gaseous exposure' (candidate critical groups; adult occupancy as above)	0.00082 μSv y^{-1}

It should be noted that the assumptions used in the assessment are conservative (including the public dose limit of 1,000 μSv y^{-1} on the walls of the waste stores) so that the actual public doses associated with any form of waste store on the site periphery are expected to be below those estimated in Table 17.

5.2.2.6 Critical Group for Hinkley Point C and Assessment of Prospective Doses against the Dose Constraint for New Sources

The source dose constraint for the maximum dose to people that may result from discharges from a single new source of 300 μSv y^{-1} applies to the dose from proposed discharges and direct radiation (Section 3.4.1.1). Moreover, the Health Protection Agency (HPA-RPD) specifically advises the UK Government to select a value for the constraint for members of the public for new nuclear power stations and waste disposal facilities that is less than 150 μSv y^{-1}.

Table 18 summarises the prospective doses to members of the two candidate critical groups due to HPC discharges (from Tables 14 and 15). The small dose due to direct radiation from the ISF for Spent Fuel (Section 5.2.2.5) would not add measurably to these assessed doses for any members in either candidate critical group:

Table 18: Summary of prospective doses to candidate critical groups due to HPC discharges

Age group	'Farming Family with marine and gaseous exposures'	'Fishing Family with marine and gaseous exposures'
Adult	2.7 μSv y^{-1}	3.0 μSv y^{-1}
Child	2.5 μSv y^{-1}	2.3 μSv y^{-1}
Infant	4.5 μSv y^{-1}	3.6 μSv y^{-1}

Table 18 shows that the highest prospective doses due to HPC routine continuous discharges (based on the activity values in Tables 12 and 13) plus the small contribution from direct radiation from the waste stores are 4.5 μSv y^{-1} to the infant and 2.5 μSv y^{-1} to the child in the 'Farming Family with marine and gaseous exposures'. The dose to the adult in the 'Fishing Family with marine and gaseous exposures' is marginally higher than to the adult in the Farming family. However, taking account of the differences in doses, the assessment shows that the

'**Farming Family with marine and gaseous exposures'** is the **Critical Group** due to HPC routine continuous discharges (plus direct radiation).

The prospective doses to this critical group are well below the source constraint of 300 μSv y^{-1} and also below the HPA-RPD guidance of 150 μSv y^{-1}. All members of the candidate critical groups ('Farming with marine and gaseous exposure' and 'Fishing Family with marine and gaseous exposure') would therefore be afforded at least the same level of protection.

The prospective doses to all members in both candidate critical groups for discharges from HPC (based on values in Tables 12 and 13) are below 10 μSv y^{-1}. This is the level at which the UK Government in its statutory guidance to the Environment Agency has stated that the agency should not seek further progressive reductions in discharge limits that are in place provided that the holder of the authorisation applies and continues to apply Best Available Techniques (BAT; Section 2.3.2).

The approach and parameters used for the Generic Design Assessment (Section 3.4.1.2) and the HPC annual dose assessments (Section 5.2.2) are different and therefore it is not appropriate to compare the results directly. However, results from the GDA are higher than those for HPC and, as such, the HPC assessment is within the envelope described in the GDA.

5.2.2.7 Collective Dose Due to HPC Discharges and Assessment against the Collective Dose Criteria

Relevant parameters for a prospective collective dose assessment are provided in Appendix C. All the prospective collective doses are based on a single year of discharge and truncated at 500 years.

The prospective collective doses to the UK, European and World populations from HPC gaseous discharges (Table 13) have been calculated to be 0.36, 2.99 and 24.6 Man Sv respectively. The collective doses to the UK, European and World populations from HPC liquid discharges have been calculated to be 0.021, 0.20 and 2.2 Man Sv respectively. Total prospective collective doses due to HPC discharges are therefore 0.4, 3.2 and 26.8 Man Sv for the UK, Europe and World populations respectively. These results are presented in Table 19 below.

The prospective *per caput* doses from gaseous discharges from HPC are equivalent to 6.55, 4.27 and 2.46 nSv for populations of the UK, Europe and World respectively. The *per caput* doses from marine discharges from HPC are equal to 0.38, 0.29 and 0.22 nSv for populations of the UK, Europe and World respectively. Average total prospective *per caput* doses due to HPC discharges are therefore 6.9, 4.6 and 2.7 nSv for the UK, Europe and the World (and included in Table 19, over).

Table 19: Collective dose to the UK, European and World populations from HPC discharges

	Collective Population		
Collective dose (Man Sv y^{-1} discharge)	UK	Europe	World
Gaseous discharges	0.36	2.99	24.6
Liquid discharges	0.021	0.20	2.2
Total collective dose due to HPC liquid and gaseous discharges	0.4	3.2	26.8
Average per caput dose (nSv y^{-1} discharge)	UK	Europe	World
Gaseous discharges	6.55	4.27	2.46
Liquid discharges	0.38	0.29	0.22
Per caput dose nSv due to HPC liquid and gaseous discharges	6.9	4.6	2.7

The collective dose to the UK population (truncated at 500 years) in Table 19 of 0.4 Man Sv y^{-1} due to liquid and gaseous discharges from HPC is less than the guideline of about 1 Man Sv y^{-1} that the IAEA considers sufficiently low that they may allow a practice or source to be exempted from regulatory control[(f)] (Section 3.4.1.1).

The per caput doses to the UK, European and World populations (truncated at 500 years) in Table 19 are all of the order of a few nSv y^{-1}. They are therefore in the range of a few nSv y^{-1} that, in the EA interim guidance document on assessment of prospective public doses, are stated should be ignored in the decision making process, as the associated risks are 'miniscule' and the contribution to total doses to individuals will be insignificant (Section 3.4.1.1)[42].

Table 19 shows that the assessed collective dose due to HPC is due mainly to gaseous discharges. Of the nuclides in these, C-14 accounts for between 95% and 100% of the collective dose to all of the populations considered. However, these doses are all much lower than that from naturally occurring C-14 to the UK population alone (about 480 man Sv y^{-1}; European Commission)[48]. Similarly, the *per caput* dose from HPC gaseous discharges to the UK (6.55 nSv y^{-1}) is much smaller than that due to naturally occurring C-14 (of the order of 8.8 μSv y^{-1}).

C-14 contributes to the bulk of the dose due to the HPC liquid discharges as well, although there is no data on natural sources and doses against which to compare this.

5.2.2.8 Individual Dose Resulting from Short-Term Gaseous Discharges and Assessment against Dose Criteria

ADMS has been used to model the dispersion of the aerial discharges using the Hinkley Point Site meteorological data for the months June to August for the years 1999 to 2008.

The dynamic food chain models described in FARMLAND (Brown and Simmonds, 1995)[80] and RP72 (Simmonds,1995)[81] have been used to determine doses from the ingestion of foodstuffs in the year following the release for all radionuclides except for H-3 and C-14. The fruit model is described in NRPB-W46 (Teale and Brown, 2003)[82]. The compartment modelling software ModelMaker4 (Modelkinetix) has been used to replicate the FARMLAND models. Concentrations of tritium and C-14 in foodstuffs were modelled using the specific activity method. Transfer and intake rates for animals and crops have been taken from RP72[81].

The pathways of exposure and the exposure times which have been considered to assess the short-term impact are the following:

- Ingestion of foodstuffs: the associated dose is calculated in the year following the short-term release;
- Inhalation and external irradiation from the plume: the associated doses are calculated for the period of the passage of the plume; and
- External irradiation from deposited radionuclides: the associated dose is calculated for the year following the release.

The input parameters, total discharge amounts, and discharge rates for the short-term scenario are presented in Appendix D.

Individual doses as a result of a short-term, 24 hour gaseous discharge to atmosphere have been calculated for a separate and specific critical group located at the location at which the highest 95th percentile air concentration and ground deposition rate is predicted to occur and based on the 10 years of summer meteorological data (this corresponds to the periods when cropping and harvesting occurs and thus gives a maximum likely nuclide up-take into local produce). Doses have been calculated as a result of a short-term discharge from the HPC West (C2) stack as this stack represents the worst case discharge for the worst case receptor. It is unlikely that both EPR reactors would discharge at elevated short-term rates simultaneously.

As for the continuous dose assessment, ingestion doses have been reported for the CEFAS[53] food intake rate scenario, using the same “Top Two” calculation. All other exposure routes are identical.

The results for the CEFAS[53] intake rate give summated doses of 0.26, 0.23 and 0.45 µSv per short-term discharge for the adult, child and infant age groups respectively. For infants (the most exposed individual) the most significant exposure route is ingestion (97% of the dose received) followed by inhalation (2%). The most significant radionuclide is C-14 (95% of the dose received) followed by tritium (2%).

The prospective doses to any of the individuals in this specific critical group exposed to short-term gaseous discharges from HPC are all significantly less (by about an order of magnitude) than those to any of the individuals in the candidate critical groups due to continuous routine releases i.e. doses to the ‘Fishing or Farming families with marine and gaseous exposure’ (which are all in the range of 2.3 to 4.5 µSv y^{-1} as summarised in Section 5.2.2.6).

The prospective doses estimated due to the short-term discharges from HPC are significantly less than the relevant dose criteria, that is the source constraint of 300 µSv y^{-1} or the public dose limit of 1,000 µSv y^{-1} (Section 3.4.1.1).

5.2.2.9 Build-Up Due to HPC Discharges

In order to determine the radiological impact of the build-up of radioactivity in the environment resulting from discharges from HPC, it is necessary to predict the concentrations in soil, seawater and sediments after 60 years of continuous discharges. This is the planned operational life time of the power station. Build-up parameters are included in Appendix E.

Table 20 presents the results calculated using PC CREAM, for the airborne concentrations and consequent concentration in soil at the off-site location with the highest concentration at year 60 from HPC (C1 plus C2) discharges. As prevailing winds are north westerly, the highest concentration will occur in a south easterly location from the site. Note that default values for deposition velocity of noble gases, tritium and C14 in PC CREAM are zero, so Table 20 shows no calculated build-up for these isotopes. It should be noted that for tritium and C-14 either the build-up dose coefficient is very low or not published and so build-up concentrations were not assessed.

The results for the activity concentration in the seawater and seabed sediments off the coast of Hinkley Point calculated using the DORIS module of PC CREAM at year 60 from HPC discharges are presented in Table 21.

Table 20: Soil concentration at the off site location with the highest concentration at year 60 from HPC (C1 and C2) discharges.

Nuclide	Air Concentration Bq m^{-3}	Soil Concentration Bq kg^{-1}
H-3	$3.6\ 10^{-01}$	-
C-14	$8.3\ 10^{-02}$	-
Ar-41	$7.7\ 10^{-02}$	-
Co-58	$3.6\ 10^{-06}$	$8.8\ 10^{-05}$
Co-60	$4.3\ 10^{-06}$	$2.3\ 10^{-03}$
Kr-85	$3.7\ 10^{-01}$	-
I-131	$2.1\ 10^{-05}$	$4.8\ 10^{-04}$
I-133	$2.6\ 10^{-05}$	$6.3\ 10^{-05}$
Xe-131m	$8.0\ 10^{-03}$	-
Xe-133	$1.7\ 10^{+00}$	-
Xe-135	$5.3\ 10^{-01}$	-
Cs-134	$3.3\ 10^{-06}$	$7.6\ 10^{-04}$
Cs-137	$3.0\ 10^{-06}$	$5.9\ 10^{-03}$

Table 21: Activity concentration in the seawater and seabed sediments off the coast of Hinkley Point at year 60 from HPC discharges

Nuclide	Activity concentrations in unfiltered seawater (Bq l^{-1})	Activity concentrations in seabed sediment (Bq kg^{-1})
H-3	$1.57\ 10^{+00}$	$1.07\ 10^{+00}$
C-14	$2.00\ 10^{-03}$	$1.19\ 10^{-01}$
Mn-54	$5.34\ 10^{-06}$	$4.03\ 10^{-05}$

Nuclide	Activity concentrations in unfiltered seawater (Bq l^{-1})	Activity concentrations in seabed sediment (Bq kg^{-1})
Ni-63	$2.01\ 10^{-05}$	$3.60\ 10^{-03}$
Cr-51	$8.28\ 10^{-07}$	$5.28\ 10^{-07}$
Co-60	$6.20\ 10^{-05}$	$2.56\ 10^{-03}$
Co-58	$3.56\ 10^{-05}$	$6.20\ 10^{-05}$
Ag-110m	$1.12\ 10^{-05}$	$1.17\ 10^{-05}$
Sb-124	$8.21\ 10^{-06}$	$2.10\ 10^{-06}$
Sb125	$1.68\ 10^{-05}$	$6.60\ 10^{-05}$
Te-125m*	$1.05\ 10^{-06}$	$6.55\ 10^{-05}$
Te-123m	$4.81\ 10^{-06}$	$2.44\ 10^{-06}$
Te-123 *	$2.16\ 10^{-20}$	$5.86\ 10^{-18}$
Cs-134	$1.15\ 10^{-05}$	$7.73\ 10^{-05}$
Cs-137	$1.98\ 10^{-05}$	$9.88\ 10^{-04}$
I-131	$3.89\ 10^{-07}$	$4.46\ 10^{-09}$

* indicates a daughter product

Prospective dose to a future construction worker off-site due to build-up from HPC discharges and assessment against dose criteria

The radiological impact of the build-up of gaseous discharges has been assessed. Section 3.4.1.6 introduced the methodology for assessing doses from contaminated land off-site and stated that the most restrictive scenario would be future construction on such an off-site area. It has been assumed that the most contaminated land off-site would be used for construction of this future off-site development. It is assumed that a construction worker would spend 2,000 hours per year working on this potentially contaminated site, 10% spent disturbing ground (manual digging, 20 hours per year and mechanical digging, 180 hours per year) and 90% of the time (1,800 hours) involved in other activities on the site.

The prospective dose to this off-site future construction worker as a consequence of the future build-up of nuclides due to the emissions from the HPC EPRs has been calculated to be $4.4\ 10^{-3}$ µSv y^{-1}. Approximately 100% of this is accounted for by the external exposure from the ground. Co-60 accounts for about 58% of this external dose. Cs-137 is also a large contributor to external dose, contributing 32%.

These prospective annual doses due to potentially contaminated ground are much smaller than typical measured terrestrial dose rate around Hinkley Point of about 0.07 µGy h^{-1} (see Table 52 of CEFAS, 2007)[53]. The predicted exposure to a future construction worker resulting from the build-up of discharges from two EPRs is equivalent to only about 4 minutes exposure per year to the local natural terrestrial background radiation.

NRPB-W36[59] recommends in its advice on radiological protection objectives for contaminated land, that it is unlikely that significant expenditure to reduce the risk to a member of the critical group of site occupants below about 10^{-6} y^{-1} would be warranted on radiological protection grounds. This risk corresponds to a dose of about 20 µSv y^{-1}. For HPC, the total maximum prospective dose to a future construction worker is 4.4 10^{-3} µSv y^{-1} which broadly corresponds to a risk value of 10^{-6} y^{-1} and therefore implies no restriction on future use of off-site land most affected by build-up due to HPC gaseous discharges.

The predicted annual exposure to a future-use construction worker estimated above is based on the build-up of activity at the location of maximum predicted concentration outside the HPC site boundary. The extent of this area of maximum concentration is relatively small and will reduce with distance from the site.

Prospective dose for marine users due to build-up from HPC discharges and assessment against dose criteria

Coastal or marine based activities other than those associated with fishing, as listed in the CEFAS[53] report are: dog walking, horse riding, playing, bird watching, fossil hunting, deckchair rental, operating donkey rides, beach combing, kite flying and walking. Commercial fishing would result in higher occupancies and intakes than the above. Therefore, the dose to members of the public from future use of the sea has been assessed as the Fishing Family group in Section 5.2.2.3 but excluding the atmospheric contribution. The prospective doses to the Fishing Family due to build-up from marine discharges from HPC were calculated to be 1.08, 0.30 and 0.120 µSv y^{-1} to adults, children and infants respectively. In this particular case, generic UK habit values[54] would result in slightly higher doses for adults than those presented here based on CEFAS habit data.

The prospective doses due to build-up from HPC for marine users are significantly lower than the public annual dose limit (1,000 µSv y^{-1}) and also significantly below the average exposure from all natural and man-made sources to an individual in the UK of 2,700 µSv y^{-1} (Watson et al, 2005)[65].

5.2.3 Assessment of Radiological Impact on Non-Human Species from Hinkley Point C discharges

To enable the assessment of the radiological impact on non-human species resulting from continuous discharges from HPC, four representative habitats were selected for the species they are likely to support in the vicinity of the proposed power station site.

- Habitat 1 lies adjacent to the Hinkley Point C boundary;
- Habitat 2 comprises the coastal mudflats and marine habitat of the adjacent estuary;
- Habitat 3 lies within the Bridgwater Bay National Nature Reserve and includes both shoreline and a fringing terrestrial area; and
- Habitat 4 comprises a small freshwater pond and lies within Habitat 1.

The location of the four habitats with respect to the Hinkley Point Site is presented in Figure 4. As the majority of marine biota is mobile, assessing the activity concentration at a single receptor point where these species live has little value, particularly given the highly dynamic nature of the tides, currents and sediments of the Severn Estuary and Bristol Channel. By assessing the average activity concentration in a small area of sea around the discharge point, the radiation exposure over a period of time of any biota present is more likely to be determined. The local compartment as defined in PC CREAM for Hinkley Point has been used for this purpose to determine concentrations in seawater and seabed sediments.

Using meteorological data, it is possible to calculate, at specific bearings and distances from the HPC stacks the concentration in soil and air of gaseous discharged radionuclides.

Parameters used for the calculation of the radiological impact on non-human species are presented in Appendix F.

Results for the assessments for HPC are summarised below. The assessments for HPA, HPB and for the cumulative site are presented in Section 7.2.

Habitat 1: Terrestrial

The assumption was made that all the species currently within the study site occupy an area south-east of the EPR stacks, corresponding to an area within the Hinkley Point Nature Trail, as this is in the direction of the prevailing winds. The nature trail is a Nature Reserve and a designated County Wildlife Site. This also corresponds to the off-site area where air concentration and consequent deposition is highest for EPR discharges for a 70 m stack height. This habitat will be the main receptor habitat for impacts due to gaseous discharges from HPC.

The surveys showed that the majority of the ERICA default organisms were present in Habitat 1. However, for completeness, all of the ERICA default organisms were included and modelled, regardless of whether they had been identified in Habitat 1 or not. Additionally, there were bats and badgers present on site, which could not be matched to any existing ERICA organisms. It was necessary, therefore, to create new organisms within ERICA to model these particular mammals. Bats are of specific importance as they are a protected species and therefore of particular value and sensitivity (see Table 2 in Section 3.4.2.1).

For the HPC discharge, the risk quotients for gaseous releases and subsequent impacts on the terrestrial environment on terrestrial organisms were determined for each of the default ERICA organisms and the additional custom organisms, badger and bat, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient (RQ) estimated was 4.17 10^{-4} for badgers (with all other species, including bats, below this). The associated dose for these organisms is 4.17 10^{-3} µGy h^{-1}.

Doses and RQs for noble gases have also been determined. Organisms from R&D128[27] were chosen for their similarity to organisms studied in ERICA. For Habitat 1, the highest dose rate due to noble gases discharged from HPC is received by caterpillars, calculated as 1.56 10^{-3} µGy h^{-1}.

Habitat 1 is not a SSSI. However, it is a habitat for bats and therefore special protection of the bats and their roosts must be considered. All the estimated doses from the HPC discharges are below the most stringent assessment level (10 µGy h^{-1}).

Habitat 2: Marine

The marine environment encompasses Bridgwater Bay and the coastal mudflats. These are modelled within DORIS as the local compartment for Hinkley Point. Default data are available within DORIS for Hinkley Point. A large number of species have been reported to reside here and this would be the region most influenced by any liquid discharge. The surveys showed that the majority of the ERICA default organisms were present in this Habitat but again, for completeness, all of the ERICA default organisms were included and modelled, regardless of whether they had been identified or not.

For the HPC discharge, the RQs for liquid releases to the marine environment on marine organisms were calculated for each of the default ERICA organisms based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 1.28 10^{-4} for mammals and reptiles. The associated dose for these organisms is 1.28 10^{-3} µGy h^{-1}.

Habitat 2, as part of Bridgwater Bay, is a designated site and therefore of interest to regulators. All the estimated doses from the HPC discharges are below the most stringent assessment level (10 µGy h^{-1}).

Habitat 3: Coastal

Habitat 3 encompasses Bridgwater Bay and the coastal mudflats at Stolford and extends eastwards to include salt marsh land. As some non-human species living in this habitat are potentially affected by liquid and gaseous discharges it was necessary to carry out an assessment for both discharges. The marine environment is also within the Hinkley Point local compartment. The terrestrial element of Habitat 3 is represented by an area of land close to the coast. It was assumed that bats and badgers would also be present at this location, and therefore the assessment included all ERICA default organisms together with bats and badgers. This habitat was selected, as Bridgwater Bay National Nature Reserve has been classified as a Ramsar site, a Special Area of Conservation, a Site of Specific Scientific Interest and a Special Protection Area so is of high importance to the Environment Agency and Natural England.

For the HPC discharge, the RQs and dose due to liquid releases to the marine environment to marine organisms were determined for each of the default ERICA organisms based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 1.28 10^{-4} for mammals and reptiles. The associated dose to these organisms is 1.28 10^{-3} µGy h^{-1}.

For the HPC discharge, the RQs for gaseous releases to the terrestrial environment on terrestrial organisms were determined for each of the default

ERICA organisms and the additional custom organisms, badger and bat based on a screening value of 10 µGy h^{-1} The maximum risk quotient was 2.46 10^{-5} for badgers. The associated dose rate to these organisms is calculated as 2.46 10^{-4} µGy h^{-1}.

Doses and RQs for discharges of noble gases from HPC were determined. Organisms from R&D128[27] were chosen for their similarity to organisms studied in ERICA. For Habitat 3, caterpillars receive the highest dose rate of 8.90 10^{-5} µGy h^{-1}.

Habitat 3 has some sites and habitats within it that have specific designated status and therefore are of high importance to stakeholders. However, all the estimated doses from the HPC discharges are below the most stringent assessment level (10 µGy h^{-1}) meaning that there would be no measurable effects on these organisms as a result of radioactivity present from radioactive discharges from HPC.

Habitat 4: Freshwater

The freshwater habitat is contained within Habitat 1 and is a small pond located near to the southern boundary of the Hinkley Point Nature Trail. It is a Nature Reserve and a designated County Wildlife Site. The pond has no river or stream input or outputs so is a stationary body of water. The freshwater organisms identified in the Hinkley Point area are assumed to reside in or visit this area and therefore to be potentially exposed to radionuclides in the runoff from the watershed area of the pond. The surveys showed that the majority of the ERICA default organisms were present in this Habitat but again, for completeness, all of the ERICA default organisms were included and modelled, regardless of whether they had been identified or not. The SRS 19 (IAEA, 2001)[83] approach for modelling discharges into the environment was used to calculate freshwater and pond sediment concentrations within the ERICA model.

For HPC, the risk quotients for freshwater organisms were calculated for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 8.33 10^{-2} for insect larvae. The associated dose for these organisms is 8.33 10^{-1} µGy h^{-1}.

Organisms common to both Habitat 1 and Habitat 4 include amphibians, birds, gastropods and mammals. The dose received by these organisms due to the gaseous discharges from HPC via both the terrestrial and marine pathways from HPC are; 3.25 10^{-2} µGy h^{-1}, 2.66 10^{-2} µGy h^{-1}, 4.04 10^{-1} µGy h^{-1} and 3.78 10^{-2} µGy h^{-1} respectively. The doses do not include those from noble gases.

Habitat 4 is not an SSSI or otherwise designated site and all the estimated doses from the HPC discharges are below the most stringent assessment level (10 µGy h^{-1}).

Summary of impacts on non-human species due to HPC discharges

In all four of the representative habitats, the assessed doses due to discharges from HPC to non-human species included in ERICA and those specifically identified and modelled (bats and badgers) are below the ERICA default screening value of 10 µGy h^{-1}. This implies no measureable harm to any of these organisms as a result of radioactivity present from radioactive discharges from HPC at the values used in the assessment (Tables 12 and 13 and Section 3.4.2.1).

A separate ERICA assessment for Habitat 1 was carried out and showed that doses and risk quotients due to discharges from the Interim Storage Facility for Spent Fuel are three orders of magnitude lower than those due to discharges from the two HPC reactors.

5.2.4 Assessment of Radiological Impact of Transport of Radioactive Materials to and from Hinkley Point C

The HPC EPRs will require regular shipments of solid radioactive materials as part of normal operation and non-destructive testing (NDT sources) during construction. These shipments will include the delivery of new fuel and the removal of low level waste (LLW). With respect to spent fuel, the EPR allows for long-term on-site management, pending a final management policy for spent fuel in the UK. Significant ILW transport is unlikely to be required until decommissioning.

This section presents the results of an assessment of the radiological consequences of the transport of radioactive materials to and from the HPC site under normal conditions of transport. Assessment of the radiological impact of the transport of radioactive materials to and from the HPC site has therefore considered the transport of the following radioactive materials:

- Radiography sources (used for non-destructive radiography testing of pipe work etc, i.e. NDT sources);
- New fuel;
- Low level radioactive waste (LLW) that includes mainly operational waste such as used personal protection equipment and filters; and
- Spent fuel[m].

A substantial amount of radiography can be expected to take place on site but the number of transports to and from the site of such sources will be limited as a

[m] Although on-site storage of spent fuel is the default position for the EPR, to cover the possible need for spent fuel transport (the most active materials arising on site) an assessment of doses from this from the HPC site has been included in the current assessment.

source store would be expected to be provided on-site. It is assumed that the radiography source is Ir-192 (in common use for radiography) and that the source will be replaced after about 3 to 5 months. It is assumed that there would be 10 radiography teams on-site during construction, requiring 40 new radiography source transports to the site per year. Such sources, when in their transport package, are likely to have a Transport Index (TI) of 0.2, i.e. a dose rate of 2 $\mu Sv\ h^{-1}$ at 1 m[65].

For the purpose of this part of the assessment, it has been assumed that the two UK EPR reactors will work on an 18 month refuelling cycle. The largest shipment of new fuel will occur prior to first start up of each reactor. The UK EPR core contains 241 fuel assemblies. Therefore the first loading of each reactor will require the shipment of approximately 250 fuel assemblies. Information from NRPB-W66 (Watson, 2005)[84] suggests that PWR new fuel casks have a typical TI of 0.4 per package. Assuming each shipment consists of 1 fuel cask holding 2 fuel assemblies with a TI of 0.4, there would be a total of 125 shipments of new fuel. A TI of 0.4 equates to a dose rate at 1 metre from the vehicle of 4 $\mu Sv\ h^{-1}$.

The PCER Sub-Chapter 6.3, (EDF, 2008)[50] details the outputs for the operating installation. There are a total of 650 LLW packages that need to be transported off-site per year for conditioning and disposal. It is assumed that the drummed wastes can be transported in seven full height ISO freight containers. It is likely that the 1 m^3 metallic boxes would be transported individually to the recipient. This combination would result in a total of 19 LLW movements per year. This information is summarised in Appendix G together with typical dose rates for these consignments as given in NRPB-W66[84].

Typical spent fuel transport practices for existing UK reactors are one to two fuel flasks per week[84]. As UK stations tend to be dual reactor stations, the same number of movements can be assumed for HPC. Therefore, it has been assumed that (should spent fuel be transported off-site) each EPR reactor would give rise to one flask of fuel per week, and that flasks from both reactors would be transported from the rail head by rail together in a single consignment.

5.2.4.1 Occupancy of Sites Past which Transport from Hinkley Point C Occurs

It is assumed that there is a single route from Hinkley Point to Bridgwater, with the supposition that a Cannington bypass is not constructed. In the absence of the Cannington bypass, the route would need to pass through Cannington (a small village with a population of approximately 2,500) and would involve a stop at a junction close to a large college and a bus stop. Dose assessments for road transport considered vehicles stopping at this junction for periods of up to 1 minute per conveyance. This is the time period assumed in NRPB-W66[84]. However, similar exposure scenarios could also occur on alternative routes. For this reason, separate assessments are made for dwellings elsewhere, one at a railhead where flasks are handled and one on a generic road route. The details of the scenarios below, including the types and forms of radioactive material, are summarised in Appendix G, Tables G3.

Bus stop exposure scenario

It is conservatively assumed that a member of the public could be waiting for a bus for 10 minutes at the same time every morning of the working week at the bus stop near the junction in Cannington and is assumed to be present for ¼ of the transports involving the sources used for NDT radiography over a period of one year at an exposure time of 1 minute per transport.

This same member of the public may also stand at a bus stop as a shipment of new fuel is transported past, on its way to the HPC site. However, it is considered unrealistic for this individual to be exposed to more than one new fuel transport per day. As it is predicted that 125 fresh fuel shipments will be required for first loading of the reactor, this is likely to occur over several days (it has been assumed to take a week). The fraction of a working day that the individual is present at the bus stop is 10 minutes every 8 hours (0.021/day). With 125 deliveries, this corresponds to the individual being present for 2.6 transports of new fuel. It is conservatively assumed that a member of the public could be exposed to up to 5 new fuel transports, consisting of one per day over 5 working days.

The member of the public could reasonably conservatively be at the bus stop for a quarter of the assumed 19 movements of LLW from the site to an off-site LLW facility, that is about 5 LLW transports per year.

With respect to an assumed two spent fuel transports per week from the HPC site, it is unlikely both these would pass the individual at the bus stop in a 10 minute timeframe; therefore it will be assumed that this member of the public is present for 1/4 of movements from a single EPR site, thus resulting in exposure to 13 transports of spent fuel from the HPC per year.

Education establishment exposure scenario

As the nearest building to the Cannington junction is an education establishment at a distance of 15 metres from the road, occupancy times would be limited to around 5 hours per day during term time, here assumed to be 40 weeks. It is therefore reasonable to assume that the same person is in the building and therefore potentially exposed to all radioactive material transports occurring for 40 weeks of the year. Therefore, this member of the public in the college building will be exposed to 125 new fuel shipments, 80 spent fuel movements, the shipment of 31 NDT radiography sources and 15 LLW shipments. It has been conservatively assumed that all new fuel shipments occur during term time, resulting in exposure to persons in the college building. No account has been taken of shielding that would be provided by the college building.

Dwelling scenarios (local railhead and generic UK road scenario)

The nearest railhead to the HPC site is at Bridgwater. Assessment of doses received whilst transferring flasks of spent fuel from lorry to rail wagon at the railhead will be calculated assuming that there is one loaded flask transport per reactor per week – i.e. it has been assumed that two flasks will be transferred at the rail head per week. A flask may be parked at the railhead for a few hours awaiting transfer to the wagon, or awaiting a second flask on the train. The whole process of loading a train with flasks would take up to four hours. The nearest dwelling where occupants are exposed to this activity is approximately 20 m from a loaded rail wagon or lorry.

The generic UK scenario for radioactive transport is appropriate for any road route taken by a conveyance on any part of a journey and not specific to Cannington or Bridgwater. It is conservatively assumed that the member of the public remains in a house on this route, at a distance of 5 m from the road at all times. However, it is unlikely that all material types are transported past this same house with this same person at 5 m from the road at all times. Therefore, this occupant of the house is taken to be exposed only to transports of one particular material type, either NDT radiography sources or new fuel or LLW or spent fuel, but not combinations of these.

5.2.4.2 Results of the Radiological Assessment for the Transport of Radioactive Materials to and from Hinkley Point C and Assessment against Dose Criteria

Details of the results, with a breakdown of the prospective doses for each type of transport past the bus stop, college, railhead and house on a generic UK road route are given in Appendix Table G4 and are discussed below.

The highest total annual dose is estimated to be received by a member of the public living adjacent to the Bridgwater railhead and exposed to spent fuel flasks being taken from HPC. It is predicted that should this scenario occur, doses in the region of 2.0 µSv y^{-1} could be received.

Should they be exposed to all four material transport scenarios (NDT sources, spent fuel, new fuel, LLW) a member of the public standing at a bus stop at the junction in Cannington could receive a dose of up to 1.8 µSv y^{-1} whilst the total dose to an occupier in the college in Cannington, close to the junction where transport of these four types of materials might need to stop is estimated as 0.07 µSv y^{-1}.

Members of the public living in a house close to a generic UK road transport route have been conservatively estimated to receive doses of up to 1.67 µSv y^{-1} from transports of new fuel to HPC (but less from transports of other materials).

Doses due to transport of spent fuel only range from 0.01 µSv y^{-1} (for an occupier in the college in Cannington) to 2.0 µSv y^{-1} (for the habitation near the Bridgewater railhead). The latter is generally comparable with the maximum individual dose due to the movement of nuclear fuel flasks of 6 µSv y^{-1} reported in NRPB-W66[84]. The NRPB assessment was carried out for a member of the public living 20 m away from a rail head, a scenario that makes it likely that it was the Bridgwater railhead that was considered (most other railheads are in more isolated areas or on the sites themselves).

The results of the transport assessment for HPC are summarised in the Table 22 below.

Table 22: Prospective public doses due to radioactive transports to and from HPC

Scenario	Dose due to transport $\mu Sv\ y^{-1}$	Dose without spent fuel transport $\mu Sv\ y^{-1}$
Habitation near Bridgwater railhead	2.00	zero
Habitation on generic UK road route close to road. Assumes only one type of transport passes.	1.67 (assumes worst case of new fuel transport only)	1.67 (assumes worst case of new fuel transport only)
Bus stop in Cannington	1.8	1.4
College in Cannington	0.07	0.06

The prospective doses for the exposure scenarios considered, including transport of spent fuel from HPC, therefore range from 0.07 $\mu Sv\ y^{-1}$ (for the occupier in the college) to 2.00 $\mu Sv\ y^{-1}$ (for the habitation at the railhead). Current assumptions are that EDF will store spent fuel on the HPC site in an Interim Spent Fuel store. Therefore, the prospective doses due to transport of materials to and from HPC would be reduced to within the range of 0.06 $\mu Sv\ y^{-1}$ (due to transport of NDT sources plus new fuel and LLW past the college) to 1.67 $\mu Sv\ y^{-1}$ (due to transport of new fuel past the house close to a road elsewhere). The dose at the habitation close to the Bridgwater railhead would fall to zero.

The transport scenarios considered here are conservative and actual realised doses are likely to be up to an order of magnitude lower than those estimated, especially for the house dweller scenarios.

These prospective dose values are significantly below the dose limit for members of the public in the Ionising Radiations Regulations 1999[16] of 1,000 $\mu Sv\ y^{-1}$ due to man-made sources, which is applicable to transport operations (Section 3.4.1.1).

6.0 MITIGATION OF IMPACTS

6.1 Construction Phase Impact Mitigation (radiological impacts on the public)

Investigations of the potential radiological contamination of soils on the HPC construction area are complete. In summary, no soil samples (including those from within previously disturbed ground) were found to be "radioactive" as defined by the relevant legislation[18,19,79] nor, in the majority of cases, in excess of normal background levels found in soils in the UK. Soils in the construction area site would therefore not be subject to regulatory controls for radioactive substance regulation.

Surface and groundwater samples contain K-40, a naturally occurring radionuclide. Low levels of tritium occur in groundwater in some areas of the construction footprint but below drinking water standards[(k).]

In view of these findings, a formalised public dose assessment due to HPC construction work has not been carried out. However, fugitive emissions of soil or water or the off-site transport or disposal of surplus soil, would be not expected to give rise to radiological impacts any more significant than those from any other form of large-scale construction project in the Hinkley Point area. From the standpoint of radiological impacts on the public from construction, no further mitigation measures over and above those required in any standard large-scale construction project (such as dust control, wheel washes, correct routing and management of waste water etc.) would be required.

6.2 Operational Phase Impact Mitigation

6.2.1 Mitigation of Discharges

It has been shown that prospective doses to all age groups in the Critical Group ('Farming Family with marine and gaseous exposure' and including the infants who receive the highest prospective dose) from HPC discharges plus direct radiation are below the new source constraint of 300 µSv $y^{-1.}$ They are also the HPA-RPD recommendation of 150 µSv y^{-1} (established in Section 3.4.1.1). All members of the candidate critical groups ('Farming Family with marine and gaseous exposure' and 'Fishing Family with marine and gaseous exposure') would therefore be afforded the same level of protection.

The prospective doses due to the HPC discharges at the activity values used in the assessment (Tables 12 and 13, plus direct radiation from the waste stores in Section 5.2.2.5) are also below 10 µSv y^{-1}, the level at which the UK Government in its statutory guidance to the Environment Agency has stated that the Agency should not seek further progressive reductions in discharge limits that are in place (and presumably those that are being applied for) provided that the holder of the authorisation applies, and continues to apply, Best Available Techniques (BAT; Section 2.3.2).

Extensive demonstration of the use of best practical techniques (BAT) for mitigation of radioactive discharges has already been achieved for the EPR but remains an ongoing consideration throughout the rest of the design, operating (and eventually, decommissioning) phases[23,24]. Demonstration of BAT is a pre-requisite to demonstrating that doses due to discharges are ALARA[42]. The following sections provide a summary of the methods used to mitigate C-14 and tritium discharges for the EPR, as they have been developed to date.

6.2.2 C-14 Discharge Mitigation

C-14 discharges from a PWR occur in liquids and gases in a number of forms, including carbon dioxide and methane. In the EPR, C-14 is minimised at source by measures aimed at increasing the efficiency of nuclear fuel which reduces its production per unit of energy produced. C-14 is also produced from nitrogen dissolved in the coolant, itself derived from nitrogen cover gas used in certain plant systems. In the EPR, this nitrogen has replaced more usual use of hydrogen which, however, may present an explosion hazard. Out-gassing from liquids means the majority of C-14 is discharged to the environment in gaseous form, with only a relatively small proportion being discharged in liquid discharges or solid wastes. C-14 discharged in gaseous form has a lower radiological impact, per unit discharged, than discharged in liquid form.

The C-14 cannot be recovered and converted to solid form from the gaseous or liquid waste streams by conventional methods of filtration, evaporation. Uptake of C-14 occurs on ion exchange resins but systems are not optimised for the removal of this particular isotope in this way. C-14 has a half-life of 5,730 years, so hold-up and decay is not a feasible abatement method. No practicable abatement techniques for the removal of C-14 from liquid and gaseous discharges have been identified, other than the removal of C-14 from liquid discharges which occurs as a result of primary coolant treatment processes which are aimed at removal of other species for operational and nuclear safety purposes. The proposed operation of the EPR is consistent with international best practice for PWRs with respect to the management of effluents containing C-14 (IAEA, 2004)[85].

6.2.3 H-3 Discharge Mitigation

Tritium makes up the bulk of the total radioactivity discharged in liquids and about 10% of that discharged in gases from HPC (Tables 14 and 15) but makes only a small contribution to the doses due to discharges from HPC (see Table 18). In liquid discharges from the EPR, the majority of the tritium is present as tritiated water liquid and in gases as tritiated water vapour. Most tritium present as tritium gas in the gaseous treatment systems is partitioned into the aqueous phase using a specific ‘catalytic recombiner’.

In the EPR, tritium is minimised at source by a number of measures. These include high integrity of fuel cladding, optimisation of coolant pH, combined with the use of burnable poisons in some fuel rods and reducing the use of secondary neutron sources[86]. The majority of tritium is discharged into the environment in liquid discharges. H-3 has a low radiological impact, and discharge in liquid form has lower radiological impact per unit discharged than discharge in gaseous form.

Tritium cannot be recovered and contained from these waste streams by conventional methods of filtration, evaporation or ion exchange. The tritium has a half-life of 12.3 years so abatement by hold-up and decay is not possible, especially given the volumes of liquid and gas that need to be managed. No practicable abatement techniques for the removal of tritium from liquid and gaseous discharges have been identified. The proposed operation of the EPR is consistent with international best practice for PWRs with respect to the management of effluents containing tritium[85].

6.2.4 Discharge Mitigation for Iodine Isotopes

Section 5.2.2.4 (Table 16) has shown that a small proportion of prospective doses is due to liquid and gaseous discharges of iodine isotopes. Isotopes of iodine are primarily contained within the fuel by the Zircaloy fuel cladding but any small defects in this allow small amounts of iodine isotopes to transfer to the reactor coolant. Stringent manufacturing standards for the fuel and control of primary circuit chemistry ensure that such leaks are minimised at source. Once in the liquid coolant, iodine nuclides will be subject to abatement on filters and demineralisers in the liquid effluent treatment systems. The French OPEX on the liquid discharges of iodines (PCER)[24] indicate that the use of demineralisers is a proven and effective abatement technique. Iodine nuclides passing into the gas phase are removed in charcoal absorbers in various gaseous radioactive treatment systems, including those serving building areas and those treating off-gas from primary coolant (charcoal absorbers are designed specifically to remove iodine and used in all nuclear power plant designs).

6.3 Mitigation of Direct Radiation

The current proposed location for the Interim Storage Facility for Spent Fuel and for the ILW store is on the edge of the site, close to the site boundary. These buildings would be designed to ensure that areas in the immediate vicinity would remain unclassified under the IRRs, that is with a dose rate below 1,000 µSv y^{-1}. Based on this bounding assumption of dose on the outside of these waste stores due to the materials stored or handled inside, the prospective dose to a member of the public walking past the stores daily over a year is 1.5 µSv y^{-1}. However, taking account of the fall off in dose at the extremities of the daily walk, the dose would fall below this value (Section 5.2.2.5). Furthermore, the estimated dose is based on a conservative source term (1,000 µSv y^{-1} at the walls of the store, the maximum that would be permissible in any such design). The actual shielding of the store would probably reduce dose rates outside to below this and thus also reduce the dose to any members of the public outside the site boundary and walking past the stores to below those calculated in Section 5.2.2.5.

6.4 Mitigation for Transport

Prospective doses to members of the public from the transport of radioactive materials to and from the proposed HPC site are dominated by the transport of spent fuel – based on the assumption that the spent fuel would be transported off-site and stored in an off-site facility. Whilst this predicted annual dose is relatively low, up to 2 µSv y^{-1}, and well below the public dose limit, doses from this scenario can be eliminated by retaining an on-site Interim Storage Facility (ISF) for the spent fuel, as is currently assumed (Section 5.2.4).

7.0 CUMULATIVE AND ADDITIVE IMPACTS

7.1 Assessment of Cumulative Radiological Impact on Humans

The methodology used to determine the radiological impact resulting from discharges from HPA and HPB is that described in Sections 3 and 5. The discharges from HPA and HPB used for these assessments are presented in the Table 23 and Table 24 (those for HPA taking account of its current decommissioning phase). These are based on discharges at the current authorised limits (rather than actual discharges) and will therefore yield conservative dose values for radiological impacts from these two sites. In addition, the cumulative impacts estimated in the current section assume that the discharges from these two sites continue for the next 60[n] years, that is, in parallel with those from the planned HPC EPR reactors. This leads to some uncertainties, and probably conservatism, in the final cumulative doses estimated (and Total dose for the site) since Hinkley Point B will have ceased operation at power and will have entered a decommissioning phase well within the operational lifetime of HPC. Furthermore, Hinkley Point A will be even further advanced in its current decommissioning programme.

Table 23: Annual gaseous discharge limits HPA and HPB

Radionuclide	Annual gaseous discharge limits (GBq y^{-1})	
	HPA	HPB[o]
H-3[k]	1,500	12,000
C-14	600	3,700
Ar-41	-	100,000
I-131	-	1.5
Co-60	-	0.1
S-35	-	350
beta[p]	0.15	1

Table 24: Annual liquid discharge limits HPA and HPB

Radionuclide	Annual liquid discharge limits (GBq y^{-1})	
	HPA	HPB
H-3[q]	1,800	650,000
Co-60	-	10
Cs-137	1,000	100
S-35	-	2,000
Other radionuclides[r]	700	80

[n] Individual dose assessments are calculated following 50 years of continuous discharges. Build-up assessments are calculated following 60 years of continuous discharges.
[o] Hinkley Point B has an on-site incinerator used to burn oils. In the assessment, discharges from this are not considered as they are minor compared with reactor operation. Moreover the limits for reactor discharges are used for the assessment, although they have never been near those authorised.
[p] Assumed to be Co-60 for HPA and HPB discharges
[q] 0.025% of H-3 assumed to be discharged as Organically Bound Tritium (OBT).
[r] Assumed to be Cs-134 for HPA and HPB

7.1.1 Cumulative Impact on the Candidate Critical Groups from HPA and HPB plus HPC

The doses to the two candidate critical groups of the farming and fishing families, assumed to reside at the same locality and where maximum exposure to airborne and deposited activity from HPC gaseous discharges occurs, but due specifically to discharges from HPA (Table 23) and HPB (Table 24) have been estimated. The methodology was the same as that used to estimate doses to these two candidate critical groups due to discharges from HPC.

In order to model discharges of Organically Bound Tritium (OBT) from Hinkley Point B, a separate radionuclide was created in PC CREAM, with the physical attributes (half-life and emissions) of tritium but with marine concentration factors as for C-14. Note that OBT is not expected to appear in discharges from PWRs.

7.1.1.1 Cumulative Effects for the 'Farming Family with marine and gaseous exposure'

The doses to the 'Farming Family with marine and gaseous exposure' considered in the current assessments (Section 3.4.1.2) due to liquid and gaseous discharges from HPA (and assuming CEFAS[53] consumption rates) were calculated as 0.6, 0.5 and 0.6 µSv y^{-1} for adults, children and infants, respectively. For this same family exposed to liquid and gaseous discharges from HPB (and again assuming CEFAS[53] consumption rates) the doses were calculated as 3.5, 4.4 and 12 µSv y^{-1} for adults, children and infants, respectively.

With those due to liquid and gaseous discharges from HPC (Section 5.2.2.2) the cumulative Hinkley Point Site doses to the 'Farming Family with marine and gaseous exposure' are given in Table 25. These cumulative prospective doses conservatively assume the HPA and HBP reactor sites discharge at the authorised limits and HPC discharges at values in Tables 12 and 13, all simultaneously.

Table 25: Cumulative prospective doses to the 'Farming Family with marine and gaseous exposure' exposed to liquid and gaseous discharges from Hinkley Points A, B and C

Age group	Predicted cumulative dose µSv y^{-1}
Adult	6.8
Child	7.3
Infant	17.2

A breakdown of how these cumulative doses are built up from those due to the discharges from HPC, HPA and HPB is shown in Figure 7. Overall, infant members of this group receive the greatest dose and this is dominated by exposures through terrestrial pathways (99% of the cumulative prospective dose). C-14 and S-35 dominate the cumulative doses to all age groups and make up 40% and 53% respectively of the cumulative dose to the infant, mainly through the consumption of milk and milk products. Figure 7 shows the dose from S-35 is due solely to discharges of this isotope from the gas cooled reactor HPB, with a small amount from HPA. The small dose contribution from the marine discharges due to the consumption of marine foods is dominated by C-14 and OBT, making-up, respectively, 50% and 32% of the dose via this route.

7.1.1.2 Cumulative Effects for the 'Fishing Family with marine and gaseous exposure'

The doses to the 'Fishing Family with marine and gaseous exposure' considered in the current assessment (Section 3.4.1.2) due to liquid and marine discharges from HPA (and assuming CEFAS[53] consumption rates) were calculated as 1.2, 0.4 and 0.5 µSv y^{-1} for adults, children and infants respectively. For this same family exposed to liquid and gaseous discharges from HPB (and again assuming CEFAS[53] consumption rates) the doses were calculated as 3.7, 3.8 and 9.4 µSv y^{-1} for adults, children and infants, respectively.

With those due to liquid and gaseous discharges from HPC (Section 5.2.2.3) the cumulative Hinkley Point Site doses to the 'Fishing Family with marine and gaseous exposure' are given in Table 26 below. These cumulative prospective doses conservatively assume the HPA and HBP reactor sites discharge at the authorised limits and HPC discharges at the activity values in Tables 12 and 13, all simultaneously.

Table 26: Cumulative prospective dose to the 'Fishing Family with marine and gaseous exposure' exposed to liquid and gaseous discharges from Hinkley Points A, B and C

Age group	Predicted cumulative dose µSv y^{-1}
Adult	7.8
Child	6.5
Infant	13.2

A breakdown of how these cumulative doses are built up from those due to the discharges from HPC, HPA and then from HPB is shown in Figure 8. Overall, the infant members of the 'Fishing Family with marine and gaseous exposure' receive the greatest dose from all sources. Although this is classed as a fishing family, the dose to all age groups is dominated by contributions from the terrestrial pathways which, in the case of the infant make up 98% of the cumulative dose received. C-14 and S-35 again dominate these cumulative doses to all age groups and make up 41% and 55% respectively of that to the infant age group. This is mainly through the consumption of milk and milk products.

7.1.1.3 Critical Group for Hinkley Point Site and Assessment of Prospective Doses against the Site Dose Constraint

The site dose constraint of 500 µSv y^{-1} for the maximum dose to people that may result from discharges from a site applies to the cumulative dose from the discharges (direct radiation is not included) from all sources at a single location.

A summary of the prospective doses to members of the two candidate critical groups due to Hinkley Point Site discharges is shown in Table 27 below:

Table 27: Summary of prospective doses to candidate critical groups due to Hinkley Point Site discharges

Age group	'Farming Family with marine and gaseous exposures'	'Fishing Family with marine and gaseous exposures'
Adult	6.8 $\mu Sv\ y^{-1}$	7.8 $\mu Sv\ y^{-1}$
Child	7.3 $\mu Sv\ y^{-1}$	6.5 $\mu Sv\ y^{-1}$
Infant	17.2 $\mu Sv\ y^{-1}$	13.2 $\mu Sv\ y^{-1}$

Table 27 shows that the highest prospective doses due to Hinkley Point Site are 17.2 $\mu Sv\ y^{-1}$ to the infant and 7.3 $\mu Sv\ y^{-1}$ to the child in the 'Farming Family with marine and gaseous exposures'. The dose to the adult in the 'Fishing Family with marine and gaseous exposure' is marginally higher than that to the adult in the farming family. However, taking account of the differences in doses, the assessment shows that the '**Farming Family with marine and gaseous exposures'** is the **Critical Group** due to Hinkley Point Site discharges.

The prospective doses to this Critical Group are well below the site constraint of 500 $\mu Sv\ y^{-1}$. Doses to all other members of the candidate critical groups ('Farming Family with marine and gaseous exposure' and 'Fishing Family with marine and gaseous exposure') would therefore also be well below this site constraint.

Figures 7 and 8 show that the cumulative prospective doses to both candidate critical groups are dominated by contributions from S-35 and from C-14. S-35 makes up the bulk of the dose to the infant, whilst C-14 dominates that to the child and adult. All of the dose due to the S-35 is from the HPB reactor site. Cumulative doses from C14 are due mainly to the EPR; data in Section 6.2.2 show that methods to mitigate the discharges of this from the EPR are consistent with best international practice and subject to on-going assessments to ensure compliance with the requirements of BAT.

Figures 7 and 8 show that the other main contributors to the cumulative prospective doses are tritium, iodine and fission products. The bulk of the dose from the tritium and iodine to age members in both candidate critical groups is due to the discharges from the HPC, whilst that from the fission products is due mainly to the HPA and HPB reactor sites. These results are expected on the basis of the overall design and operation of the HPC and HPB reactors and the decommissioning operations at HPA.

Figure 9 shows a breakdown of the prospective cumulative doses due to liquid and gaseous discharges from HPA, HPB and HPC to each of the age groups in the **Critical Group** of the '**Farming Family with marine and gaseous exposure**' (as a percentage of the cumulative dose for each age group). A generally similar breakdown applies to the three age groups in the 'Fishing Family with marine and gaseous exposure'. Thus, discharges from HPA account for between about 3% to 15% of the cumulative prospective dose to all three age groups, those from HPB account for between about 47 and 70% and those from HPC account for between about 26 and 40% of the cumulative prospective dose. Overall, the largest proportion of the prospective cumulative dose to all members of both candidate critical groups is due to liquid and gaseous discharges from the current operational HPB AGR. Once this enters its decommissioning phase in about 2016 the cumulative Hinkley Point site doses will decrease and, realistically, only those due to the operational HPC EPRs would need be considered.

7.1.2 Total Dose to an Individual on the Hinkley Point Site

Total dose takes into account historical and future Hinkley Point site discharges, and future direct radiation from other facilities on the Hinkley Point Site in addition to the future discharges from HPC and the on-site impacts of discharges from elsewhere. This grand total represents the ‘Total Dose’ to an individual on the Hinkley Point Site, which can be compared with the public dose limit.

Retrospective critical group doses as a result of discharges from the existing Hinkley Point Site are assessed annually in the RIFE reports. These were presented in Table 4 for the years 2001 to 2007. The highest retrospective dose in recent years was 40 µSv to consumers of seafood. Besides that due to discharges from HPA and HPB, this dose includes contributions from other establishments that discharge into the Bristol Channel. In particular these are from the GE Healthcare Cardiff site, which produces H-3 and C-14 for medical research, and also historical contributions from Berkeley, Oldbury, Sellafield and Chernobyl. Direct radiation dose from the existing HPA and B stations was measured to be 4 µSv y^{-1} in 2007 as reported in RIFE-13[55]. This value is appropriate to use as the future direct radiation dose for the Hinkley Point Site as it was determined that the direct radiation dose at the closest dwelling to HPB would be 0.14 nSv, and as HPA and B are decommissioned, direct radiation doses from these facilities should reduce.

Summing the retrospective critical group dose from all the above sources with the direct radiation dose and the future exposures critical group dose (from 50 years of combined discharges from the Hinkley Point Site viz the maximum cumulative dose of 17.2 µSv y^{-1} in Table 27) results in the Total Dose for an individual on site of 61 µSv, equivalent to 6.1% of the public dose limit.

7.1.3 Cumulative Collective Dose

All of the collective doses discussed below are expressed as per year of discharge and truncated at 500 years.

The collective doses calculated to the UK, European and World populations from HPA gaseous and liquid discharges are presented in Table 28.

Table 28: Collective doses to the UK, European and World populations from HPA discharges

HPA discharges	Collective Population		
Collective dose (Man Sv)	UK	Europe	World
Gaseous discharges	0.155	1.32	10.6
Liquid discharges	0.0039	0.022	0.022
Total Collective dose due to HPA discharges	0.159	1.34	10.6

Collective doses calculated to the UK, Europe and World populations of from HPB gaseous and liquid discharges are presented in Table 29.

Table 29: Collective doses to the UK, European and World populations from HPB discharges

HPB discharges	Collective Population		
Collective dose (Man Sv)	UK	Europe	World
Gaseous discharges	1.4	9.2	65.1
Liquid discharges	0.00065	0.0046	0.031
Total Collective dose due to HPB discharges	1.4	9.2	65.1

With those due to HPC (Section 5.2.2.7) the collective doses to the UK, European and World populations due to gaseous discharges to the atmosphere from the Hinkley Point Site were calculated to be 1.9, 13.5 and 100.3 Man Sv, respectively. With those due to HPC, the collective doses to the UK, European and World populations due to liquid discharges from the Hinkley Point Site were calculated to be 0.025, 0.23 and 2.2 Man Sv, respectively. The final results for the cumulative collective dose assessment for the Hinkley Point site and the calculated total *per caput* doses are presented in Table 30.

Table 30: Collective doses to the UK, European and World populations from Hinkley Point Site discharges

HP Site	Collective Population		
Collective dose (Man Sv)	UK	Europe	World
Gaseous discharges	1.9	13.5	100.3
Liquid discharges	0.025	0.23	2.2
Total Collective dose due to Hinkley Point Site marine and gaseous discharges	1.9	13.7	102.5
Average per caput dose (nSv)	UK	Europe	World
Gaseous discharges	34.5	19.3	10.0
Liquid discharges	0.45	0.33	0.22
Total *per caput* dose due to Hinkley Point Site marine and gaseous discharges	34.5	19.6	10.3

The collective dose to the UK population (truncated at 500 years) in Table 30 of 1.9 Man Sv per year of discharge from Hinkley Point site is similar to a guideline of about 1 Man Sv per year of discharge that the IAEA considers sufficiently low to allow a source or practice to be exempted from regulatory control (Section 3.4.1.1).

The *per caput* doses from all Hinkley Point Site discharges (per year of discharge and truncated at 500 years) have been calculated to be 34.5, 19.6 and 10.3 nSv y^{-1} discharge for populations of the UK, Europe and the World respectively. Those to the World population are therefore in the range of a ‘few nSv’ that, in the EA interim guidance document on assessment of prospective public doses, are stated should be ignored in the decision making process, as the associated risks are miniscule with the contribution to total doses to individuals being insignificant. Those to the UK and European populations are above this ‘few nSv’ range but still well below those of a ‘few µSv’ that can be considered as ‘trivial’ and well below those in the higher end of the µSv range that the EA state might require some additional consideration (Section 3.4.1.1).

The collective dose due discharges from the Hinkley Point Site are all dominated by the C-14 present in gaseous discharges, which accounts for between 75% and practically 100% of the cumulative collective doses for all of the populations considered. However, these are all much lower than that from naturally occurring C-14 to the UK population alone (about 480 man Sv y^{-1}; European Commission)[48]. Similarly, the *per caput* doses from these gaseous discharges (of up to 34.5 nSv y^{-1}) are all much smaller than that due to naturally occurring C-14 to the UK population of the order of 8.8 µSv y^{-1}[(48)].

C-14 contributes to the bulk of the dose due to the Hinkley Point Site liquid discharges as well, although there is no data on natural sources and doses against which to compare this.

A breakdown of the collective doses for the UK, European and World populations due to liquid and gaseous discharges from HPA, HPB and HPC is shown in Figure 10. This shows that HPA contributes to between about 8% (for the UK) and 10% (for the World) of the cumulative collective dose, whilst HPB contributes to between 64 and 71% and HPC contributes to between 20 and 26%. Thus, the majority of the cumulative Hinkley Point Site collective dose to the UK, European or World populations is due to the liquid and gaseous discharges from the currently operating HPB reactor. Like those to the candidate critical groups (Section 7.1.1.3) cumulative doses from the Hinkley Point site will therefore be expected to decrease when this reactor ceases operation in 2016 and, like HPA, enters a decommissioning phase.

7.1.4 Build-Up due to Cumulative Hinkley Point Site Discharges

Table 31 (over/) presents the results for the soil concentration at the area off-site with the highest concentration at year 60 due to all Hinkley Point Site gaseous discharges to the atmosphere.

The results for the activity concentration in the seawater and seabed sediment off the coast of Hinkley Point at year 60 from all Hinkley Point Site marine discharges are presented in Table 32 (over/).

Table 31: Soil concentration at the area off site with the highest concentration at year 60 from all Hinkley Point gaseous discharges to the atmosphere

Nuclide	Air Concentration Bq m^{-3}	Soil Concentration Bq kg^{-1}
H-3	$6.1\ 10^{-01}$	-*
C-14	$1.63\ 10^{-01}$	-*
S-35	$6.5\ 10^{-03}$	$2.0\ 10^{-01}$
Ar-41	$1.9\ 10^{-00}$	-*
Co-58	$3.6\ 10^{-06}$	$8.8\ 10^{-05}$
Co-60	$2.7\ 10^{-05}$	$1.5\ 10^{-02}$
Kr-85	$3.7\ 10^{-01}$	-*
I-131	$4.8\ 10^{-05}$	$1.1\ 10^{-03}$
I-133	$2.6\ 10^{-05}$	$6.3\ 10^{-05}$
Xe-131m	$8.0\ 10^{-03}$	-*
Xe-133	$1.7\ 10^{+00}$	-*
Xe-135	$5.3\ 10^{-01}$	-*
Cs-134	$3.3\ 10^{-06}$	$7.6\ 10^{-04}$
Cs-137	$3.0\ 10^{-06}$	$5.9\ 10^{-03}$

* Soil concentrations not calculated for noble gases H-3 or C-14.

Table 32 Activity concentration in the seawater and seabed sediment off the coast of Hinkley Point at year 60 from all Hinkley Point Site marine discharges

Nuclide	Activity concentrations (Bq l^{-1}) in unfiltered seawater	Activity concentrations (Bq kg^{-1}) in sediment
H-3	$8.38\ 10^{+00}$	$5.69\ 10^{+00}$
C-14	$2.00\ 10^{-03}$	$1.19\ 10^{-01}$
Mn-54	$5.34\ 10^{-06}$	$4.03\ 10^{-05}$
Ni-63	$2.01\ 10^{-05}$	$3.60\ 10^{-03}$
Cr-51	$8.28\ 10^{-07}$	$5.28\ 10^{-07}$
Co-60	$1.65\ 10^{-04}$	$6.83\ 10^{-03}$
Co-58	$3.56\ 10^{-05}$	$6.20\ 10^{-05}$
Ag-110m	$1.12\ 10^{-05}$	$1.17\ 10^{-05}$
Sb-124	$8.21\ 10^{-06}$	$2.10\ 10^{-06}$
Sb-125	$1.68\ 10^{-05}$	$6.60\ 10^{-05}$
Te-125m*	$1.05\ 10^{-06}$	$6.55\ 10^{-05}$
Te-123m	$4.81\ 10^{-06}$	$2.44\ 10^{-06}$
Te-123 *	$2.16\ 10^{-20}$	$5.86\ 10^{-18}$
Cs-134	$8.00\ 10^{-03}$	$5.39\ 10^{-02}$
Cs-137	$1.15\ 10^{-02}$	$5.75\ 10^{-01}$
I-131	$3.89\ 10^{-07}$	$4.46\ 10^{-09}$
S-35	$1.78\ 10^{-02}$	$4.82\ 10^{-03}$

* indicates a daughter product

The prospective dose to a future construction worker off-site as a consequence of the build-up of nuclides as a result of emissions from HPA, HPB and HPC has been calculated to be $1.8\ 10^{-2}$ µSv y^{-1}. Approximately 100% of this dose is due to external exposure from the ground. The nuclide that contributes the most to external exposure is Co-60, which accounts for 89% of external dose.

The annual exposure due to the future use of the marine environment resulting from the cumulative discharges from HPA ,HPB and HPC is likely to be associated with commercial fishing and leisure activities. Therefore, the dose to members of the public from future use of the sea has been assessed as the Fishing Family group and therefore taking account of the total marine dose only.

The individual total marine doses due to build-up to the 'Fishing Family with marine and gaseous exposure' from HPA were calculated as 0.97, 0.16 and 0.039 $\mu Sv\ y^{-1}$ for adults, children and infants respectively.

The individual total marine doses due to build-up to the 'Fishing Family with marine and gaseous exposure' from HPB were calculated as 0.78, 0.21 and 0.082 $\mu Sv\ y^{-1}$ for adults, children and infants respectively.

Taking into account marine dose from build-up due to HPC discharges (Section 5.2.2.9) the prospective dose due to build-up to the 'Fishing Family with marine and gaseous exposure' from all marine discharges from the Hinkley Point Site was therefore calculated to be 2.8, 0.67 and 0.24 $\mu Sv\ y^{-1}$ for adults, children and infants respectively. This assumes CEFAS[53] ingestion rates.

These cumulative prospective doses due to build-up from the Hinkley Point Site are well below the annual public dose limit of 1,000 $\mu Sv\ y^{-1}$ or the typical average exposure to an individual from all sources of 2,700 $\mu Sv\ y^{-1}$.

7.2 Assessment of Cumulative Radiological Impact on Non-Human Species

7.2.1 HPA, HPB and Cumulative Hinkley Point Site Impact for Habitat 1

The surveys showed that the majority of the ERICA default organisms were present in all four Habitats but (as for the HPC assessment) for completeness, all of the ERICA default organisms were included and modelled, regardless of whether they had been identified or not.

7.2.1.1 HPA

For HPA, the risk quotients for gaseous releases to the terrestrial environment on terrestrial organisms were determined for each of the default ERICA[28] organisms and the additional custom organisms, badger and bat, based on a screening value of 10 $\mu Gy\ h^{-1}$. The maximum RQ was 5.24 10^{-5} for badgers. The associated dose for these organisms is 5.24 10^{-4} $\mu Gy\ h^{-1}$.

7.2.1.2 HPB

For HPB, the risk quotients for gaseous releases to the terrestrial environment on terrestrial organisms were determined for each of the default ERICA organisms and the additional custom organisms, badger and bat, based on a screening value of 10 $\mu Gy\ h^{-1}$. The maximum RQ was 3.37 10^{-4} for badgers. The associated dose for these organisms is 3.37 10^{-3} $\mu Gy\ h^{-1}$.

Doses and RQs for discharges of noble gases from HPB were also calculated. Organisms from R&D128[27] were chosen for their similarity to organisms studied in ERICA. For Habitat 1, caterpillars receive the highest dose rate of 1.2 10^{-3} µGy h^{-1}.

7.2.1.3 Habitat 1 Cumulative from Hinkley Point Site

For the cumulative Hinkley Point Site, the risk quotients for gaseous releases to the terrestrial environment on terrestrial organisms were determined for each of the default ERICA organisms and the additional custom organisms, badger and bat, based on a screening value of 10 µGy h^{-1}. The maximum RQ was 8.06 10^{-4} for badgers. The associated dose for these organisms is 8.06 10^{-3} µGy h^{-1}.

Doses and RQs for discharges of noble gases from cumulative discharges were also calculated. Organisms from R&D128[27] were chosen for their similarity to organisms studied in ERICA. For Habitat 1, caterpillars receive the highest cumulative dose rate of 2.70 10^{-3} µGy h^{-1}.

7.2.2 HPA, HPB and Cumulative Hinkley Point Site Impact for Habitat 2

7.2.2.1 HPA

For HPA, the risk quotients for liquid releases to the marine environment on marine organisms were determined for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 3.46 10^{-4} for reptiles. The associated dose for these organisms is 3.46 10^{-3} µGy h^{-1}.

7.2.2.2 HPB

For HPB, the risk quotients for liquid releases to the marine environment on marine organisms were determined for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum RQ was 4.70 10^{-5} for reptiles. The associated dose for these organisms is 4.70 10^{-4} µGy h^{-1}.

7.2.2.3 Habitat 2 Cumulative from Hinkley Point Site

For the cumulative Hinkley Point Site, the risk quotients for liquid releases to the marine environment were determined for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum RQ was 5.20 10^{-4} for reptiles. The associated cumulative dose rate to these organisms is 5.20 10^{-3} µGy h^{-1}.

7.2.3 HPA, HPB and Cumulative Hinkley Point Site Impact for Habitat 3

7.2.3.1 HPA

For HPA, the RQs for gaseous releases to the terrestrial environment on terrestrial organisms were determined for each of the default ERICA organisms and the additional custom organisms, badger and bat, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 1.53 10^{-5} µGy h^{-1} for badgers. The associated dose for these organisms is 1.53 10^{-4} µGy h^{-1}. RQs and doses for marine organisms have been presented in Section 7.2.2.1.

7.2.3.2 HPB

For HPB, the RQs for gaseous releases to the terrestrial environment on terrestrial organisms were determined for each of the default ERICA organisms and the additional custom organisms, badgers and bat, based on a screening value of 10 µGy h^{-1}. The maximum RQ was 1.22 10^{-4} for badgers. The associated dose for these organisms is 1.22 10^{-3} µGy h^{-1}. RQs and doses for marine organisms are presented in Section 7.2.2.2.

Doses and RQs for discharges of noble gases from cumulative discharges were also calculated. Organisms from R&D128[27] were chosen for their similarity to organisms studied in ERICA. For Habitat 3, Caterpillars receive the highest dose rate of 4.3 10^{-4} µGy h^{-1}.

7.2.3.3 Habitat 3 Cumulative from Hinkley Point Site

For the cumulative Hinkley Point Site, the risk quotients for atmospheric releases to the terrestrial environment on terrestrial organisms were determined for each of the default ERICA organisms based on a screening value of 10 µGy h^{-1} with the additional custom organisms, badger and bat. The maximum risk quotient was 1.62 10^{-4} for badgers. The associated dose for these organisms is 1.62 10^{-3} µGy h^{-1}. RQs and doses for marine organisms are presented in Section 7.2.2.3.

Doses and RQs for discharges of noble gases from the Hinkley Point Site were determined. Organisms from R&D128[27] were chosen for their similarity to organisms studied in ERICA. For Habitat 3, Caterpillars receive the highest cumulative dose rate of 5.16 10^{-4} µGy h^{-1}.

7.2.4 HPA, HPB and Cumulative Hinkley Point Site Impact for Habitat 4

7.2.4.1 HPA

For HPA, the RQs for freshwater organisms were calculated for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 3.02 10^{-2} for insect larvae. The associated dose rate to these organisms is 3.02 10^{-1} µGy h^{-1}.

Organisms common to both Habitat 1 and Habitat 4 include amphibians, birds, gastropods and mammals. The dose rates from terrestrial and freshwater exposures due to gaseous discharges to these organisms are 2.37 10^{-3} µGy h^{-1}, 2.56 10^{-3} µGy h^{-1}, 1.52 10^{-1} µGy h^{-1} and 2.64 10^{-3} µGy h^{-1} respectively.

7.2.4.2 HPB

For HPB, the risk quotients for freshwater organisms were determined for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 1.84 10^{-1} for insect larvae. The associated dose rate to these organisms is 1.84 µGy h^{-1}.

Organisms common to both Habitat 1 and Habitat 4 include amphibians, birds, gastropods and mammals. The dose rates from terrestrial and freshwater exposures due to gaseous discharges to these organisms are 1.99 10^{-2} µGy h^{-1}, 2.11 10^{-2} µGy h^{-1}, 9.28 10^{-1} µGy h^{-1} and 2.16 10^{-2} µGy h^{-1} respectively. The doses do not include those from noble gases.

7.2.4.3 Habitat 4 Cumulative

For HP Site, the RQs for freshwater organisms were determined for each of the default ERICA organisms, based on a screening value of 10 µGy h^{-1}. The maximum risk quotient was 2.97 10^{-1} for insect larvae. The associated dose for these organisms is 2.97 µGy h^{-1}.

Organisms common to both Habitat 1 and Habitat 4 include amphibians, birds, gastropods and mammals. The summated dose from terrestrial and freshwater exposures due to gaseous discharges is 5.48 10^{-2} µGy h^{-1}, 5.03 10^{-2} µGy h^{-1}, 1.48 µGy h^{-1} and 6.22 10^{-2} µGy h^{-1} respectively. These doses do not include the dose from noble gases.

7.3 Overall Discussion of Cumulative Impacts for Hinkley Point Site

The highest prospective doses from all Hinkley Point Site discharges (assuming HPA and HPB continue to discharge at the current authorised rates and HPC discharges at the activity values in Tables 12 and 13) were estimated as 17.2 µSv y^{-1} to the infant and 7.3 µSv y^{-1} to the child in the 'Farming Family with marine and gaseous exposure'. Within the two critical groups, there is a marginally higher dose to the adult in the 'Fishing family with marine and gaseous exposures' but taking account of the differences in dose for each age group, the '**Farming Family with marine and gaseous exposures'** is considered as the **Critical Group** due to Hinkley Point Site discharges.

The prospective doses to this Critical Group are well below the site constraint of 500 µSv y^{-1}. Doses to all other members of the candidate critical groups ('Farming Family with marine and gaseous exposure' and 'Fishing Family with marine and gaseous exposure') would therefore also be similarly well below the site constraint.

The prospective doses to all members of the candidate critical groups from Hinkley Point Site discharges is less than 1% of the average dose to an individual in the UK population of 2,700 µSv y^{-1} from all sources of radioactivity and are also smaller than the man-made average contribution to this background of 410 µSv y^{-1}. The highest prospective dose of 17.2 µSv y^{-1} (to the infant in the 'Farming Family with marine and gaseous exposure') is comparable in magnitude to that received on a return flight from the UK to Europe (which is due to exposure to cosmic radiation). It is also comparable in magnitude to a chest x-ray which result in a dose of 20 µSv y^{-1}.

The *per caput* dose from all Hinkley Point Site discharges to the UK population was calculated to be 34.5 nSv y^{-1}. This can be compared to the average *per caput* dose to the UK population from all sectors of industry of 900 nSv y^{-1} [(65)]. It is marginally above the value of 'a few nSv' considered in relevant guidance (Environment Agency[42]) to be 'miniscule' but still well below those of a 'few µSv' that can be considered as 'trivial' and also well below those in the higher end of the µSv range that the guidance states might require some additional consideration.

Calculated doses to a future off-site construction worker or those using the marine environment (members in the Fishing Family) are well below the annual public dose limit of 1,000 µSv y^{-1} or the typical average exposure to an individual from all sources of 2,700 µSv y^{-1} and also below local terrestrial background values.

The biota in the freshwater habitat most affected by discharges from the Hinkley Point Site cumulative discharges was assessed to be insect larvae in Habitat 4, which would receive a dose of 2.97 µGy h^{-1}. This is below the ERICA screening value of 10 µGy h^{-1} and also therefore below the EA biota dose guideline of 40 µGy h^{-1}.

The total electrical output of the two HPC UK EPRs will be 3,300 MWe whilst the current electrical output from the remaining operational AGR is 860 MWe. Overall, therefore, the radiological impacts (assuming maximum design or authorised discharges) on a pro-rata basis of 'impact versus electrical output' from the UK EPR are estimated to be significantly less than those from the current HPB AGR.

8.0 RESIDUAL IMPACTS

The EPR design, has been developed using operational feedback from the wide experience of EDF and AREVA NP. The EPR is designed to reduce the production of solid waste and liquid and gaseous radioactive discharges. Principle objectives of the EPR design include:

"*minimise personnel dose exposure and radioactive releases and waste during normal operation*"[86]

"*the concentration and containment of radioactive emissions is a central objective of BAT* (OECD)" [86]

"*the equipment has to be designed, operated and maintained so as to limit the emissions of effluents. These emissions are to be, as much as possible, collected at their source, monitored and, if necessary, treated in such a way that consequential discharges are kept as low as reasonably possible. In any event, discharge limits will be set on the basis of the use of the best available technologies at an economically acceptable cost, and taking account of specific environmental characteristics of the sit*e." [86]

These objectives will reduce, as far as possible, the doses to the public, site workers and the environment incurred by the nuclear activities "as low as reasonable achievable" (ALARA) in accordance with UK regulatory principles, intergovernmental organisations such as the OECD and IAEA and the overall principles of BAT (Best Available Techniques) described in Section 2.3.1.

The following overarching goals were included in the design optimisation for the EPR:

- Reduction and control of tritium liquid discharges;
- Reduction and control of C-14 liquid discharges;
- Reduction of discharges of other radionuclides;
- Maximum recycling of boron (used in the primary circuit coolant);
- Optimisation of the primary circuit water quality (that can affect discharges);
- Overall reduction of chemical discharges;
- Minimisation at source;
- Selection of materials for construction.

This Technical Note has outlined the radiological assessments that have been undertaken for the Environmental Impact Assessment associated with the construction and operation of the HPC Reactors. The receptor groups and details and the overall outcomes of the assessment for the planned development are summarised below:

The source constraint for the maximum dose to people that may result from discharges from a new single discharges of 300 µSv y^{-1} applies to the dose from proposed discharges and direct radiation. Moreover, the Health Protection Agency (HPA-RPD) specifically advises the UK Government to select a value for the constraint for members of the public for new nuclear power stations that is less than 150 µSv y^{-1}.

For the Critical Group for HPC ('Farming Family with marine and gaseous exposures') prospective doses assessed due to continuous routine discharges (at values in Tables 12 and 13) plus direct radiation to adults, children and infants are, respectively, 2.7, 2.5 and 4.5 µSv y^{-1}. The prospective doses to all age groups in this Critical Group are much lower than the source constraint of 300 µSv y^{-1} and also below the HPA-RPD recommendation of 150 µSv y^{-1}. Doses assessed for all members in the other candidate critical group ('Fishing Family with marine and gaseous exposures') are of a similar order to those to the Farming family and also, therefore, well below the source constraint (and the HPA-RPD recommendation).

The prospective doses estimated due to HPC gaseous and liquid discharges (and direct radiation) to all age groups in both of the candidate critical groups are less than 10 µSv y^{-1}. This is the level at which the UK Government in its statutory guidance to the Environment Agency has stated that the Agency should not seek further progressive reductions in discharge limits that are in place provided that the holder of the authorisation applies and continues to apply best available techniques (BAT). It may be assumed that this also applies to discharges used in a prospective dose assessment.

All of the prospective doses to any member of either candidate critical group are much lower than the average dose to the UK population of 2,700 µSv y^{-1} from all sources of radioactivity and also lower than the average due solely to man-made sources of 410 µSv y^{-1}, nearly all of which is due to exposures to medical procedures[65]. The highest assessed dose due to HPC discharges (4.5 µSv y^{-1} to an infant) is comparable in magnitude to that received on a return flight within the UK (about 6 µSv/flight and due to exposure to cosmic radiation) or that received during a single medical X-ray (about 5 µSv).

The *per caput* dose from an annual HPC liquid and gaseous discharge to the UK population (and truncated at 500 years) was calculated to be 6.9 nSv y^{-1}. This is much smaller than the average *per caput* dose to the UK population from industry as a whole (including the nuclear industry) of 900 nSv y^{-1}. This *per caput* dose, and those assessed for Europe and the World (4.6 and 2.79 nSv y^{-1}) are all within the 'few nSv' range that, in its guidance on assessment of public doses, the Environment Agency states should be ignored in the decision making process, as the associated risks will be miniscule and the total doses to individuals will be insignificant.

The collective dose due to discharges from HPC at the values in Tables 12 and 13 (Man Sv^{-1} of discharge truncated at 500 years) was assessed at between 0.4 (for the UK and 24.6 (for the World) Man Sv y^{-1} discharge. These are all very much less than that due to naturally occurring C-14 to the UK population alone (480 Man Sv y h^{-1}). Per caput doses are also all significantly less than that due to naturally occurring C-14 to the UK (8.55 µSv y^{-1}).

The prospective doses due to a short-term gaseous discharge from HPC are of the order of 0.23 to 0.45 µSv y^{-1} and therefore about an order of magnitude lower than those predicted for continuous routine discharges and also well below the source constraint of 300 µSv y^{-1} or the dose limit of 1,000 µSv y^{-1} (that are the appropriate criteria against which to assess doses due to short-term discharges). Short-term liquid discharges would not occur.

The highest annual dose to an individual due to transport of materials associated with HPC would be received by a member of the public living adjacent to the Bridgwater railhead and exposed to spent fuel flasks being transferred off-site. It is predicted that should this scenario occur, doses in the region of 2 µSv y^{-1} could be received. This is much lower than the dose limit for members of the public from the Ionising Radiations Regulations 1999[16] of 1,000 µSv y^{-1} which is applicable to transport operations. With the implementation of the proposed on-site Interim Storage Facility for Spent Fuel, the actual doses due to transport of radioactive materials will be expected to be smaller than those estimated.

The freshwater habitat presented the worst-case dose rates for non-human species due to HPC discharges. The species most affected was calculated to be insect larvae, which would experience a dose rate of 0.833 µGy h^{-1}. This is below the ERICA screening value of 10 µGy h^{-1} and also therefore below the EA biota dose guideline for non-human species of 40 µGy h^{-1}:

The assessments all show that, when judged against a range of stringent internationally agreed criteria on Radiological Protection of Human and Non-human species, the assessed impacts from the liquid and gaseous discharges from HPC and other impacts due to site operations (transport, waste storage) are all very small, without additional mitigation being required over and above that in the current design.

For the Critical Group (‘Fishing Family with marine and gaseous exposures’) prospective doses due to discharges from Hinkley Point Site discharges to adults, children and infants are, respectively, 6.8, 7.3 and 17.2 µSv y^{-1}. The doses to all age groups in this Critical Group are much lower than the site constraint of 500 µSv y^{-1}. Doses to all members in the other candidate critical group (‘Fishing Family with marine and gaseous exposures’) are of a similar order to those to the Farming family and also, therefore, well below the site constraint. Infants receive the greatest dose of the three age groups and this is dominated by S-35 due to gaseous discharges from Hinkley B. These cumulative impacts assume that discharges from HPA and HPB continue for the next 50 years in parallel with those from the planned HPC EPR reactors. This leads to some uncertainties and probably conservatism in the Hinkley Point Site doses assessed because by about 2016 HPB will have entered its decommissioning phase and HPA will be even further advanced in its current decommissioning programme.

9.0 UNCERTAINTIES

The Environment Agency guidance on the assessment of assessment of prospective public doses[42] states that some consideration should be given to uncertainties in the methods used and results obtained.

For the dose assessments for the candidate critical groups (Section 5.2.2) there are two main sources of uncertainty, those inherent in the PC CREAM 98 model software and those associated with the input parameters (habits for the candidate critical groups).

PC CREAM 98 software uses annual averages for parameters such as weather, water flow and food consumption rates. This is considered adequate when assessing the consequences of routine releases integrated over long periods of time. Some of the sub-routines in the model assess doses at year1, 5 or 50 and the 60 year assumed for the operational life of the EPRs is not available as an option. However, in its guidance (paragraph 67) the Environment Agency[42] suggests an accumulation time of 50 years is usually selected for new plants or plants where it may be difficult to specify a closure date (which may the case for any life extension).

For Hinkley Points A and B, the dose assessments are based on current authorised limits and it is unlikely that either station will discharge close to or at these for the period over which the HPC UK EPRs will operate. For all the reactors, there may be some fluctuations in discharges but ultimately it is expected to be a downward trend in the discharges from HPA and HPB over the lifetime of HPC. Therefore the assessment based on current authorised limits for HPA and HPB is considered to be conservative.

Finally, in its guidance, the Environment Agency suggests that more formal and detailed review of results, input parameters etc. is required only if mean assessed critical group doses exceed 20 µSv y^{-1}. Those estimated for HPC are of the order of 3 µSv y^{-1}, those from Hinkley point Site being of the order of 10 µSv y^{-1}, implying no more formal assessment of uncertainties is warranted.

The effects of varying numerous parameters in the short-term assessment is included in the appendices of NRPB-W54[57]. The uncertainties can include discharge patterns and time, weather patterns during the discharge and pathways. However, the source term considered for HPC short-term discharges of monthly discharges within a 24 hour period is conservative and using the parameters assumed, the assessed doses are all very small (mostly less than 10% of those due to continuous discharges). Again, these assessed doses (up to 0.45 µSv y^{-1}) are well below the 20 µSv y^{-1} guideline that the Environment Agency suggests should require a more detailed assessment of uncertainty.

With respect to the collective dose assessment, since PC CREAM 98 (used for the assessment) was developed, the population and boundaries of Europe have changed and there have been population changes in the UK and World as well.

However, the collective doses and in particular the per caput doses estimated, are very low and changes in collective dose parameters are not expected to significantly affect the results. Again, the assessed per caput doses (up to 34.5 nSv y^{-1} for the UK due to Hinkley Point Site discharges) are well below the 20 µSv y^{-1} guideline that the Environment Agency suggests should require a more detailed assessment of uncertainty.

Regarding the potential build-up assessment, the doses are assessed using the methodology described in NRPB-W36. The main sources of uncertainty are on the types of scenarios considered. However, for those that are (future off-site construction worker and Fishing family using the sea) the habit data and discharge values considered are all conservative. Again, the assessed doses (up to 2.8 µSv y^{-1} for the adult in the Fishing Family) are well below the 20 µSv y^{-1} guideline that the Environment Agency suggests should require a more detailed assessment of uncertainty.

GLOSSARY & LIST OF PREFIXES

An explanation of the specific radiological protection terminology referred to within this report is provided below.

Term	Explanation
ALARP	As low as is Reasonably Practicable. The ALARP (As Low As Reasonable Practicable) principle is unique to British law. It requires the employer to provide systems (engineered, management etc.) to reduce the radiation dose until or unless the cost of implementing those measures (in time, trouble or money) is considered to be grossly disproportionate to the risk averted. In practice this requires the employer to go beyond the requirements of the ALARA principle in reducing dose.
ALARA	As low as is Reasonably Achievable. As Low as Reasonably Achievable (social and economic factors being taken into account). This term was introduced by the ICRP and requires that all be reasonably done to lower radiation exposures below Dose Limits. It requires the employer to provide systems to reduce the radiation dose until or unless the cost of implementing those measures (in time, trouble or money) is considered to be greater than the risk averted.
BPEO	Best Practical Environmental Option. This was defined by the 12th Report of the Royal Commission on Environmental Pollution as " the outcome of a systematic and consultative decision making process that establishes, for a given set of objectives, the option (e.g. for radioactive waste management) that provides the most benefit or least damage to the environment as a whole at acceptable cost in the long term and short-term as well.
BPM	Best Practical Means. A term used by the Environment Agencies requiring operators to take all reasonably practical measures in the design and management of their facilities to minimise discharges and disposals of radioactive waste so as to achieve a high standard of environmental protection of the environment and the public.
BAT	Best Available Technique. The Environment Agency has defined BAT (for the purposes of radioactive waste management) as the means by which an operator optimises the operation of a waste management practice to keep exposures from the disposal of radioactive waste ALARA, economic and social factors being taken into consideration. In their latest guidance, the Agency considers BPM and BAT to be essentially synonymous and to achieve the same overall outcomes
Build-up of radionuclides	The accumulation of radionuclides in environmental media, e.g. longer lived radionuclides such as Cs137 may accumulate in the soil as a result of continuous discharges over a prolonged period of time
Bq	Becquerel is the standard SI Unit of radioactivity. One Bq is defined as the activity of a quantity of radioactive material in which one nucleus decays per second. The Bq unit is therefore equivalent to s^{-1}.
C-14	An isotope of naturally occurring carbon (C-12) that is formed in small quantities in the natural environment and also be certain processes in a nuclear reactor. Its chemical properties are identical to those of carbon itself.
Collective dose	The collective dose is the summated individual exposures to a population group from a specified source within a specified time period. The unit of

Term	Explanation
	collective dose is joule per kilogram and has the usual name of man Sievert (Man Sv).
Critical rates	Habits (intakes and occupancies) that members of the critical group undergo. For example consumption at 97.5th percentile of national habit data.
Critical group	A group of members of the public which is reasonably homogeneous with respect to its exposure for a given radiation source and given exposure pathway and is typical of individuals receiving the highest effective dose or equivalent dose (as applicable) by the given exposure pathway from the given source.
Direct radiation	Ionising radiation emitted directly by processes or operations on premises and not as a result of discharges of radioactive substances to the environment. Mostly consisting of gamma photons that are attenuated to varying degrees by distance or structures such as walls and other barriers.
Environment Agency of England and Wales	An Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs and an Assembly Sponsored Public Body responsible to the National Assembly for Wales. Its stated aims are to protect and improve the environment, and to promote sustainable development. It was directly responsible for granting authorisations for the discharge of radioactive waste from nuclear premises under the requirements of RSA 93 and will continue to be responsible for permits under the more recent Environmental Permitting regime. Separate bodies carry out a similar role in Scotland and Northern Ireland.
EPR	European Pressurised Water Reactor. The EPR design is derived from the latest generations of reactors built in France (N4 Reactors) and Germany (KONVOI Reactors) and combines the safety experience and knowledge acquired from operating reactors. The proposed safety options also benefit from the results of research and development, in particular in the area of severe accidents.
EPR 2010	The Environmental Permitting Regulations, brought into force in 2010.
Fission products	Radioactive materials formed in nuclear fuel as a result of fission in a nuclear reactor and the production of heat and useful energy.
GDA	Generic Design Assessment. In this process, companies submit information on their reactor designs to the UK's Nuclear Regulators, who assess this information before a full application is made to build a nuclear power station at a particular site. The process involves a rigorous and structured examination of detailed design information by the Regulators. At the end of their assessment (and at key stages during it), the Regulators will issue reports on their findings, confirming whether they judge a design to be satisfactory.
HLW High level radioactive waste	High level waste is highly radioactive liquid waste that is produced when spent nuclear fuel is reprocessed. It is self heating and requires cooling. Over 95% of the radioactive material arising from the nuclear power industry is high level, but it has a very small volume. At Sellafield (British Nuclear Fuels Limited, Cumbria), liquid high level waste is solidified into a glasslike form (borosilicate) which reduces its volume even more.
IAEA	The International Atomic Energy Agency is the world´s center of co-operation in the nuclear field. Set up as the world´s "Atoms for Peace" organization in 1957 within the United Nations. The Agency works with Member States and multiple partners worldwide to promote safe, secure

Term	Explanation
	and peaceful nuclear technologies.
ICRP	International Commission on Radiological Protection. An independent Registered Charity, established to advance for the public benefit the science of radiological protection, in particular by providing recommendations and guidance on all aspects of protection against ionising radiation.
ILW Low Level Radioactive Waste	Intermediate Level Waste. Contains activity above the maximum specified limits for Low Level Waste but unlike High Level Radioactive waste, is not heat-generating. Most intermediate level waste is sufficiently radioactive to require shielding during its handling and transportation. It is currently stored at nuclear sites.
LLW Low Level Radioactive Waste	Solid waste materials containing radioactivity above the current Exemption value of 4 Bq g^{-1} beta gamma activity and a maximum of 12,000 bq g^{-1} beta gamma activity or 4,000 Bq g^{-1} alpha activity. Low level waste mostly consists of lightly contaminated materials and is disposed of by burial at approved sites, in the UK, principally at the Low Level Waste Repository near the village of Drigg in Cumbria.
m Sv	Milli -Sievert, 1/1000 th of the standard dose unit of a Sievert.
Most exposed members of the public	Synonymous to critical group but may be related to individual members of the public or a single source/pathway of exposure.
Nuclear Site	A site licensed by the Nuclear Installations Inspectorate under the Nuclear Installations Act 1965 and Nuclear Installations Regulations 1971.
Per Caput Dose	Collective dose averaged over all the individuals in the population over which the collective dose was estimated.
PID	Process and Information Document. A document drawn up by the Environment Agency requesting interested parties of new nuclear power station designs to provide information on a range of issues relating specifically to areas regulated by the agency (notably radioactive waste and discharges under RSA 93). Responses allow the Environment Agency to state, in principle, if a design is acceptable in the UK context. A separate, but similar, process is used by the Nuclear safety Directorate of the HSE to address issues under their regulatory control (Site License Conditions). Satisfactory responses to the process are not binding on the Agency and a separate process will be required for obtaining an authorisation to discharge radioactive waste under RSA 93 from any specific future site.
PCER	Pre-construction Environmental Report. Report produced by EDF (or other prospective site operators or plant designers) to satisfy the requirements of the PID. Forms part of the GDA (Generic Design Assessment) submissions.
Radioactive waste	Legal definitions of radioactive material and radioactive wastes are contained in Sections 1 and 2 of the Radioactive Substances Act 1993; the effect of the definitions is that radioactive waste generally includes: a) scrap, surplus or spoilt radioactive material; and b) any other waste substance or article which has become radioactive or has acquired an increased concentration of radioactivity.
Ramsar	The Convention on Wetlands (Ramsar, Iran, 1971) - called the "Ramsar Convention" -- is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological

Term	Explanation
	character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. Unlike the other global environmental conventions, Ramsar is not affiliated with the United Nations system of Multilateral Environmental Agreements (MEA), but it works very closely with the other MEAs and is a full partner among the "biodiversity-related cluster" of treaties and agreements.
Short-term dose	Dose incurred due to short-term releases of a significant proportion of the 12-month discharge limit, can occur as a result of variations in site operations. For assessment purposes the duration of a release is typically assumed to be 30 minutes or 24 hours.
Spent fuel	Fuel that is removed from the reactor due to operational constraints such as having met its designed burn-up (energy production). It contains the majority of the radioactive materials formed in the reactor. After it is removed from the reactor it is stored underwater on-site to cool until a final off site route is decided on (notably reprocessing or direct disposal).
SSSI	Site of Special Scientific Interest is a conservation designation denoting a protected area in the United Kingdom.
Tritium	A radioactive isotope of hydrogen formed in a nuclear reactor via a range of processes. Most appears as tritiated water that has predominantly the same physical and chemical properties of water so behaves in the same way in the environment.
Gray (Gy)	The Gray is a unit used to measure a quantity called absorbed dose. This relates to the amount of energy actually absorbed in some material, and is used for any type of radiation and any material. One Gray is equal to one joule of energy deposited in one kg of a material. The unit Gray can be used for any type of radiation, but it does not describe the biological effects of the different radiations. As there are no dose coefficients for non human species due to a lack of biological data, doses are expressed in Gray.
Sievert (Sv)	The Sievert is a unit used to derive equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. To determine equivalent dose (Sv), you multiply absorbed dose (Gy) by a quality factor (Q) that is unique to the type of incident radiation. Doses to humans are expressed in Sieverts as biological data is readily available for humans.

FIGURES

Figure 1 Location map of the site

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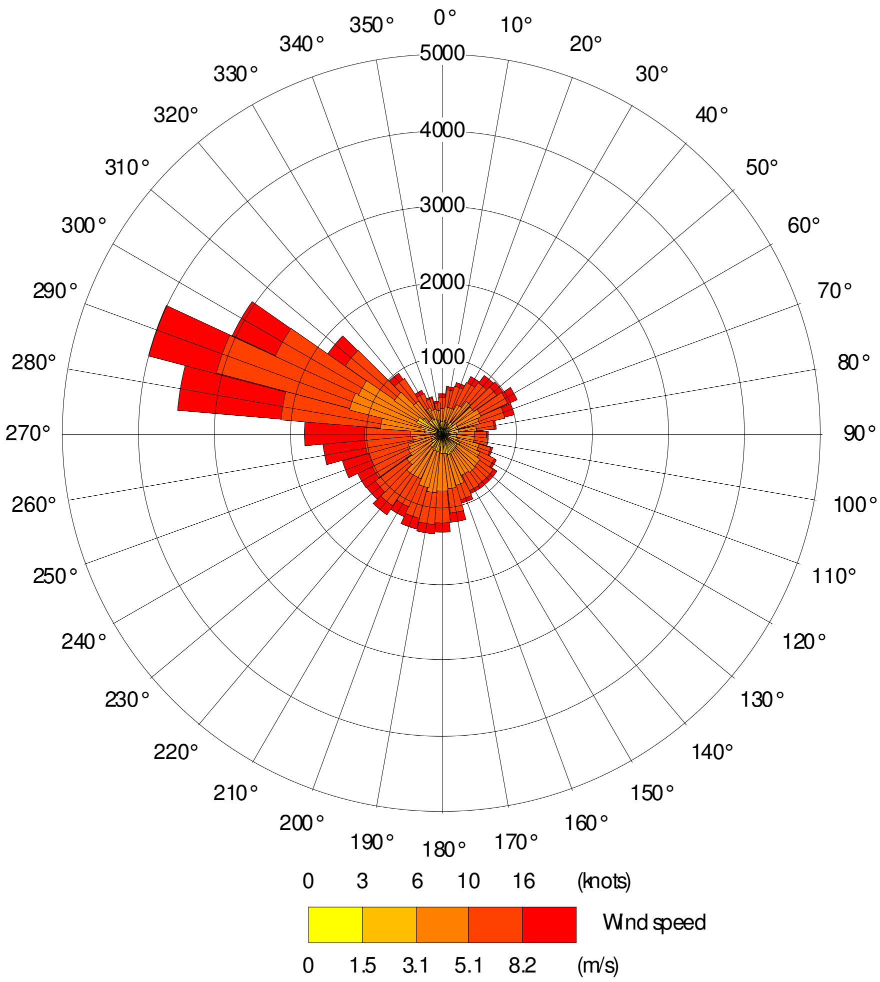
Figure 2 Wind rose for Hinkley Point for 2004-2008



Wind rose pattern used for the ADMS modelling of dispersion from the HPC gaseous discharge stacks, See section 3.

Wind is blowing from the 290 degree quadrant and thus from the north-west towards the southeast.

Figure 3: 5 year average Total Integrated Activity Concentration (Bq m^{-3}) for a release of all radionuclides at the discharge limits from UK EPR West and from UK EPR East for a stack height of 70m

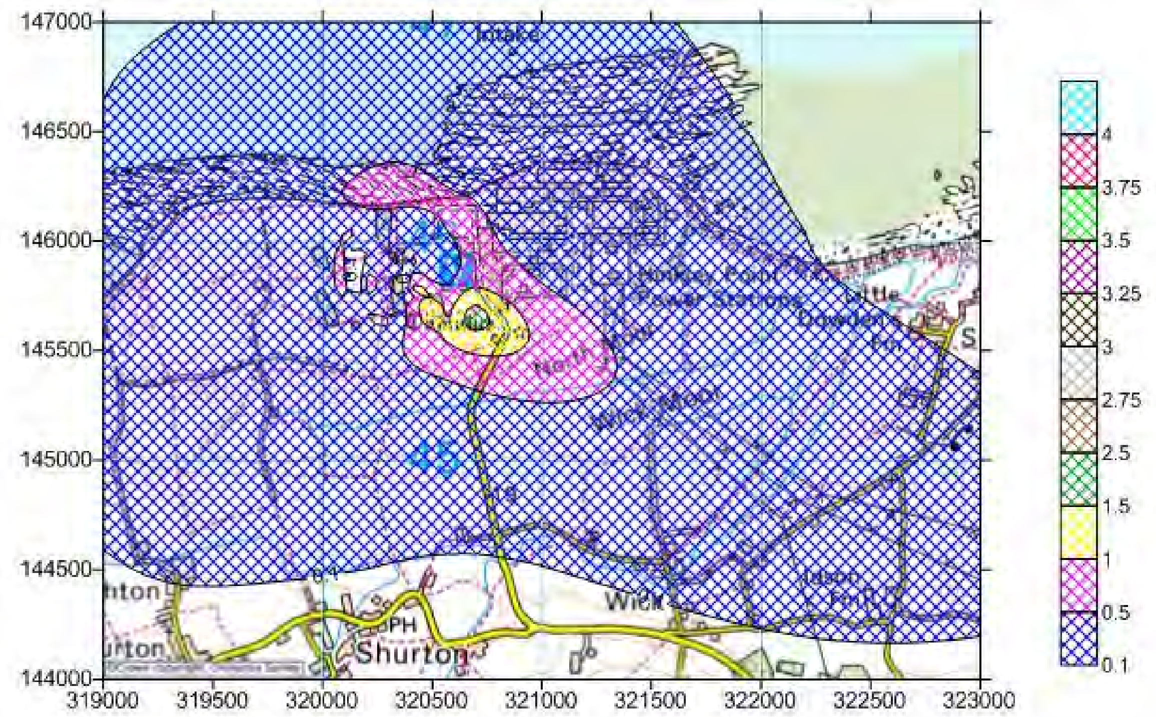
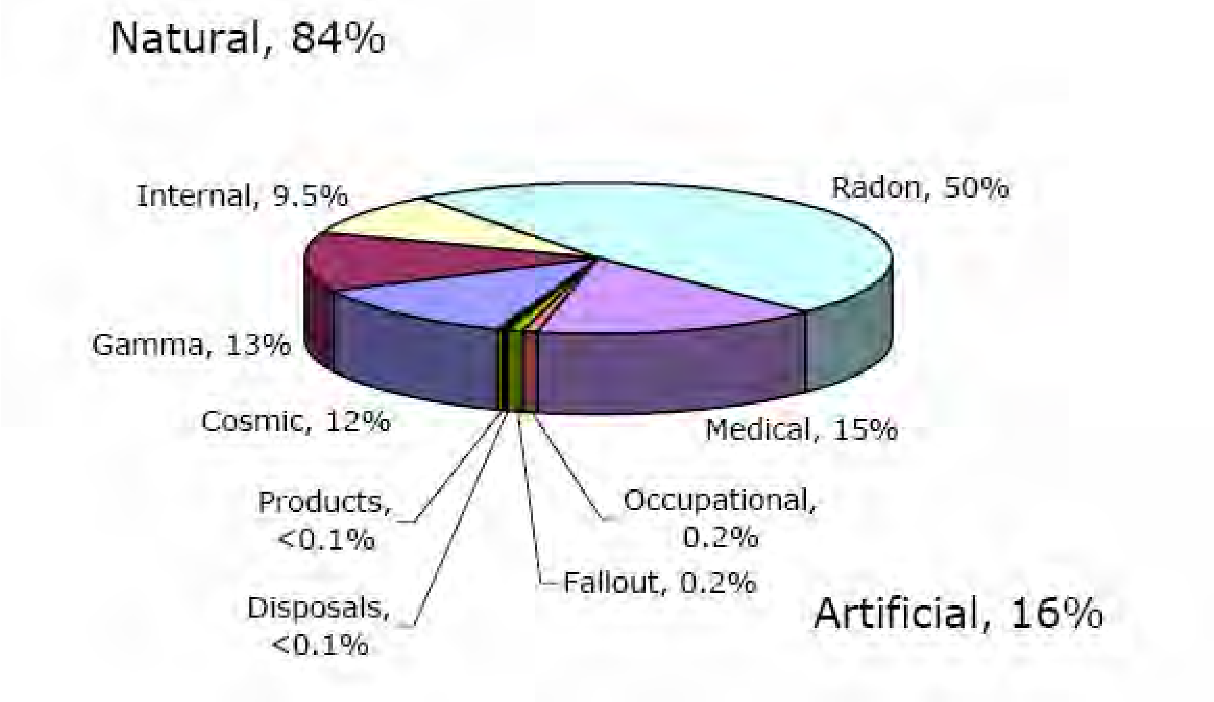


Figure 4: Map showing the habitats around HPC.

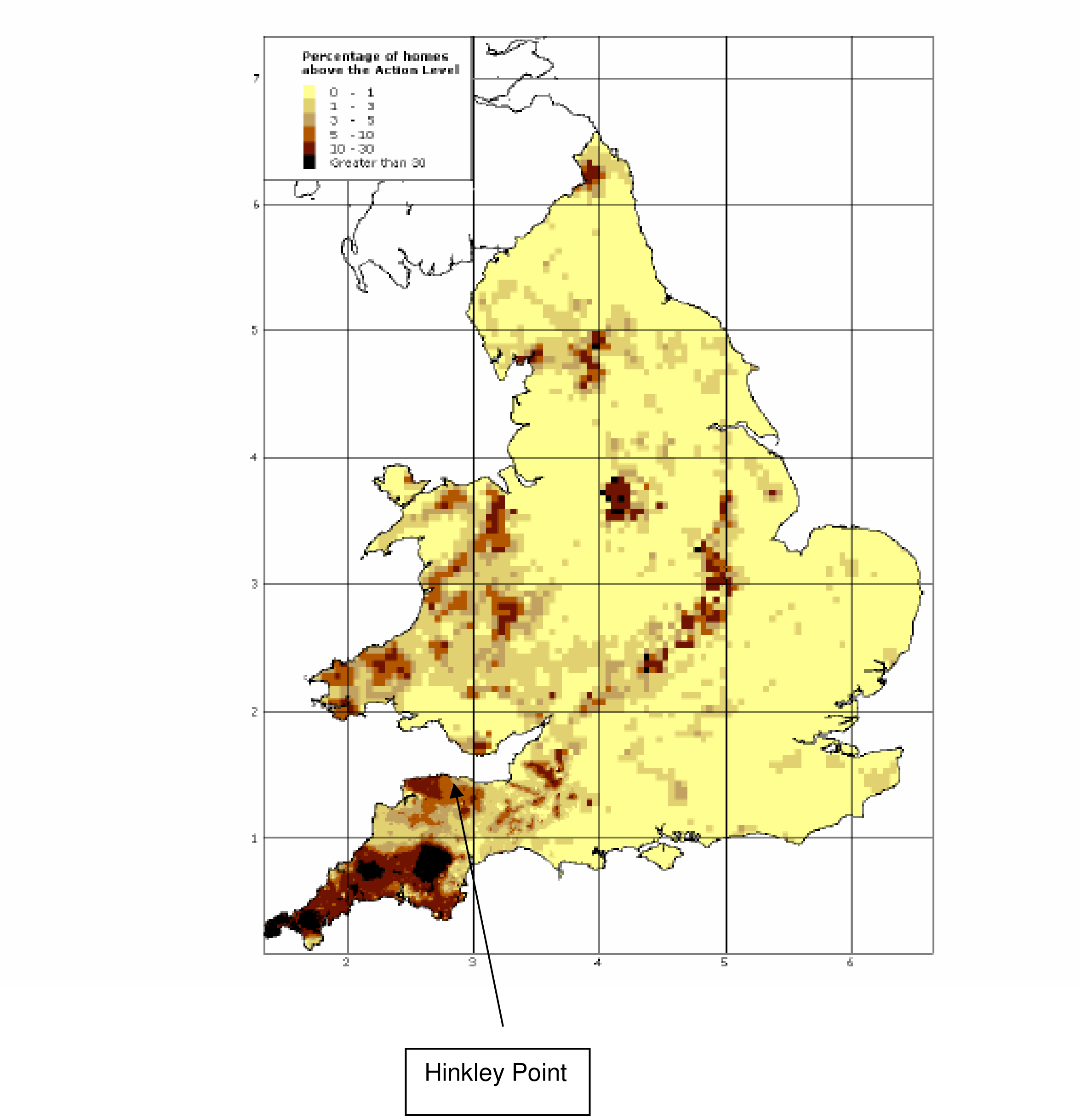
Habitat 1
Habitat 2
Habitat 3
Habitat 4

Figure 5: Annual average dose to the UK population from all sources: 2,700 uSv y^{-1}.



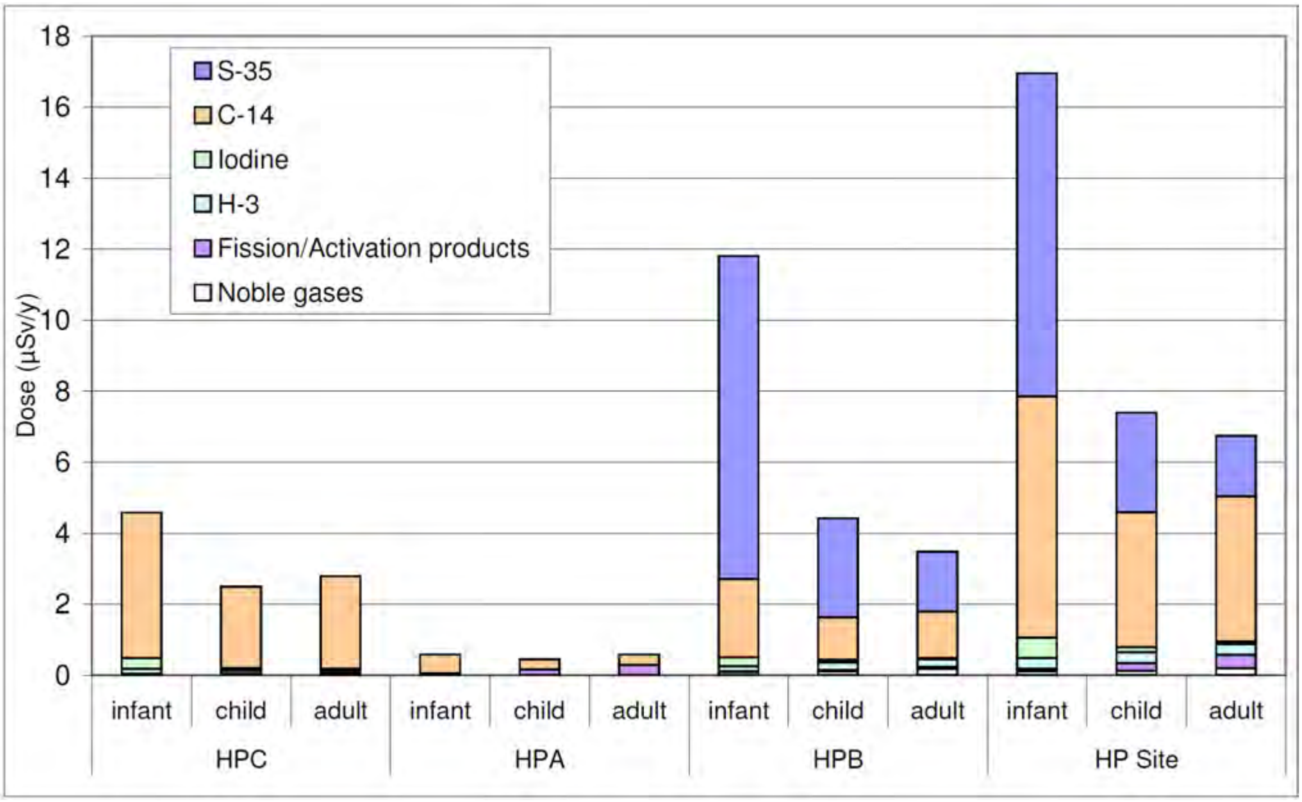
Source: HPA-RPD-001 - Ionising Radiation Exposure of the UK Population: 2005 Review [65]

Figure 6: Overall map of radon affected areas in England and Wales.



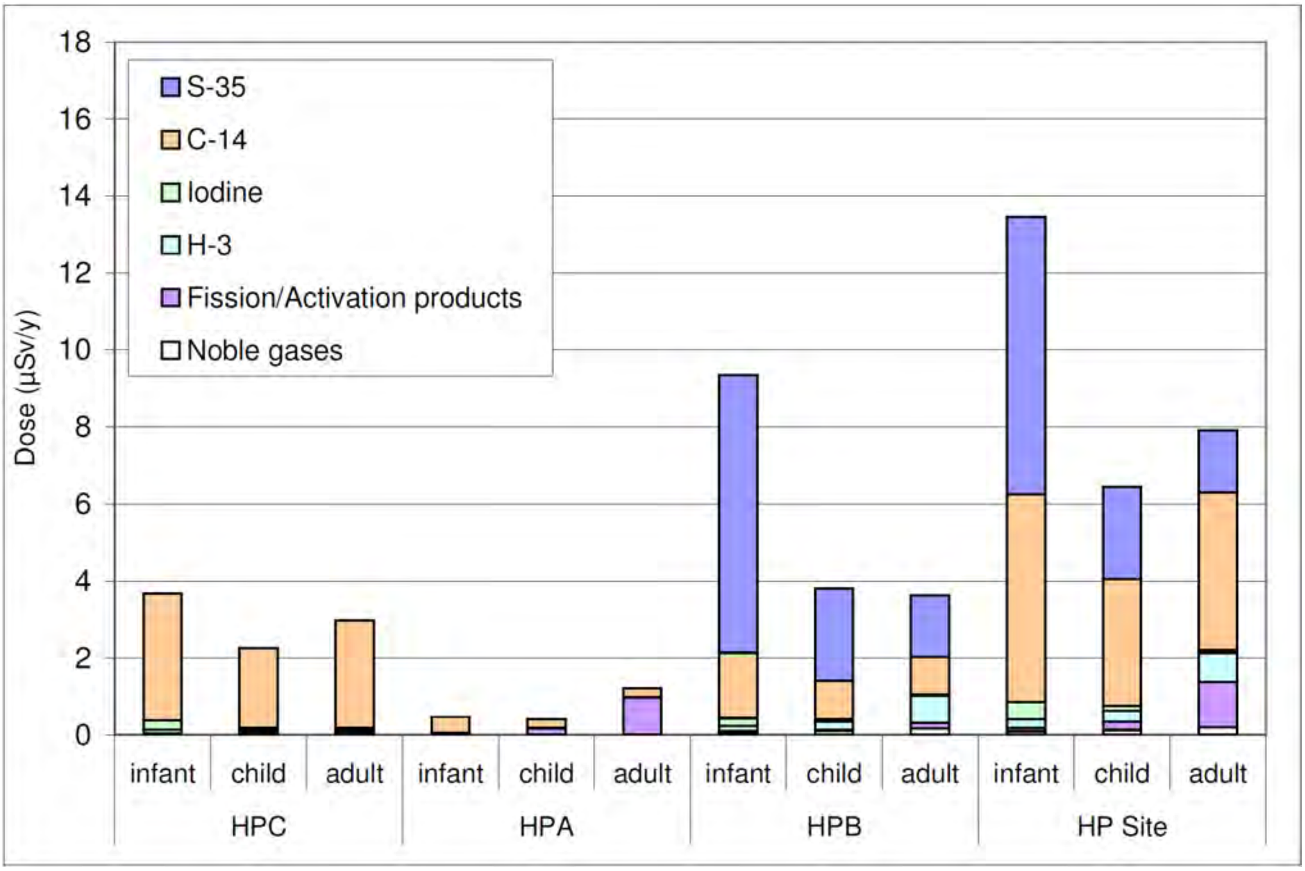
Source: HPA-RPD-001 - Ionising Radiation Exposure of the UK Population: 2005 Review[65]

Figure 7: Predicted dose from HPC, HPA & B and cumulative to the Farming Family who also ingest seafood from all sources



Breakdown of contributions to the cumulative dose from HPC, HPA and HPB and main nuclide contributors.

Figure 8: Predicted dose from HPC, HPA & B and cumulative to the Fishing Family who also ingest vegetable from all sources



Breakdown of contributions to the cumulative dose from HPC EPRs, HPA and HPB and main nuclide contributors.

Figure 9: Breakdown of the prospective cumulative doses due to liquid and gaseous discharges from HPA, HPB and HPC to each of the age groups in the Critical Croup of the 'Farming Family with marine and gaseous exposure' (as a percentage of the cumulative dose for each age group)

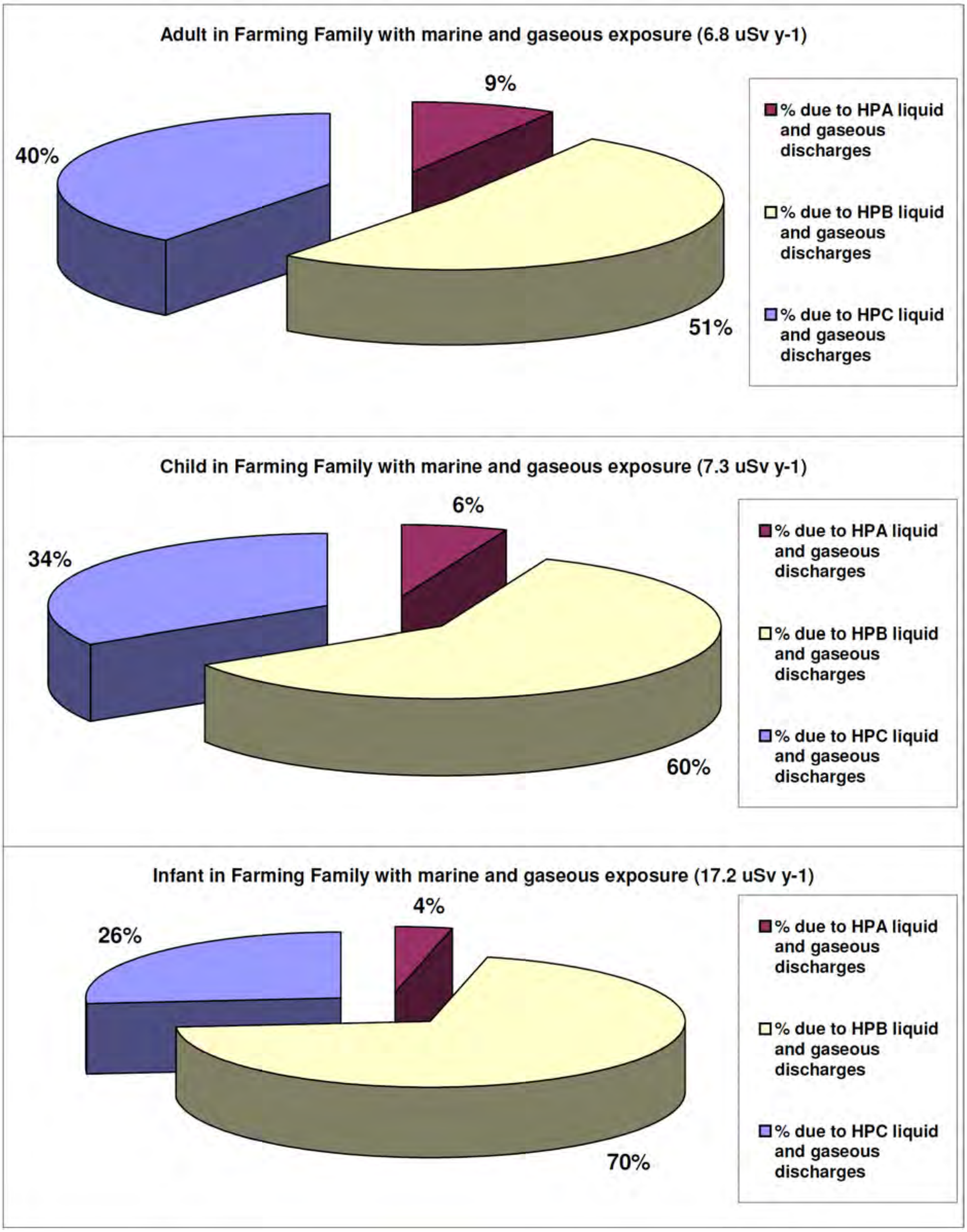
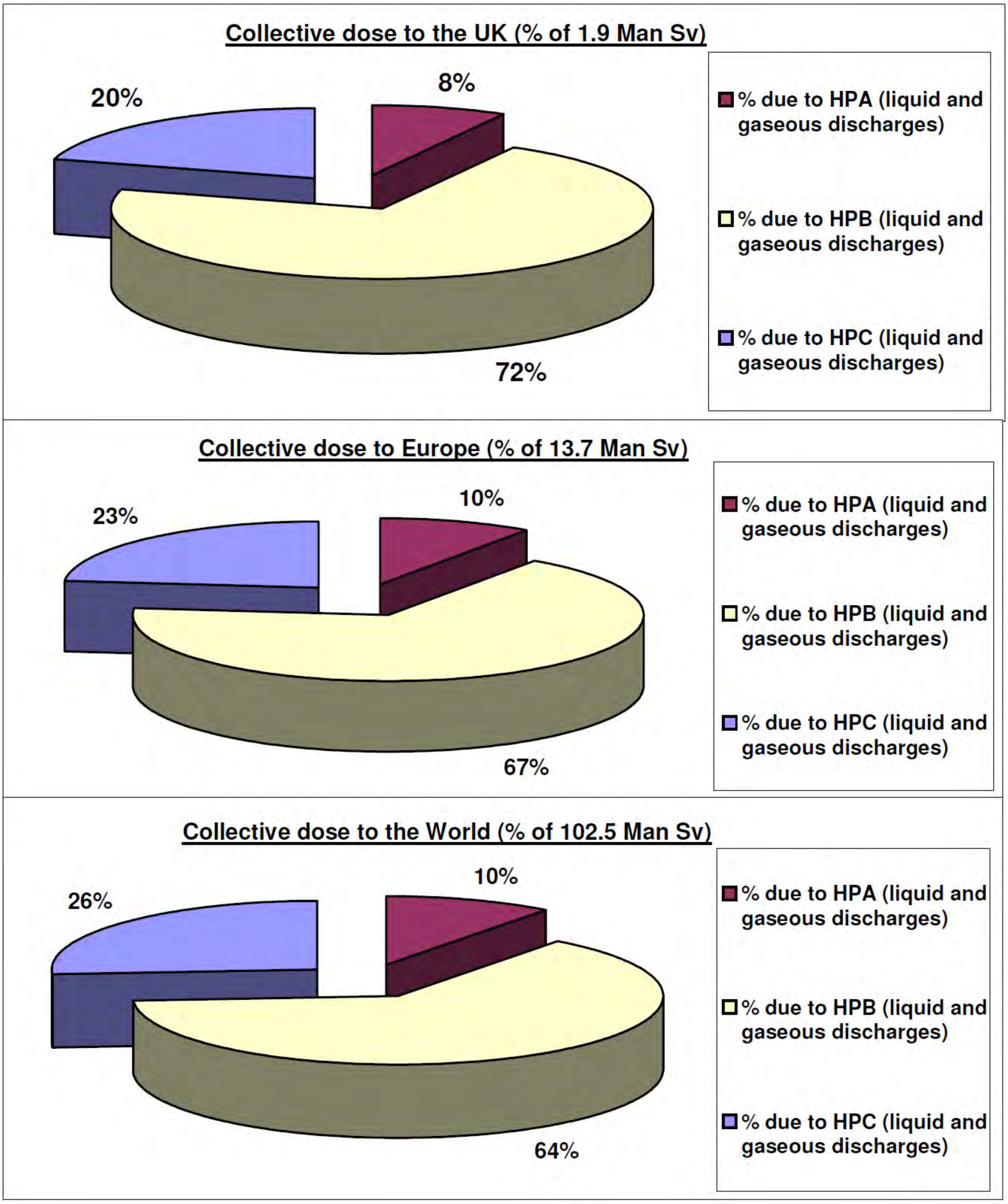


Figure 10: Breakdown of the collective doses for the UK, European and World populations due to liquid and gaseous discharges from HPA, HPB and HPC (as % of collective doses to each population)



APPENDIX A

Results of site radiological soil and water surveys

Figure A1: Groundwater (Built Development Area West) – gross alpha results.

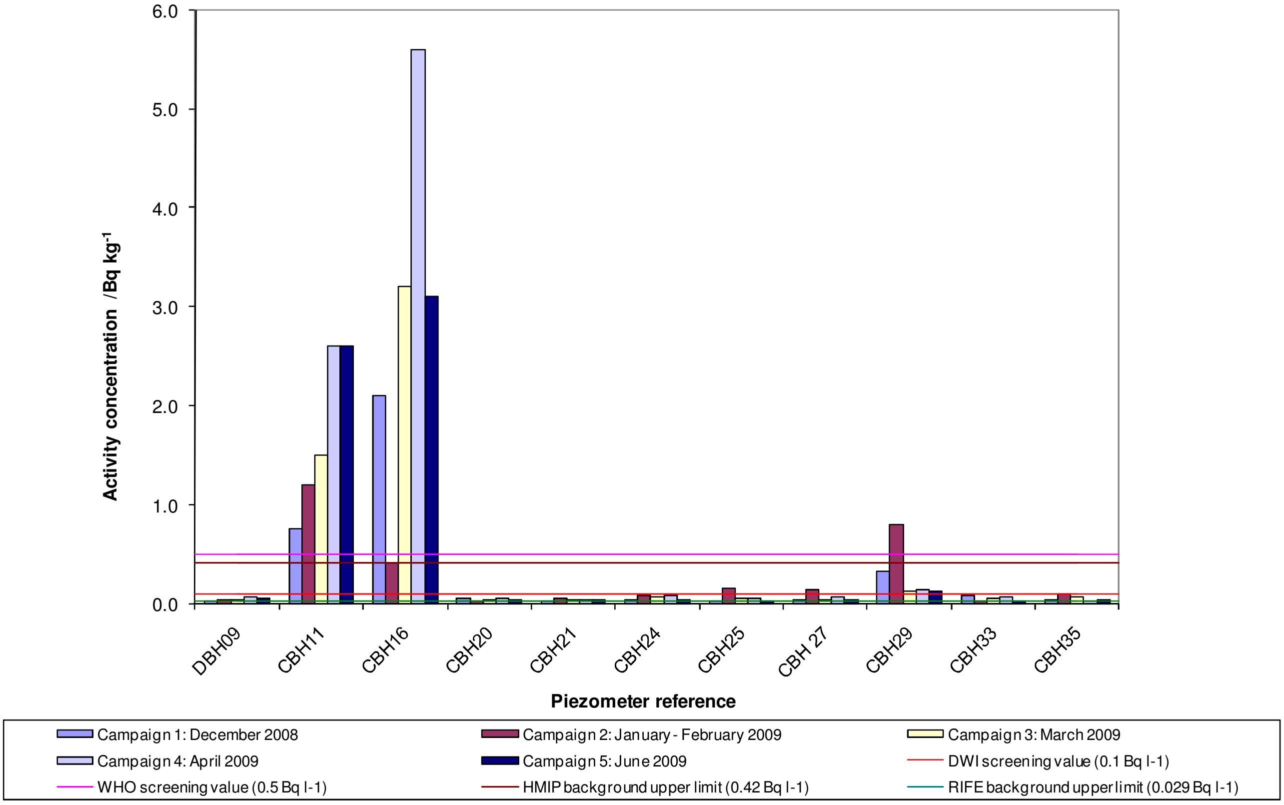


Figure A2: Groundwater (Built Development Area West) – gross beta results.

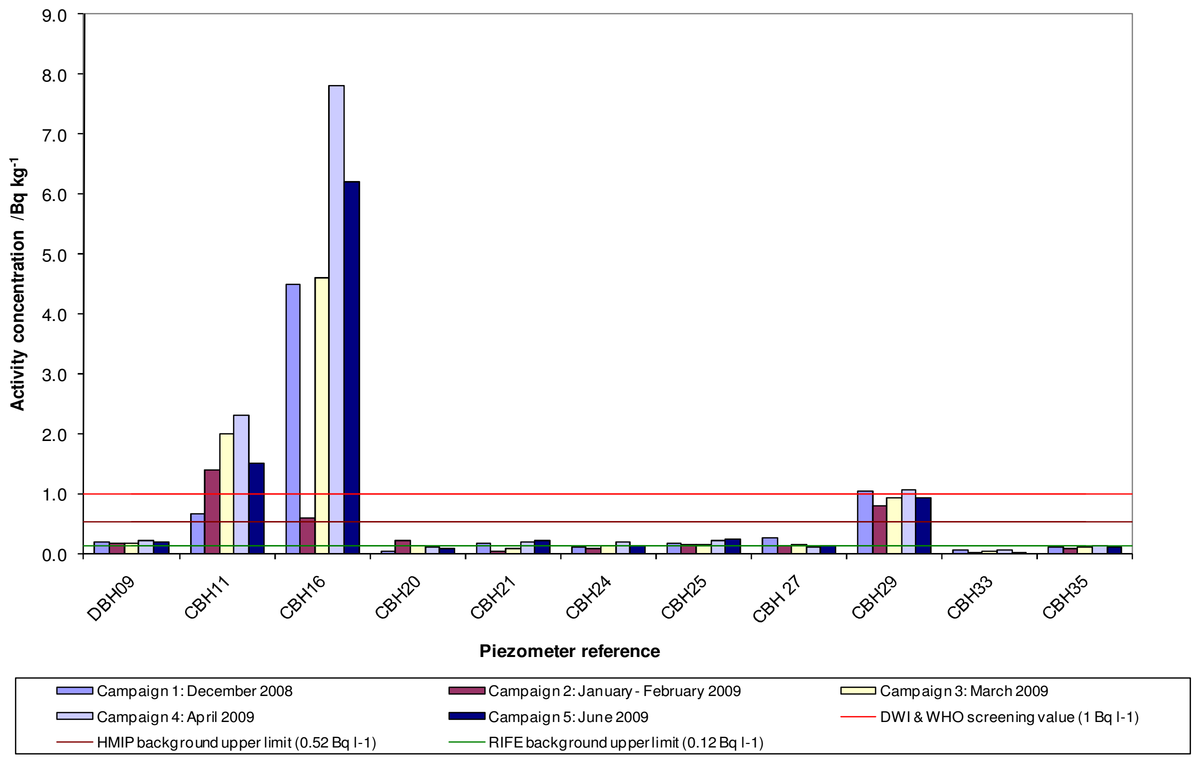


Figure A3: Groundwater (Built Development Area West) – H-3 results.

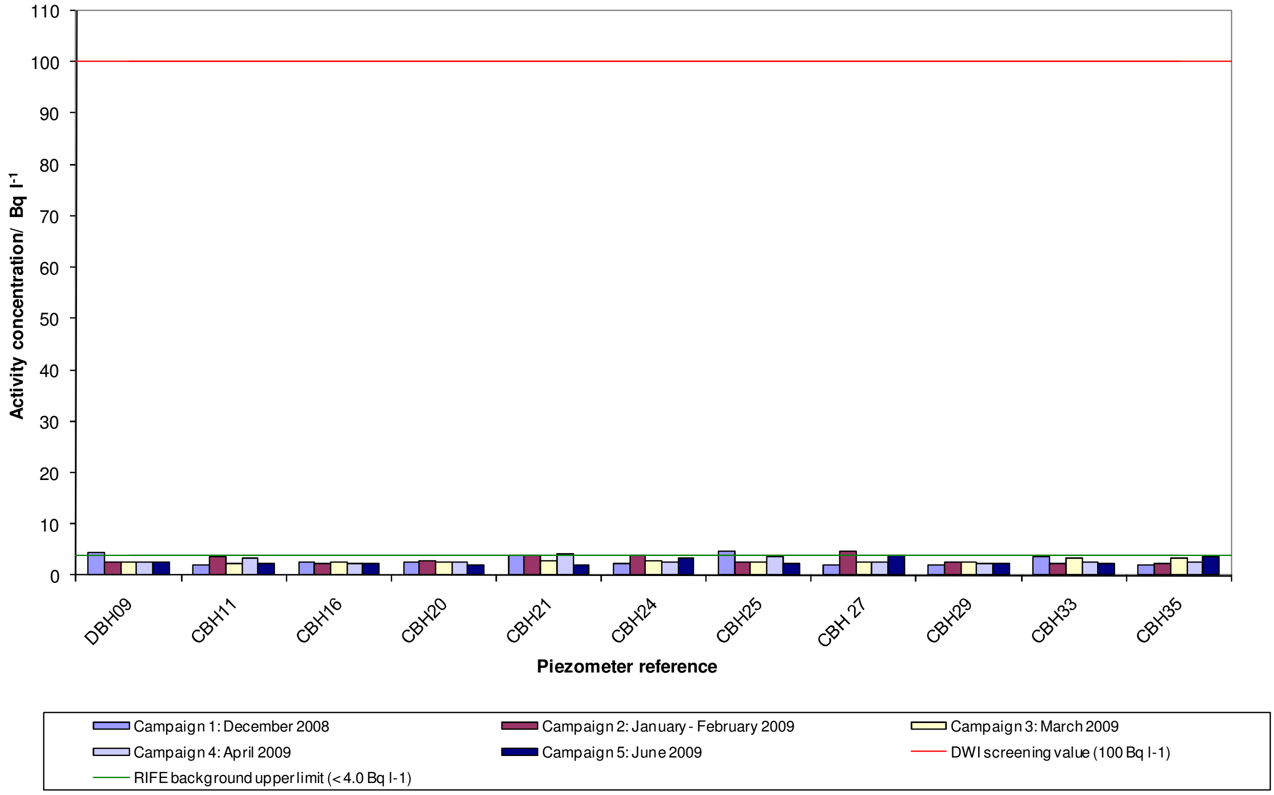


Figure A4: Groundwater (Built Development Area East) – gross alpha results.

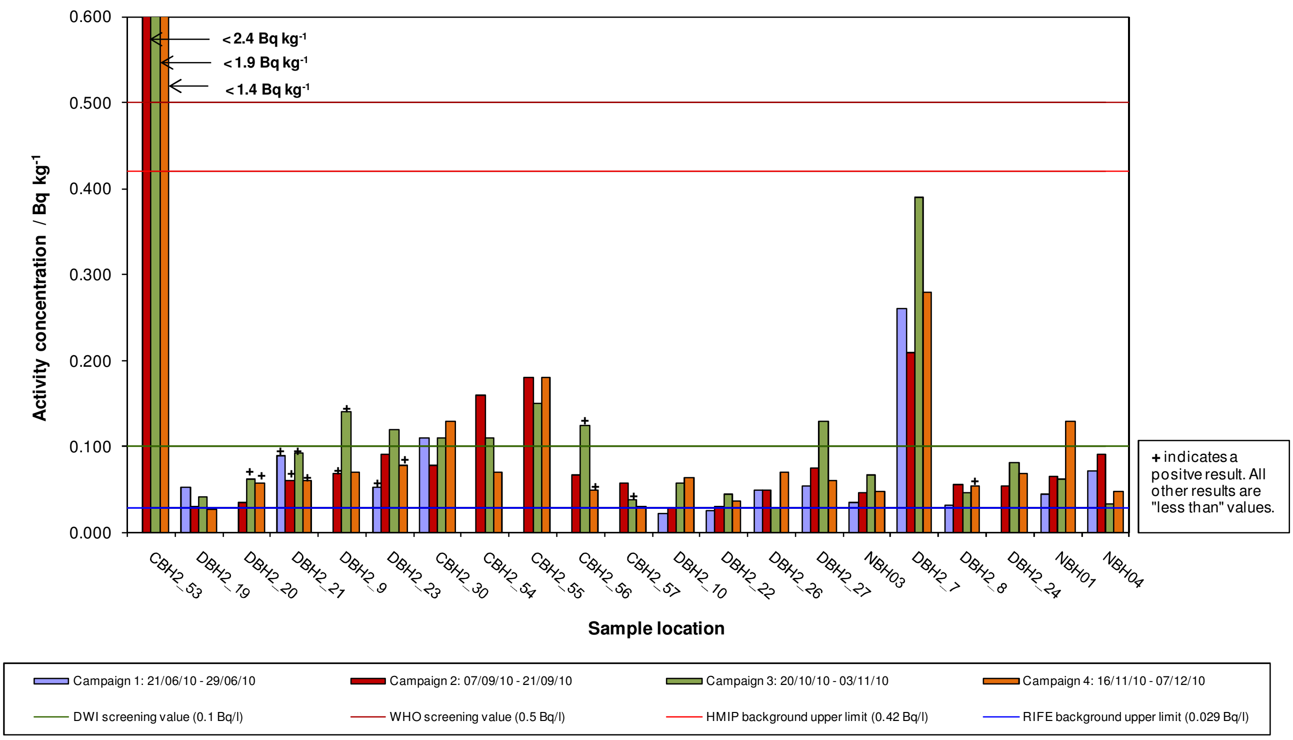


Figure A5: Groundwater (Built Development Area East) – gross beta results

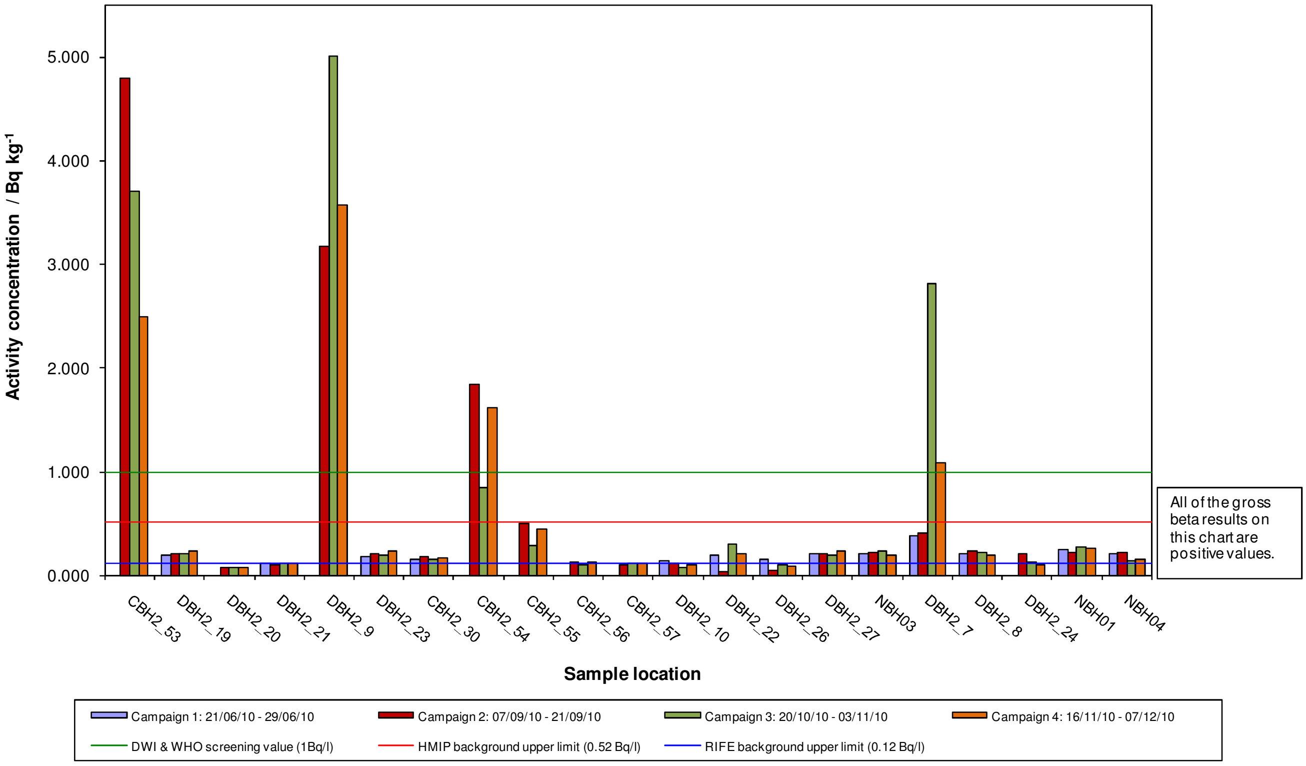


Figure A6: Groundwater (Built Development Area East) – H-3 results

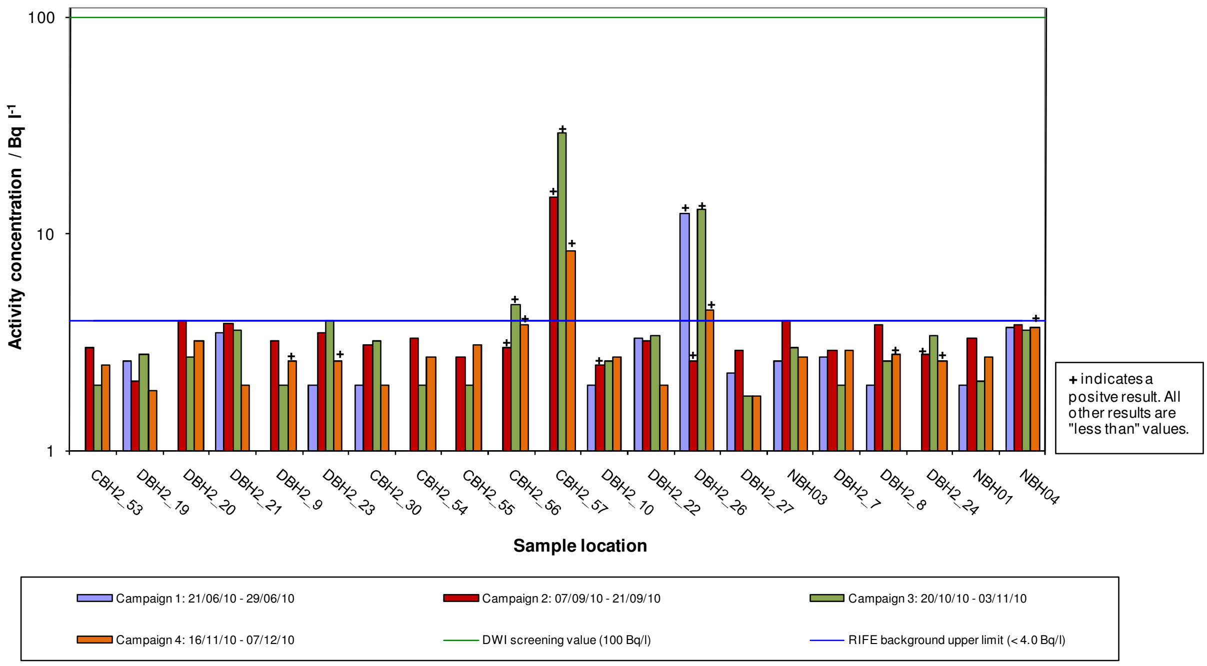


Figure A7: Groundwater (Southern Construction Phase Area) – gross alpha results

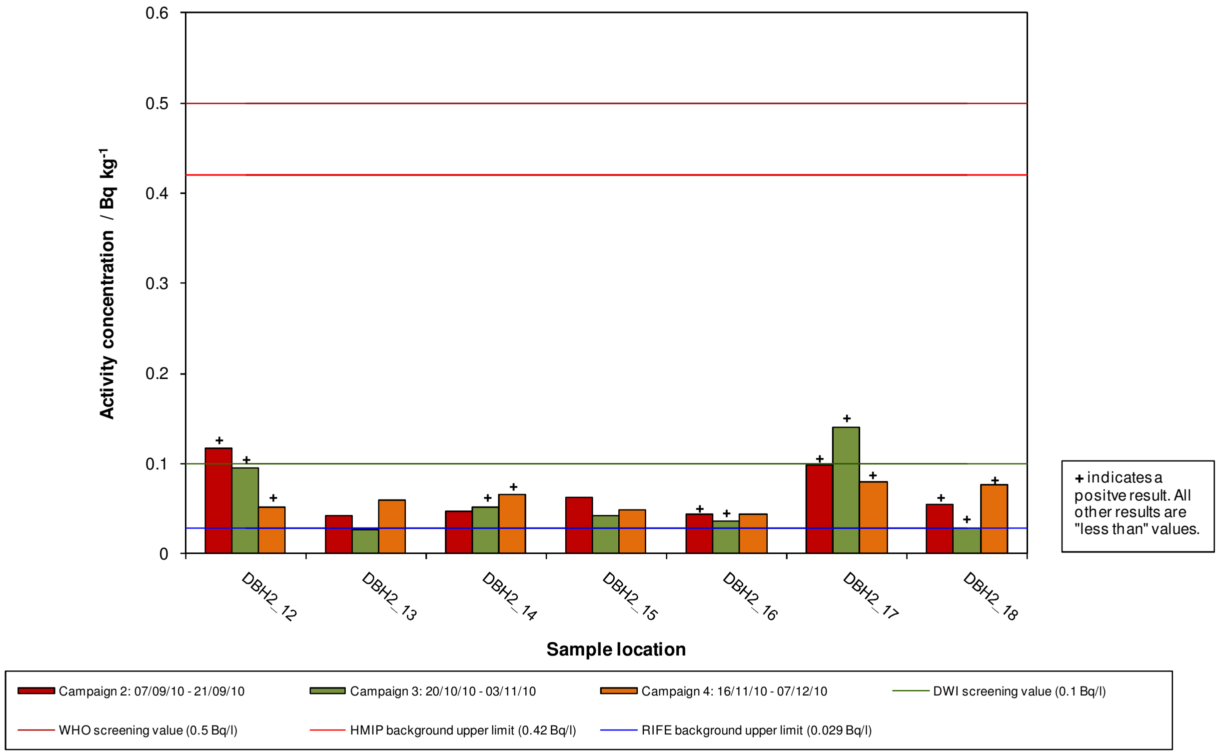


Figure A8: Groundwater (Southern Construction Phase Area) – gross beta results

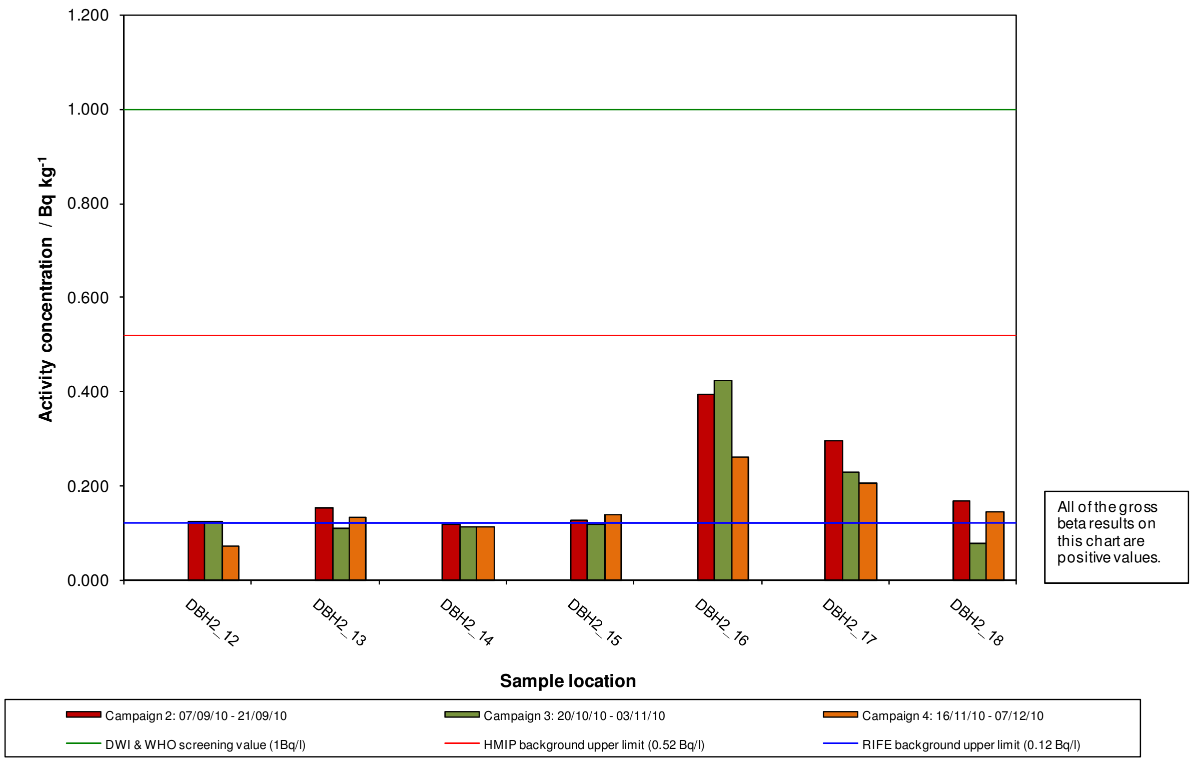


Figure A9: Groundwater (Southern Construction Phase Area) – H-3 results

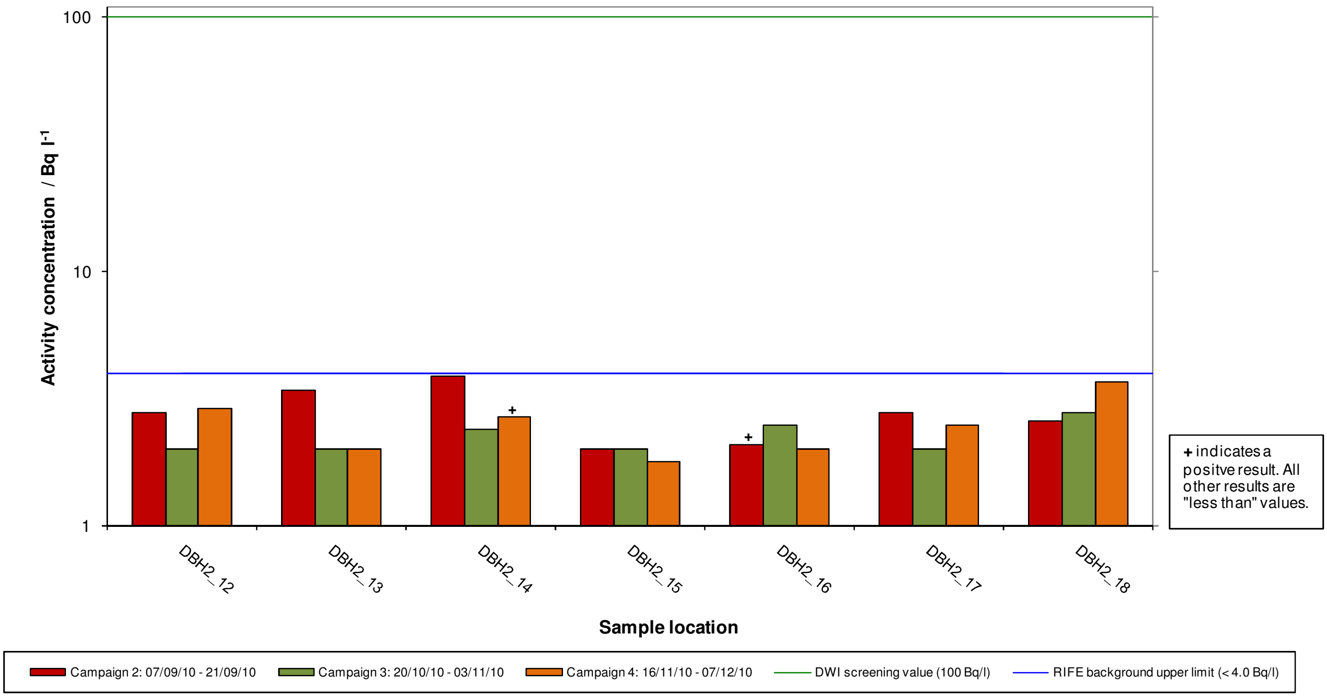


Figure A10: Surface water campaigns 1 to 6 – gross alpha results

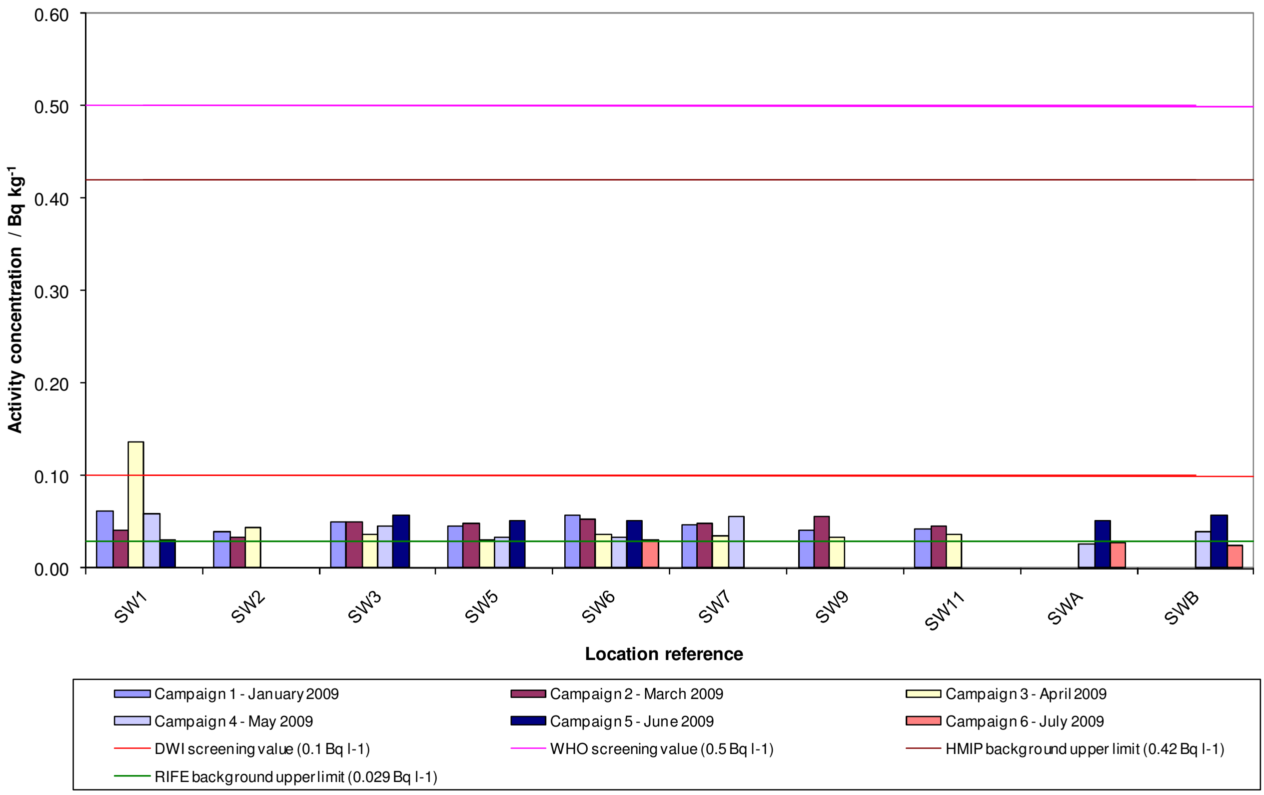


Figure A11: Surface water campaigns 1 to 6 – gross beta results

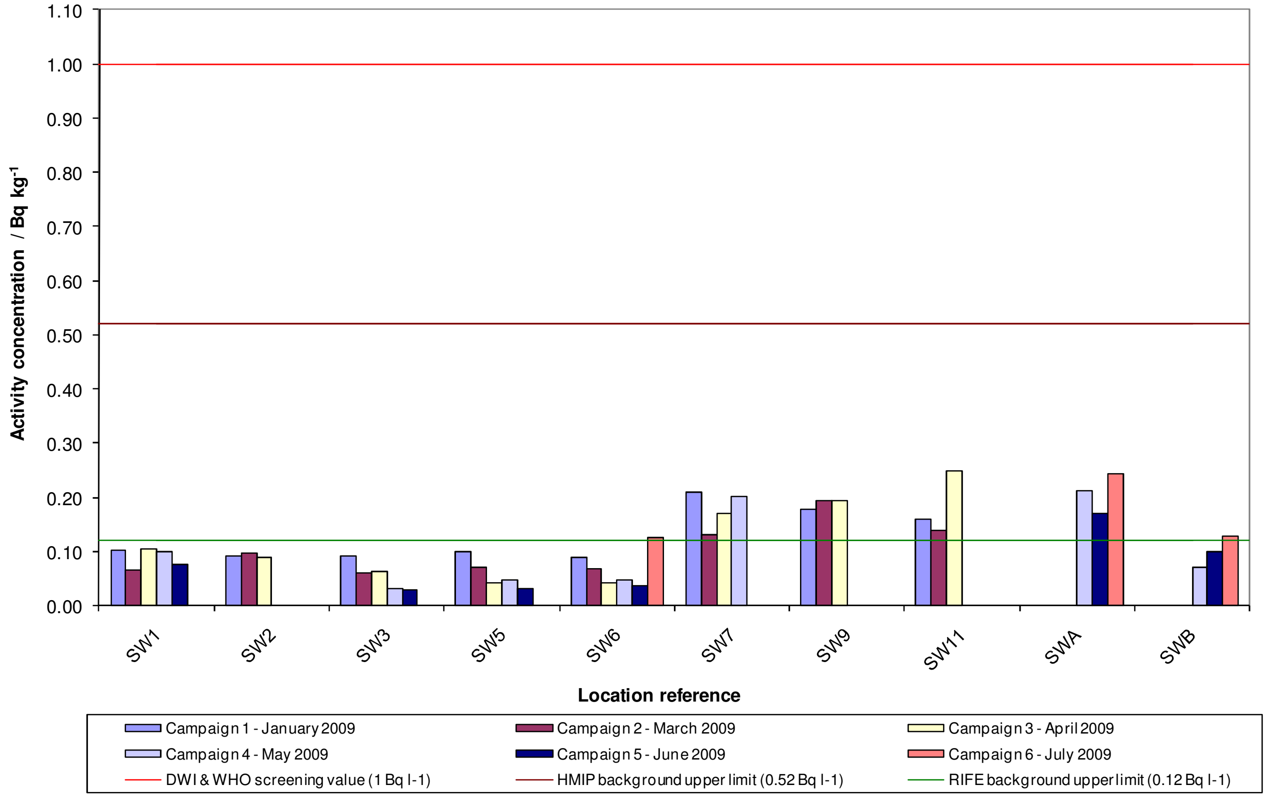
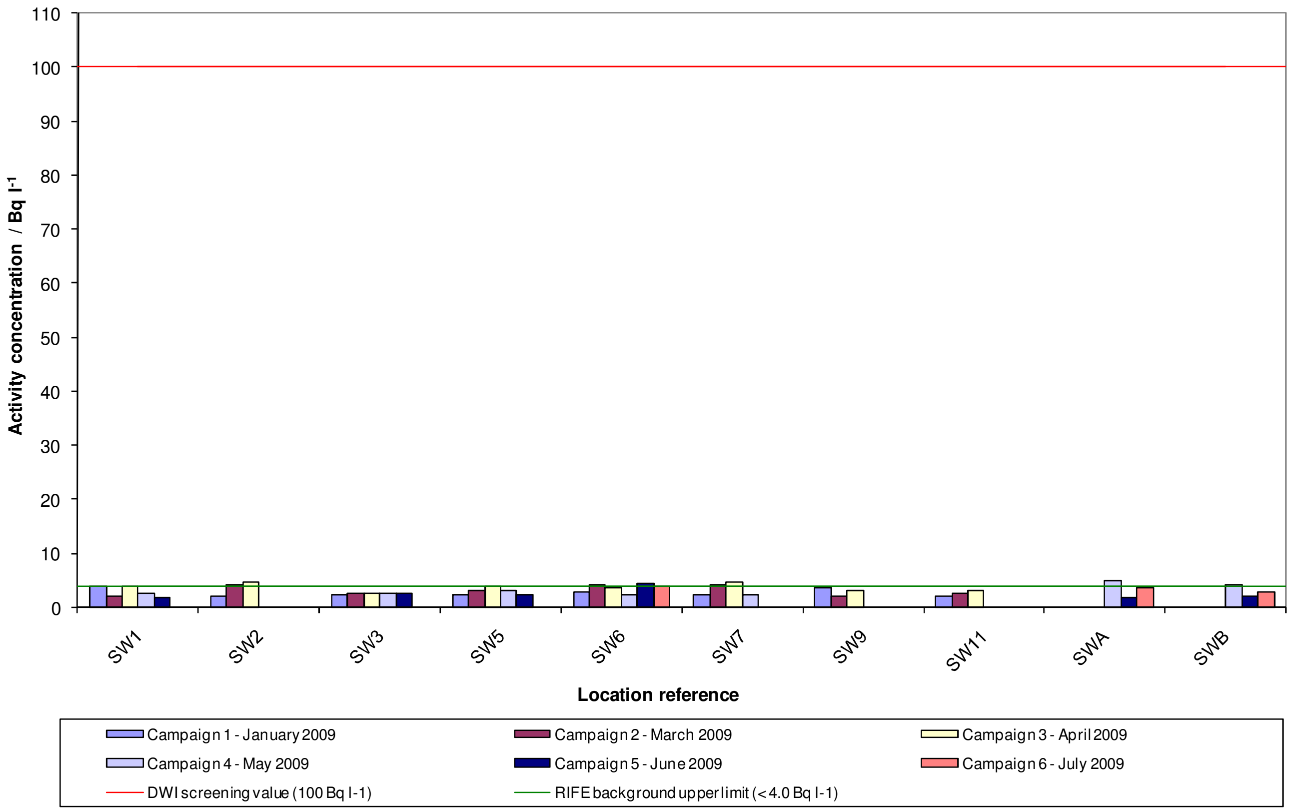


Figure A12: Surface water campaigns 1 to 6 – H-3 results



APPENDIX B

Human assessment input parameters

Table B1: Fishing Family who also consume terrestrial foodstuffs habit parameters based on CEFAS[53] data

Parameter	Adult	Child	Infant
Occupancy home outdoors ($h\ y^{-1}$)	2420[s]	1577	866
Occupancy home indoors ($h\ y^{-1}$)	4,380	7,008	7,884
Fraction of time indoors	0.5	0.8	0.9
Occupancy on beach (hy^{-1})	1960	175	10[t]
Breathing rate marine ($m^3\ h^{-1}$)	1.69	1.12	0.35
Breathing rate terrestrial ($m^3\ h^{-1}$)	0.92[u]	0.64	0.22
Handling fishing gear (hy^{-1})	1,560	0	0
Ingestion of sea fish (kg $person^{-1}y^{-1}$)	47.2	11.8	2.6[v]
Ingestion of crustacea (kg $person^{-1}y^{-1}$)	15.3	1.5	0
Ingestion of mollusca (kg $person^{-1}y^{-1}$)	1.9	0	0
Fraction of seafood caught locally	1	1	1
Marine area of interest	Bristol Channel		
Ingestion of locally produced green vegetables. (kg $person^{-1}y^{-1}$)	33.4	23.3	4.8
Ingestion of locally produced root vegetables. (kg $person^{-1}y^{-1}$)	49.1	26.6	12.3
Ingestion of locally produced fruit (kg $person^{-1}y^{-1}$)	16.2	6.6	7.5
Ingestion of locally produced sheep meat (kg $person^{-1}y^{-1}$)	7.7	3.1	0.9
Ingestion of locally produced cow meat (kg $person^{-1}y^{-1}$)	26.9	14.3	6.0
Ingestion of locally produced milk (kg $person^{-1}y^{-1}$)	136.6	158.1	186.9
Ingestion of locally produced milk products (kg $person^{-1}y^{-1}$)	31.7	23.8	23.8

[s] Calculated based on 50% indoor occupancy and 1960 hours per year on the beach
[t] As there is only 1 infant observation it should be noted that using the term '97.5th percentile' is not strictly correct in this case
[u] As a fisherman during terrestrial occupancy hours this individual is not working and hence a worker breathing rate is not appropriate
[v] As there is only 1 infant observation it should be noted that using the term '97.5th percentile' is not strictly correct in this case

Table B2: Farming Family who also consume locally caught seafoods. Habit parameters based on CEFAS[53] data.

Parameter	Adult	Child	Infant
Occupancy in the local area($h\ y^{-1}$)	8,760	8,760	8,760
Recreational beach occupancy ($h\ y^{-1}$)	400	175	10
Fraction of time indoors	0.5	0.8	0.9
Breathing rate terrestrial ($m^3\ h^{-1}$)	1.12	0.64	0.22
Distance to Farm[w]	1.65 km		
Bearing to Farm[jj]	134º		
Ingestion of locally produced green vegetables. (kg $person^{-1}y^{-1}$)	33.4	23.3	4.8
Ingestion of locally produced root vegetables. (kg $person^{-1}y^{-1}$) (97.5th rate for adult, average rates for child and infant)	121.5	26.6	12.3
Ingestion of locally produced fruit (kg $person^{-1}y^{-1}$)	16.2	6.6	7.5
Ingestion of locally produced sheep meat (kg $person^{-1}y^{-1}$)	7.7	3.1	0.9
Ingestion of locally produced cow meat (kg $person^{-1}y^{-1}$)	26.9	14.3[x]	6.0
Ingestion of locally produced milk products (kg $person^{-1}y^{-1}$) (97.5th rate for child and infant and average for adult)	36.3	27.2	27.2
Ingestion of milk (kg $person^{-1}y^{-1}$)	136.6	207.40	276.5
Ingestion of sea fish (kg $person^{-1}y^{-1}$)	13.4	11.2	2.6
Ingestion of crustacea (kg $person^{-1}y^{-1}$)	2.6	1.5	0
Ingestion of mollusca (kg $person^{-1}y^{-1}$)	1.9	0	0

[w] From EPR East (C1) stack
[x] As there is only 1 child observation who consumes cow meat, the terms 'mean' and '97.5th percentile' are not strictly correct in this case. However, this data is consistent with the NRPB W41 value.

APPENDIX C

Collective dose parameters

Table C1: Summary of collective dose parameters

Parameter	Value
Collective dose truncated at year	500
Populations of interest	UK, Europe, World
Effective Release Height HPC (m)	23.3
Effective Release Height HPA (m)	17.8
Effective Release Height HPB (m)	21
Meteorological data	Hinkley Point centred Meteorological data for the period 1999-2008
Regional marine compartment	Bristol Channel

APPENDIX D

Short-term input parameters

Table D1: Activity discharged in a short-term release (24 hour discharge scenario)

		24 hour discharge scenario
Radionuclide	Total activity discharged (Bq)	Discharge rate (Bq s^{-1})
H-3	$3.00\ 10^{11}$	$3.47\ 10^{6}$
C-14	$1.00\ 10^{11}$	$1.16\ 10^{6}$
Kr-85	$6.95\ 10^{11}$	$8.04\ 10^{6}$
Xe-133	$3.16\ 10^{12}$	$3.66\ 10^{7}$
Xe-135	$9.90\ 10^{11}$	$1.15\ 10^{7}$
Ar-41	$1.45\ 10^{11}$	$1.68\ 10^{6}$
Xe-131m	$1.50\ 10^{10}$	$1.74\ 10^{5}$
I-131	$1.37\ 10^{8}$	$1.59\ 10^{3}$
I-133	$1.63\ 10^{8}$	$1.89\ 10^{3}$
Co-58	$1.53\ 10^{7}$	$1.77\ 10^{2}$
Co-60	$1.81\ 10^{7}$	$2.09\ 10^{2}$
Cs-134	$1.40\ 10^{7}$	$1.62\ 10^{2}$
Cs-137	$1.26\ 10^{7}$	$1.46\ 10^{2}$

Table D2: Short-term habit and site parameters

Parameter	Value
Date of release	1st July[y]
Time of day of release	00:00 to 24:00
Discharge period (h)	24
Stack Height (m)	70
Effective Stack Height (m)	23.3
Receptor point (m)	Locality subject to maximum dose from atmospheric discharges from HPC
Distance between EPR reactor centres	230 m
Met Data	Hinkley Point specific
Reduction factor, inhalation – indoors occupancy[z]	0.5
Location factor cloud gamma – indoors occupancy	0.2
Location factor deposited gamma – indoors occupancy	0.1
Location factor deposited gamma – outdoors occupancy	1
Fraction of food locally produced	1
Occupancy terrestrial adult (h y^{-1})	8,760
Occupancy terrestrial child (h y^{-1})	8,760
Occupancy terrestrial infant (h y^{-1})	8,760
Fraction of time indoors terrestrial adult – outdoor worker	0.5
Fraction of time indoors terrestrial child – 5-10 y old	0.8
Fraction of time indoors terrestrial infant	0.9
Breathing rate terrestrial adult m^3 h^{-1} – indoors	0.48
Breathing rate terrestrial child m^3 h^{-1} – indoors	0.58
Breathing rate terrestrial infant m^3 h^{-1} – indoors	0.21
Breathing rate terrestrial adult m^3 h^{-1} – outdoors	1.75
Breathing rate terrestrial child m^3 h^{-1} – outdoors	0.87
Breathing rate terrestrial infant m^3 h^{-1} – outdoors	0.31
Ingestion rates See Appendix B– Table B 2, Terrestrial Ingestion rates only	
Ingestion rates	See Appendix B – Table B2, Terrestrial Ingestion rates only

[y] Assumed for calculation purposes that release occurs on 1st July, however met. data for June to August for the years 1999 to 2008 has been used to determine 97.5th percentile values rather than met data specific to 1st July.

[z] Reduction factor only relevant for depositing radionuclides, i.e., Co, Cs, I. There is no reduction factor for non-depositing radionuclides.

APPENDIX E

Build-up parameters

Table E1: Site and PC CREAM parameters for build-up assessment

Parameter	Recommended value
Activity Concentration calculated at year	60
Effective Release Height HPC (m)	23.3
Effective Release Height HPA (m)	17.8
Effective Release Height HPB (m)	21
Met data	Hinkley Point Specific

Table E2: Parameters for construction workers scenario

Parameter	Value
Age group	Adult
Working year (hours)	2000
Is respiratory protection worn?	None
Time spent on site (hours)	2000
Fraction of time spent outside	1
Fraction of time spent outside with disturbed ground	0.1
Time spent manually digging (hours)	20
Time spent mechanically digging (hours)	180
INH_h (m^3h^{-1})	3
INH_{am} (m^3h^{-1})	1.5
Fraction of the area occupied that is assumed to be contaminated	1.0
Distance and Bearing from EPR East (C1)	427m, 105 degrees

Table E3: Dose to construction worker from work on land contaminated by HPC gaseous discharges

Radionuclide	External Dose (Sv y^{-1})	Skin Dose (Sv y^{-1})	Inhalation Dose (Sv y^{-1})	Ingestion Dose (Sv y^{-1})	Total dose (Sv y^{-1})
Co-58	$3.67\ 10^{-11}$	$1.06\ 10^{-15}$	$3.74\ 10^{-16}$	$3.26\ 10^{-16}$	$3.67\ 10^{-11}$
Co 60	$2.52\ 10^{-09}$	$1.13\ 10^{-13}$	$4.96\ 10^{-14}$	$3.91\ 10^{-14}$	$2.52\ 10^{-09}$
Cs 134	$3.17\ 10^{-10}$	$3.64\ 10^{-14}$	$2.22\ 10^{-14}$	$7.22\ 10^{-14}$	$3.17\ 10^{-10}$
Cs 137	$1.39\ 10^{-09}$	$3.80\ 10^{-13}$	$1.20\ 10^{-13}$	$3.84\ 10^{-13}$	$1.40\ 10^{-09}$
I 131	$9.06\ 10^{-11}$	$2.91\ 10^{-14}$	$1.60\ 10^{-14}$	$5.28\ 10^{-14}$	$9.07\ 10^{-11}$
I 133	$1.19\ 10^{-11}$	$4.20\ 10^{-15}$	$4.02\ 10^{-16}$	$1.35\ 10^{-15}$	$1.19\ 10^{-11}$
Total	$4.37\ 10^{-09}$	$5.63\ 10^{-13}$	$2.09\ 10^{-13}$	$5.49\ 10^{-13}$	$4.37\ 10^{-09}$

Table E4: Dose to construction worker from work on land contaminated by cumulative Hinkley site gaseous discharges

Radionuclide	External Dose ($Sv\ y^{-1}$)	Skin Dose ($Sv\ y^{-1}$)	Inhalation Dose ($Sv\ y^{-1}$)	Ingestion ($Sv\ y^{-1}$)	Total ($Sv\ y^{-1}$)
Co-58	$3.67\ 10^{-11}$	$1.06\ 10^{-15}$	$3.74\ 10^{-16}$	$3.26\ 10^{-16}$	$3.67\ 10^{-11}$
Co 60	$1.64\ 10^{-08}$	$7.35\ 10^{-13}$	$3.23\ 10^{-13}$	$2.55\ 10^{-13}$	$1.64\ 10^{-08}$
Cs 134	$3.17\ 10^{-10}$	$3.64\ 10^{-14}$	$2.22\ 10^{-14}$	$7.22\ 10^{-14}$	$3.17\ 10^{-10}$
Cs 137	$1.39\ 10^{-09}$	$3.80\ 10^{-13}$	$1.20\ 10^{-13}$	$3.84\ 10^{-13}$	$1.40\ 10^{-09}$
I 131	$2.08\ 10^{-10}$	$6.66\ 10^{-14}$	$3.68\ 10^{-14}$	$1.21\ 10^{-13}$	$2.08\ 10^{-10}$
I 133	$1.19\ 10^{-11}$	$4.20\ 10^{-15}$	$4.02\ 10^{-16}$	$1.35\ 10^{-15}$	$1.19\ 10^{-11}$
S-35	$0.00\ 10^{+00}$	$5.51\ 10^{-12}$	$6.68\ 10^{-13}$	$7.70\ 10^{-13}$	$5.95\ 10^{-12}$
Total	$1.84\ 10^{-08}$	$5.73\ 10^{-12}$	$1.16\ 10^{-12}$	$1.60\ 10^{-12}$	$1.84\ 10^{-08}$

APPENDIX F

Non-Human parameters and results

Table F1: Animal species recorded in Hinkley Point area and ERICA reference

Animal	ERICA reference
Bats	
Pipistrelle	User Defined
Myotis	User Defined
Rhinolophus hipposideros	User Defined
Nyctalus noctula	User Defined
Eptesicus serotinus	User Defined
Plecotus auritus	User Defined
Mammals	
Water Vole	Freshwater mammal
Deer	Mammal (deer)
Badger	User Defined
Reptiles	
Slow Worm	Reptile
Grass Snake	Reptile
Insects	
Great Silver Water Beetle	
Water beetle	
Hoverfly	Flying Insect
Soldier flies1	Flying Insect
Aquatic snail	Gastropod
Hairy dragonfly	Flying Insect
Ladybird	Flying Insect
Birds	
Whimbrel	Bird
Black Tailed Godwit	Bird
Wigeon	Bird
Dunlin	Bird
Nightingale	Bird
Peregrine falcon	Bird
Jackdaw	Bird
Stonechat	Bird
Kestrel	Bird
Collared and Stock doves	Bird
Whitethroat	Bird
Rock Pipit	Bird

Animal	ERICA reference
Linnet	Bird
Dunnock	Bird
Other	
Salt Marsh Grazed Sheep	Mammal (deer)
Bee	Flying insect
Trout	Pelagic Fish
Farm	
Cow	Mammal (deer)
Sheep	Mammal (deer)
Pig	Mammal (deer)
Chicken	Bird
Marine	
Grey mullet	Benthic fish
Plaice	Benthic fish
Dogfish	Benthic fish
Cuttlefish	Mollusc
Skate	Benthic fish
Prawns	Crustacean
Sea Bass	Benthic fish
Sole	Benthic fish
Crustacean	Crustacean
Mollusc	Mollusc
Wild Fowl	Bird
Butterflies	
Chalkhill blue	Flying Insect
Dark green fritillary	Flying Insect
Meadow brown	Flying Insect
Marbled white	Flying Insect
Small heath	Flying Insect
Common blue	Flying Insect

Table F2: Plant species recorded in Hinkley Point area and ERICA reference

Plants	ERICA reference
Hedgerow	
Ash	Tree
Blackthorn	Tree
Brambles	Tree
Dog Rose	Shrub
Dogwood	Shrub
Elder	Tree
Elm	Tree
Field Maple	Tree
Hawthorn	Shrub
Ivy	Tree
Privet	Shrub
Wayfaring Tree	Tree
Spindle	Shrub
Other	
Oilseed rape	Grasses & Herbs
Hay meadow	Grasses & Herbs
Deciduous woodland	Tree
Tussocky grassland	Grasses & Herbs
Marine plants and algae	Macroalgae/vascular plants
Seaweed	Macroalgae

Figure F1: Map of Hinkley Point with respect to the UK

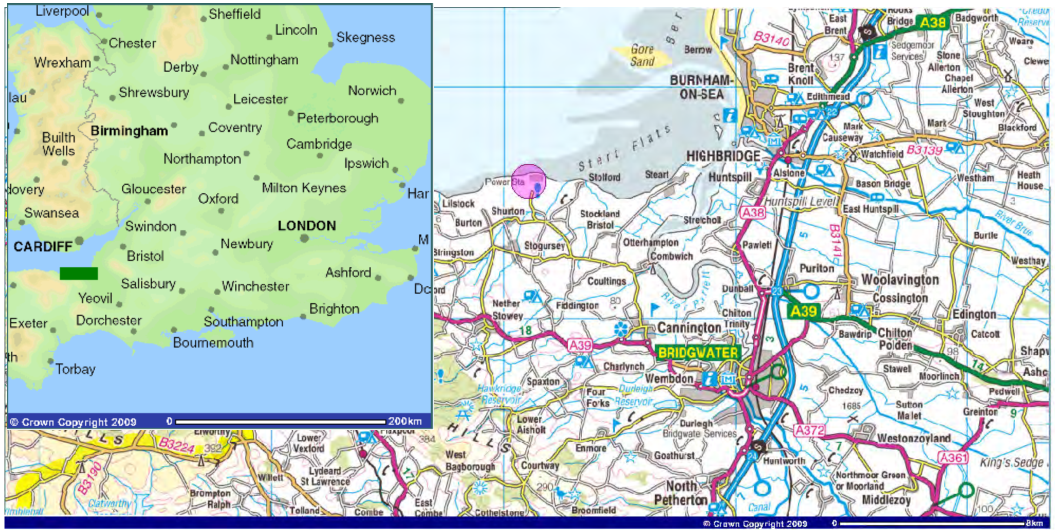


Figure F2: Map of Hinkley Point and surrounding local area

Figure F3: Close up of pond in Habitat 4 and dimensions

Figure F4 Location of pond with respect to Hinkley Point Power Station

Figure F5: Location map of the four habitats

Habitat 1
Habitat 2
Habitat 3
Habitat 4

APPENDIX G

Transport parameters and results

Table G1: Waste packages to be consigned annually from Hinkley Point UK EPRs

Type of waste	Package description	Packages per year	Typical activity (MBq/package unless otherwise stated)[aa]
SGBS ion-exchange resins (without regeneration)	0.2 m^3 plastic drums	76	11.84
Wet sludge (sumps, tanks)	0.2 m^3 metallic drums	16	900
Water filters from effluent treatment	0.2 m^3 metallic drums	2	180
Non compactable: air and water filters	0.2 m3 metallic drums	40	50
Pre-compacted operational wastes (plastics, clothes, small items)	0.2 m^3 metallic drums	126	248 (per m^3)
	0.2 m^3 plastic drums	376	248 (per m^3)
Scraps	1 m^3 metallic boxes	12	2333
Operational waste	0.2 m^3 metallic drums	2	480
Total LLW	-	650	-
Spent fuel	Fuel Flask	100	$1.5\ 10^{10}$ (bb)

[aa] Typical activities are for information only. The dose values for the transport scenarios are based on generic NRPB dose rates given in Table G2 (over).
[bb] Activity taken from NRPB-W66, Table 14 “other UK and overseas sites to the reprocessing site”.

Table G2: Annual radioactive material consignments for Hinkley Point EPR

Packages	Contents	Activity per conveyance GBq	Typical contact dose rate µSv h^{-1}[cc]	Typical dose rate at 1m µSv h^{-1}
Type A/B source containers	NDT radiography sources	<1 10^3	-	2
New fuel casks	New fuel assemblies	Unknown [dd]	Unknown	4
186 x 0.2 m^3 metallic drums in 2 ISO containers	Wet sludge (sumps, tanks), Water filters from effluent treatment, Non compactable: air and water filters, Operational waste, Pre-compacted operational wastes (plastics, clothes, small items…)	24.5	15	6
452 x 0.2 m^3 plastic drums in 5 ISO containers	SGBS ion-exchange resins (without regeneration), Pre-compacted operational wastes (plastics, clothes, small items)	18.8	15	6
12 x 1m^3 metallic boxes	Scraps	2.3	15	6
100 Fuel Flasks	Spent fuel	1.5 10^7	20	2

[cc] Contact dose rates taken from Table 18 of NRPB-W66. The one PWR in the UK does not transport flasks of spent fuel. Therefore general maximum values have been used.
[dd] The activity per conveyance will depend on the enrichment and type of fuel – not known at this stage.

Table G3: Scenarios considered

Source	Bus stop	College	House at 5m	House at railhead
NDT sources	Yes	Yes	Yes	No
New fuel	Yes	Yes	Yes	No
LLW	Yes	Yes	Yes	No
Spent Fuel	Yes	Yes	Yes	Yes

Table G4: Annual dose to critical members of public.

Scenario	Content of package	Distance between vehicle and member of public (m)	Exposure time per movement (min)	Exposure time per movement (h)	Dose rate at 1m ($\mu Sv\ h^{-1}$)	Annual number of movements exposed to.	Dose rate at receptor ($\mu Sv\ h^{-1}$)	Annual Dose (μSv)
Bus stop	NDT sources	1	1	0.017	2	10	2.00	0.51[ee]
	New fuel	1	1	0.017	4	5	4.00	0.33
	LLW	1	1	0.017	6	5	6.00	0.50
	Spent fuel	1	1	0.017	2	13	2.00	0.43
College	NDT sources	15	1	0.017	2	31	0.01	0.0075[ee]
	New fuel	15	1	0.017	4	125	0.02	0.04
	LLW	15	1	0.017	6	15	0.03	0.01
	Spent fuel	15	1	0.017	2	80	0.01	0.01
Railhead	Spent fuel	20	240	4	2	100	0.005	2.00
House	NDT sources	5	1	0.017	2	40	0.08	0.08[ee]
	New fuel	5	1	0.017	4	125	0.80	1.67
	LLW	5	1	0.017	6	19	1.20	0.38
	Spent fuel	5	1	0.017	2	100	0.40	0.67

[ee] Includes a factor of 1.5 to account for return factor of spent NDT sources

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APPENDIX 22A: ZTV METHODOLOGY

Appendix 22.A

Zone of Theoretical Visibility - Methodology

Introduction

A Zone of Theoretical Visual (ZTV) is used in the Landscape and Visual Impact Assessment (LVIA) process to illustrate the areas of surrounding landscape from which proposed features would be theoretically visible.

ZTV is typically a 'bare ground' scenario based on topographical analysis and it does not take account of other screening factors, such as vegetation or buildings. It is therefore considered to be a 'worst case scenario' in terms of the potential visibility of the proposed features.

ZTV is a key supporting tool used in visual analysis and allows identification of areas from which proposed features would not be seen with high certainty and accuracy. It is typically overlaid onto an OS map and represented by colours showing different levels of visibility. The areas identified as having potential for visibility of the proposed features are then reassessed during site visits to establish the actual visibility of the proposed features by taking account of all screening features, including vegetation or buildings.

Software and data

All ZTVs for the Hinkley Point C (HPC) project have been prepared using Key Terra Firma (KTF) Release 7 module for AutoCAD 2008. The following datasets were used during the preparation of ZTV for the proposed development within the HPC development site:

- Ordnance Survey (OS) 1:50,000 Scale Colour Raster map. Mapping extents: 291624, 171668 (top left corner OS grid reference); 340575, 123019 (bottom right corner OS grid reference). The 1:50,000 Scale Colour Raster provides a digital view of Ordnance Survey's Landranger® map series and has a wide variety of uses across all areas of business. The maps detail roads, footpaths, woods, water features, important buildings and contour lines.
- OS Landform Profile Digital Terrain Model (DTM) ASCII XYZ height data. This dataset does not cover part of the Bridgwater Bay to the north-west of the proposed HPC development site. Mapping extents: 291624, 171668 (top left corner OS grid reference); 340575, 123019 (bottom right corner OS grid reference). In this Digital Elevation Model (DEM) the ground surface has been modelled in detail with elevation points provided every five meters. This dataset is considered sufficient for carrying out analysis of large study areas. In the Landform Profile DTM, the whole country has been covered using airborne RADAR technology that provides a one-meter vertical resolution for the first reflective surface that is subsequently interpolated using a bespoke "TerrainFit" algorithm to derive the underlying 'bare ground' or terrain model.

ZTV Analysis

Ground model

The initial requirement before starting a ZTV analysis is to create a model using the suitable height data for the LVIA study area. The model for HPC development site has been created from the OS Landform Profile DTM ASCII .xyz file using the Gridding method.

KTF ground model settings:

- Extents: X: 291630, 340570; Y: 123020, 171660
- Area: 50km x 50km
- Triangles in model: 100350 (all active)

Running ZTV analysis

ZTV analysis is carried out by drawing a series of rays radiating out from the target points (proposed features) and it may help to consider this as many hundreds or thousands of sections being calculated automatically (see Plate 1). Each section is then divided into 'visible' and 'invisible' sub-sections, which indicate whether the proposed features are visible or not (see Plate 2).

The ZTV Analysis was carried out on 22 February 20010. To reflect the visibility of the proposed HPC proposed development in the surrounding landscape it was considered appropriate to use the following target points for the ZTV analysis:

- 2 target points at the elevation of +84m Above Ordnance Datum (AOD). These target points were placed on top of the tallest proposed structures (stacks).
- 76 target points located 10m above the existing ground level within the HPC development site (to allow for the proposed topographical changes within the HPC development site outside the HPC permanent development area).
- The visibility of the stacks (the tallest proposed structures) is a good indicator of the potential maximum visibility of the HPC proposed development, additional points at the ground level were added to reflect the visibility of the southern part of the HPC development site, in particular in the short and medium distance, where stacks might be screened by the existing landform but the southern parts of the HPC proposed development site might be visible. In the long distance, the lack of visibility of the stacks means that the lower levels of the HPC proposed development site would not be visible.

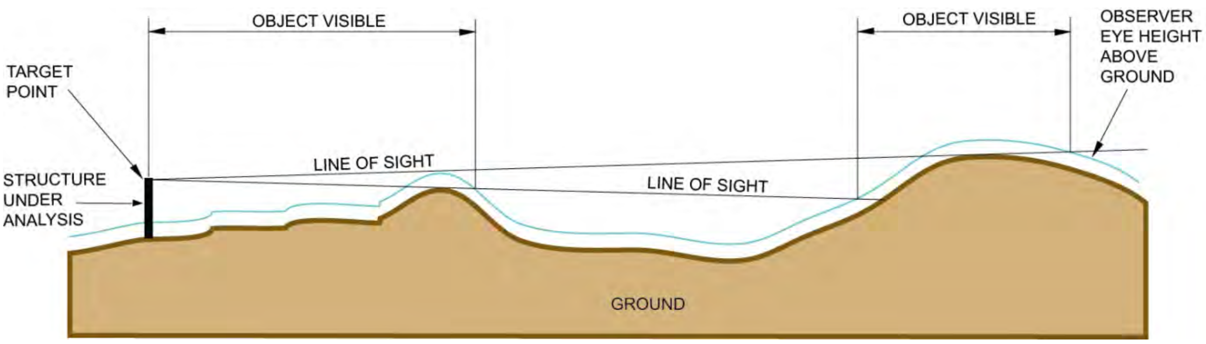

Plate 1 Illustration of ZTV analysis. Based on: KTF Ltd. (2007) ZVI and Visualisation

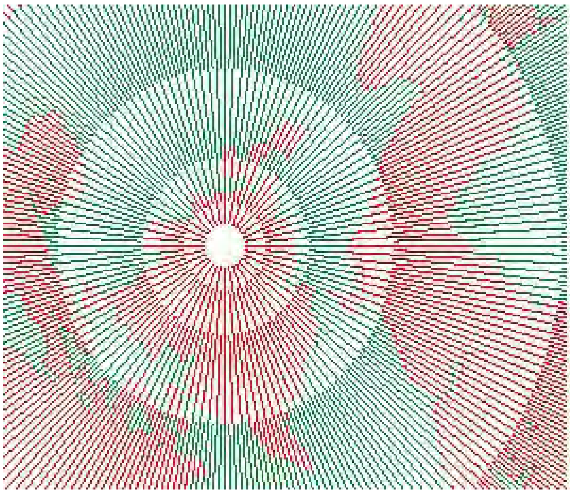

Plate 2 Example of single point analysis showing 'visible' (red) and 'invisible' (green) rays (source: KTF Ltd. (2007) ZVI and Visualisation)

ZTV analysis settings:

- Area: 50km x 50km (extents of the KTF ground model);
- Elevation of 2 target points at the top of the stacks: +84m AOD;
- Number of remaining target points within the HPC development site: 76 (elevation varies and set 10m above the existing ground levels);
- Ray resolution: 100m;
- Optimal Density Expansion (ODE) Expansion method: Yes. This was set 'on' to ensure that the lateral spacing between adjacent rays will never exceed the ray resolution value (see Plate 3);
- Start distance: 100m from each target point;
- Visual barriers: no.

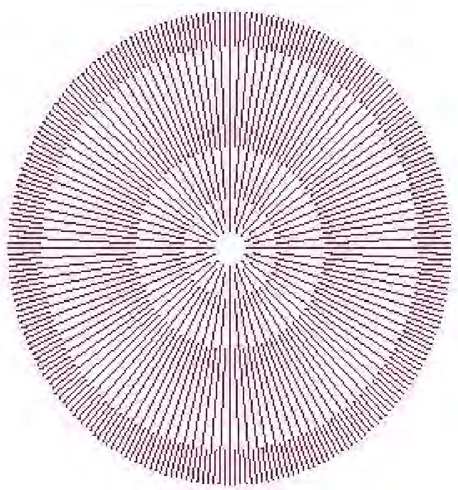

Plate 3 Example of rays for a single target analysis using ODE Expansion method (source: KTF Ltd. (2007) ZVI and Visualisation)

Colour mapping – graphical output

The ZTV analysis output file was saved as a Visibility Model, which is typically used for multiple target point analysis. It allows mapping areas using user defined colours assigned to a number of potentially visible targets.

For the purpose of HPC proposed development ZTV analysis, one colour band was chosen (blue) for mapping all areas from which at least one target point would be visible.

The graphical output was then overlaid onto OS 1:50,000 Scale Colour Raster map using OS grid references.

APPENDIX 22B: VISUALLY VERIFIABLE IMAGES METHODOLOGY

EDF Energy Hinkley Point C

Visually Verifiable Images - methodology

October 2011

HayesDavidson

EDF Energy Hinkley Point C

Visually Verifiable Images - methodology

October 2011

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Appendices


City developments


Iconic buildings


Images for townscape assessment


Images for landscape assessment

1 Hayes Davidson

1.0 Hayes Davidson (London) LLP was founded in 1989 to specialise in computer aided architectural illustration. The company has a team which deals exclusively in the creation of three dimensional digital models and the representation of buildings and cities. The team is overseen by four managing Partners all of whom have architectural, technical and artistic experience. A Partner specialising in Technical and Planning disciplines with qualifications and experience of geometry and construction oversees all projects where geometric definition and accuracy is required. Hayes Davidson has been invited to sit on judging panels for a number of architectural illustration awards, and lecture on computer aided illustration techniques, perception and three dimensional representation.

1.1 Alan Davidson, the founder and Managing Director, has a BA and MA (Hons.) in Architecture from the University of Edinburgh and is an ARCUK registered architect. He studied Fine Art and attended Art College in Edinburgh. He has worked as an architect since 1986 and an architectural illustrator since 1979.

1.2 Hayes Davidson is considered to be the most experienced architectural computer imaging company working in the UK having produced over 10,000 'virtual' or 'computer aided' images since 1989. The work of Hayes Davidson has been acknowledged as pioneering; advancing the use of computer technologies in the representation of buildings. The work has been widely published. Hayes Davidson has won the CICA ('Construction Industry Computing Association') award for the best computer rendering of buildings three years consecutively. The computer generated artwork of Hayes Davidson is collected by the Royal Institute of British Architects Drawings Collection.

1.3 The following is a reference for Hayes Davidson from Dr. Neil Bingham, Assistant Curator of the Royal Institute of British Architects Drawings Collection.

"The RIBA Drawings Collection was established at the foundation of the RIBA in 1834, now holds an estimated 3/4 million drawings, and is considered one of the finest architectural collections in the world. Since 1994, the RIBA has been acquiring the work of Hayes Davidson. The Drawings Collection recognise their work as representing some of the highest quality and most important architectural illustration of the late 20th Century."

1.4 Hayes Davidson is the only company to our knowledge to have verified photomontage, videomontage and surround montage accepted at public inquiry level in the UK. Hayes Davidson has produced evidence for both the Heron Tower (Architect Kohn Pedersen Fox) and London Bridge Tower (Architect Renzo Piano Building Workshop) Inquiries. On both occasions the material produced by Hayes Davidson has been accepted and praised by the Inquiry.

2 Work Commissioned

2.0 Hayes Davidson was commissioned by EDF Energy to produce a series of dimensionally accurate Visually Verifiable Images in a rendered format of the proposed EDF Energy Hinkley Point C development from 42 viewing locations at positions varying from 25m to 20km from the site. All views were to be represented in daylight conditions with 13 views also being represented at dusk.

2.1 Each of these views of the proposal was to be created as Visually Verifiable Images (VVI's). A Visually Verifiable Image (VVI) is an image of a proposed element in its future context, prepared using a repeatable, verifiable methodology.

2.2 Preparation of VVI is complex and challenging and the choice of simulation and technique is essential. This is described in section 3.

2.3 In order to prepare VVI, it is necessary to establish the view positions accurately at the source. The view positions were agreed by EDF Energy with statutory and local consultees and this information was provided to Hayes Davidson by Gillespies Landscape Architects. The viewing positions are described in section 4 and Appendix A and B.

2.4 High resolution photography suitable for use in the preparation of VVI was required for all views. The specification and process for capturing the photography is described in section 5.

2.5 Accurately surveyed camera positions and local context are an essential part of the verifiable view creation process. A chartered survey company was employed to carry out this precision work and this is described in detail in section 6.

2.6 Photography captured at site requires colour correction and preparation in order to be suitable for use as a baseline for the AVR image. This is described in section 7.

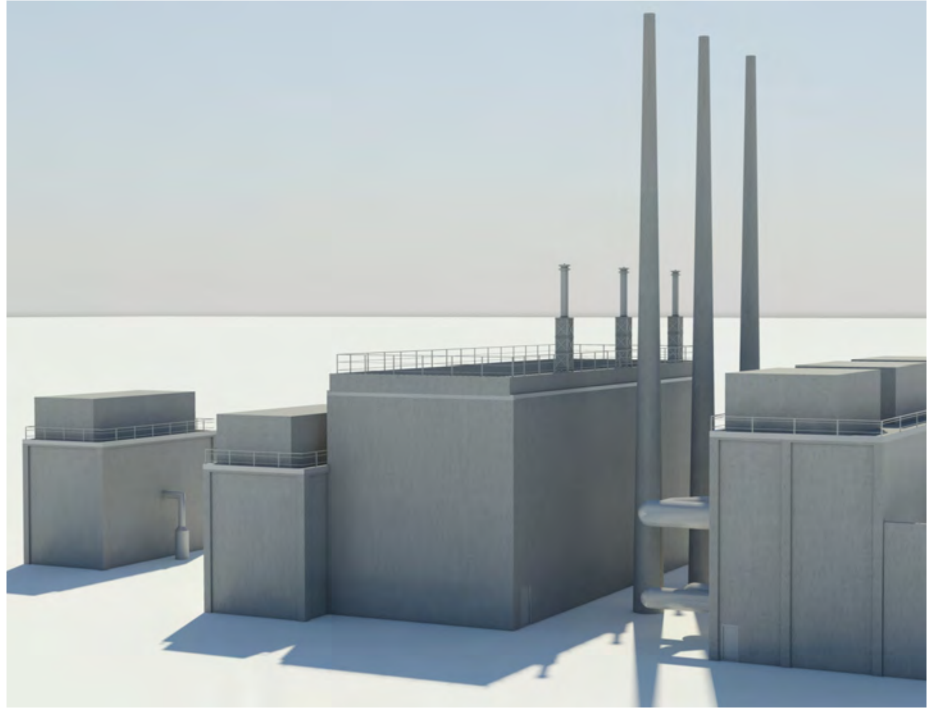
2.7 Accurate digital 3D models of the proposed development were created by Hayes Davidson for use in the VVI images. All drawn and digital information regarding the proposed development was supplied to Hayes Davidson in digital and hardcopy format by YRM Architects and Gillespies Landscape Architects. Section 8 describes the 3D modeling and location process. The building locations are in Appendix C.

2.8 Once the site based information, photography post-processing and 3D modeling is complete it is necessary to align these components accurately. This is described in section 9.

2.9 When an accurate alignment is achieved and confirmed through the studio QA process, final image production can occur. This is described in section 10.

2.10 The VVI images are designed to be viewed in print at a predetermined viewing distance. The way we calculate this viewing distance and how we determine the field of view is described in Section 11 and Appendix D.

On-site photography



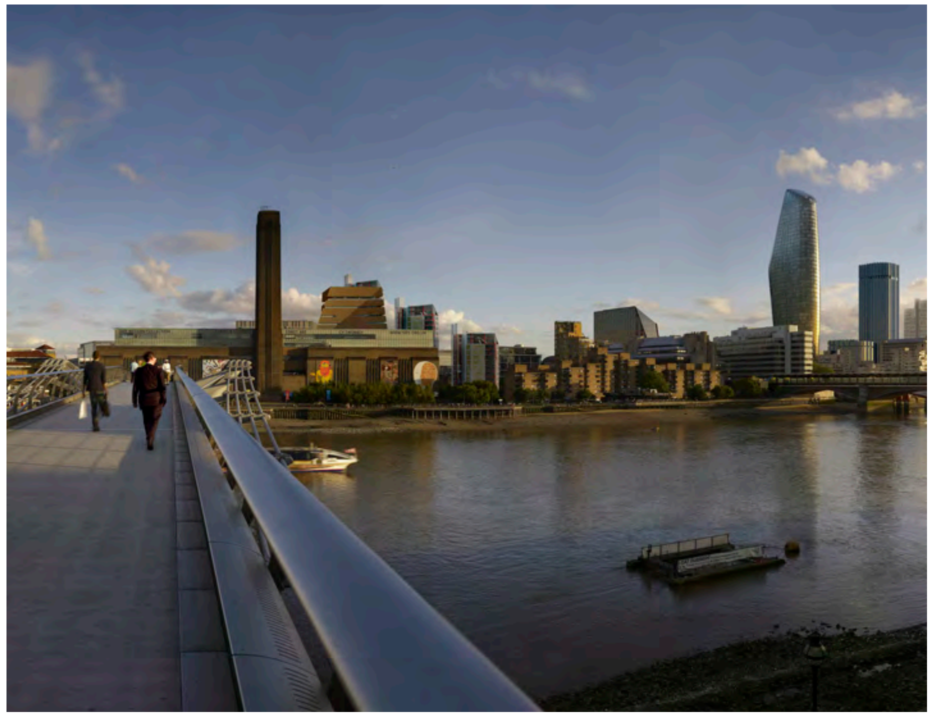
Modelling of structures - early development

Accurate viewpoint location

Terrain modelling

3 Choice of simulation technique


Depth


Silhouette


Night Lighting


Surrounding context

3.0 It is important to emphasise that no media can currently reproduce the human experience of viewing a scene. There is no method of analysis or representation that will accurately summarise every lighting, material, social, sensory or climatic condition.

3.1 A photomontage is the superimposition of an image onto a photograph for the purpose of creating a realistic representation of proposed or potential changes to a view. Printed photomontage allows the highest resolution and allows the eye to see the greatest detail. In this way it starts to simulate the effect of looking at a view from a single position.

3.2 Setting aside time of day and year and local climactic conditions, the different aspects of a building that contribute to its aesthetic appearance can be summarised as follows: (For the purpose of simplicity we will disregard the speed of walking and social and other sensory influences but these are also relevant).

- proportion (height, width)
- distance / depth from viewer
- outline and definition of building edges
- the viewers 360º awareness of the surroundings
- position in view
- the effect of light on and the nature of the buildings materials
- night lighting
- nature of surrounding buildings/ structures (shadowing and reflection)

3.3 The images presented have been created using a verifiable methodology that will allow a third party to verify the accuracy of the scale, height and mass of the proposal. Not all simulation techniques can be verified and where detailed analysis of materials and their behaviour to light are to be considered, no wholly objective analysis method is possible, and the architect and Hayes Davidson work together to apply subjective judgement. The shading presented is based on the position of the sun at the date and time of the capture of the baseline photography.

4 Viewpoint establishment

4.0 The list of viewpoints was agreed by EDF Energy with statutory and local consultees. The approximate location and photo references for each of the view positions were provided to Hayes Davidson by Gillespies Landscape Architects.

4.1 Hayes Davidson, a professional architectural photographer and members of a chartered surveying team attended the site in February 2011 to establish the view positions.

4.2 Each of the attendees was fully inducted in site safety and security processes and requirements at the existing Hinkley Point B site prior to the commencement of any viewpoint establishment.

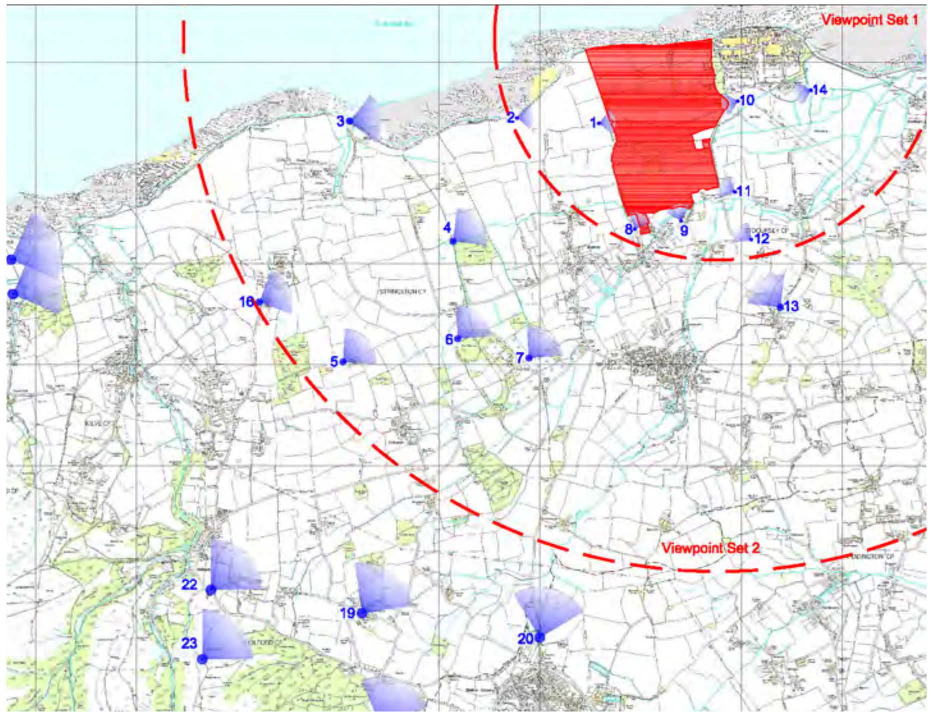
4.3 Using the information provided by Gillespies Landscape Architects, the team visited each viewpoint. Where necessary, relevant permissions to access private land were obtained through EDF Energy.

4.4 At each view position the location was matched using the provided Gillespies information. Where a composition needed to be improved due to obstruction or foliage growth, a more suitable position was chosen that still demonstrated the requirement of the original view. In each case the variations to each position was marginal.

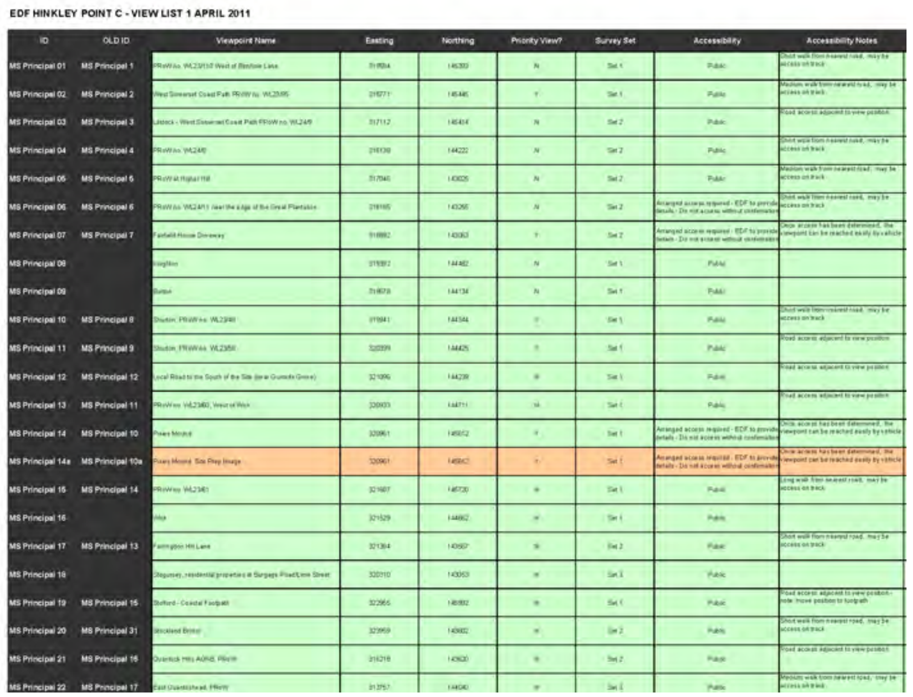
4.5 Professional survey marking materials were used to mark and maintain each view location. The type of survey marker utilised was dependent on the ground surface conditions.

4.6 Each marker was photographed and recorded for reference purposes.

4.7 Appendix 1 and 2 show the viewpoint locations and viewpoint details.



Viewpoint planning

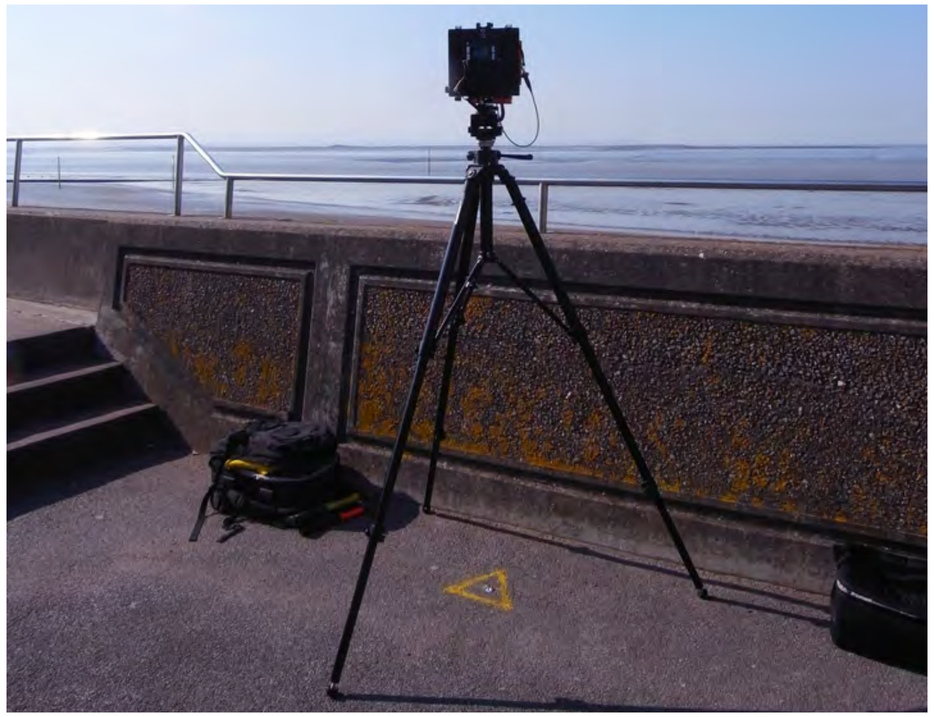


Record keeping

Accurate viewpoint location

5 Photography

Professional architectural photography equipment



Camera in position

Accurate viewpoing matching

5.0 All photography was carried out by a professional architectural photographer fully briefed, trained and audited in the capture of photography for verifiable imagery

5.1 For each image the photographer used the following equipment:

Camera: Arca Swiss F-Compact 6x9 Camera

Digital Back: Phase One P45+

Lens: 35mm Schneider Apo Digital Lens

The images were processed initially by the photographer to achieve results that best reflected the experience of each scene at the time of the photography.

5.1 The scenes were photographed using the survey markers to accurately identify the view locations. A plumb line was used to ensure that the centre of the camera was directly over the surveyed viewing positions at a height of 1.70 metres. A log was kept of the time and date that the photographs were taken so that lighting conditions could be recreated in the computer model.

5.2 There is no single definitive camera and lens format that is suitable for all planning photomontage work. Choices need to be made with care and clearly explained through method statement / annotation. Single panel landscape photography taken with a 40º lens (50mm lens / 35mm camera) is most often likely to be inadequate for purpose and is not recommended as it may be unrealistic. If chosen appropriately, correctly annotated, and with professional understanding by those assessing, there is little to be lost by using wider angle lenses (up to 70º), as this can add peripheral information that more closely reflects the viewers 'experience' of a scene.

5.3 Very wide angle single lens views can minimise impact and as such this technique is also inappropriate. Through a careful choice of lenses that allow wider fields of views, landscape is able to be better assessed. The use of hybrid lenses/photographic solutions (ref. Multi-Lens section 9.2) ensure that distortion issues can be minimised for panoramic images.

Hayes Davidson recommends that all parties are mindful that Environmental Statement photomontage should be used as a compliment to site based assessment.

6 Surveying

6.0 During the site visit Hayes Davidson identified key static points such as building corners, road edges and street furniture that would be visible within each photograph. A chartered measured engineering surveying company surveyed the points as described below and the information was issued digitally.

6.1 Additionally, the surveyors identified 3 or 4 objects within the scene, which fell along the horizon line of each photograph. Numbered camera positions were surveyed using line of sight surveying and aligned to the local site grid in easting, northing and elevation supplied by the architect and to the Ordnance Survey National Grid (OSGB36) in easting and northing, and in elevation to the Ordnance Survey Datum (OSD) using the OSTN02 GPS transformation.

6.2 A line of sight, two station baseline is established, coordinated and levelled utilising GPS observations.

6.3 The survey control stations are either observed by GPS or traversed from GPS-observed points. The Leica Smart Net GPS correction service was used to capture and transform the data from the WGS84 universal GPS coordinate system to the Ordnance Survey National Grid (OSGB36) National Grid using the OSTN02 transformation and is accurate in both position and height. Relative height accuracies comparable to geodetic levelling can be achieved, without visiting any existing OS bench marks.

6.4 A Total Station capable of measuring horizontal and vertical angle observations combined with an internal co-axial non contact distance measuring device accurately measured and stored the three dimensional coordinates of the key features from the control stations.

6.5 The required horizon line within the image is established using the horizontal collimation of the Total Station. The horizon line coordinates were surveyed and stored.

6.6 Surveying equipment used:

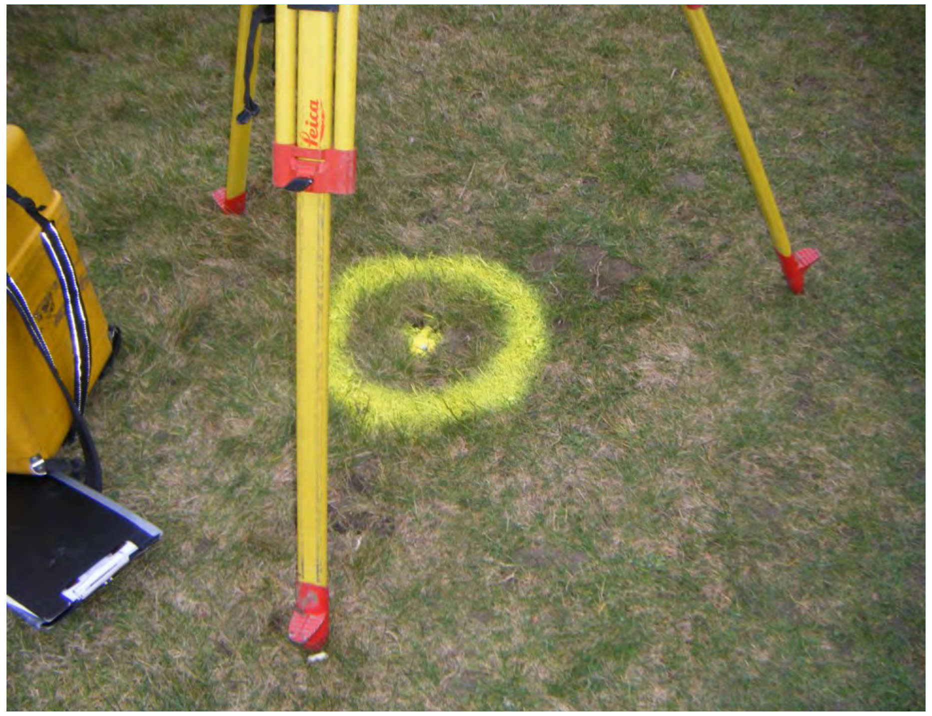
GPS - Leica GPS / TCR 1200 Smart Station.

Trimble 5600 Reflectorless Total Station with a 5” angle measuring accuracy and 3mm + 2ppm distance measuring accuracy.

6.7 Processed Data Delivery:

Coordinate and level data in Excel file format, together with DWG and JPG files detailing the observed points and the horizon line.

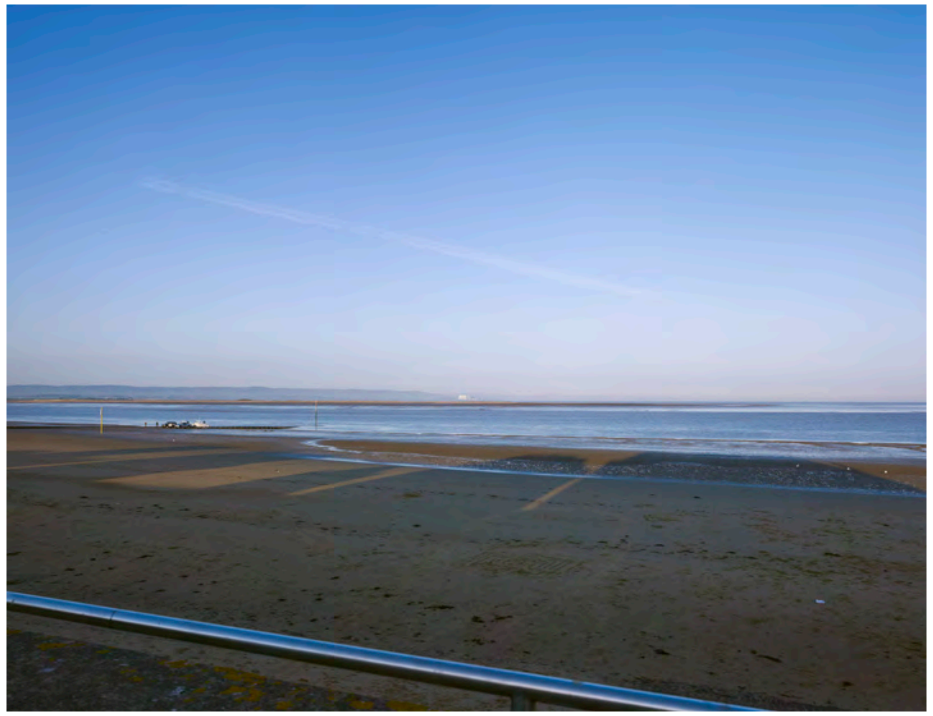
On-site surveying



Accurate viewpoint matching

Context point surveys

7 Colour correction and baseline adjustment



Uncorrected image as supplied by photographer

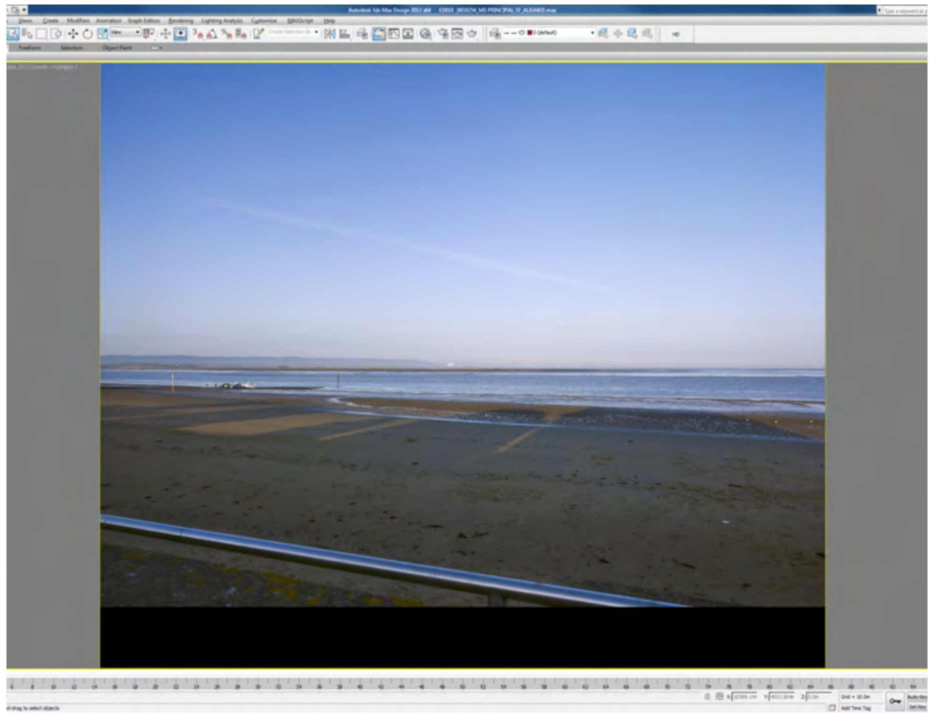
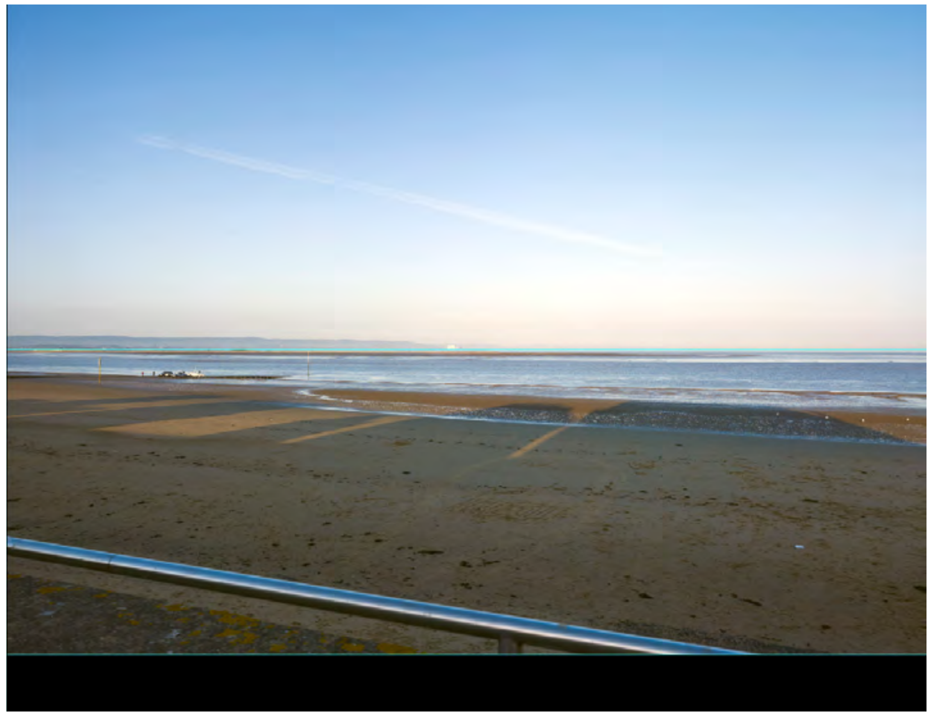


Image being corrected in 3D software



Corrected horizon and colour

7.0 All baseline images were reviewed by YRM, Gillespies and EDFEnergy prior to being used for the production of imagery. Where images were deemed not to be of sufficient quality for the production of imagery, the scenes were reshot by the photographer using the methods described previously.

7.0 The digital images supplied by the photographer were saved as Photoshop PSD files for use in the verification process.

7.1 Using the surveyed horizon points as a guide, the images are checked and rotated, if necessary, to ensure that the horizon line on the photograph is level, based upon the information received from the surveying team.

7.2 Any incorrect colour 'casts' are adjusted to match the original images. Similarly the brightness/contrast ratios of the images are corrected to match the original images.

7.3 In professional architectural photography, having the camera pointing 'horizontally' (parallel with the ground) is desirable to ensure that vertical elements of the photographed scene remain perpendicular to the horizon. In reality the eye and brain compensate for non-perpendicular verticals and it is desirable to replicate this with photography. The tripods used by professional architectural photographers have built-in spirit level 'bubbles' to assist the photographer in keeping the vertical building elements 'vertical'. The photographer also uses a secondary spirit level to check the verticality through 360 degrees.

7.4 Following from 7.3 above, the cameras used by professional architectural photographers have the ability to 'shift' the back of the camera upwards which removes the 'static' nature of having the horizon midway along the vertical dimension of the photograph (as opposed to a standard 35mm camera) and allows for the inclusion of more sky over immediate foreground. This is standard practice within architectural photography and more realistically reflects the viewer's experience on site. The photographer employed this technique at his discretion and recorded the results of each shift, where used.

7.5 The 'virtual' cameras in proprietary 3D software typically do not have this 'shift-negative' feature and so their horizon line will always bisect the vertical dimension of the view when the camera's view cone is positioned parallel to the ground plane. Consequently the baseline images are further resized to ensure that the surveyed horizon line bisects the background image in the vertical dimension

8 3D digital modelling

8.0 All drawn and digital information regarding the proposed development was supplied to Hayes Davidson in digital and hardcopy format by YRM Architects and Gillespies Landscape Architects.

8.1 For each building or structure, YRM Architects provided plans, sections and elevations that detailed the proposed construction.

8.2 The ground level and height of each building or structure was provided on the sections and elevations measured in metres and in metres Above Ordnance Datum (mAOD).

8.3 For the position of each building, YRM provided a masterplan drawing in digital format that located the footprint of each building based on Ordnance Survey National Grid.

8.4 Materials information was provided by YRM in digital format as PDF and JPG. Colour information for solid materials was provided with colour references and precedent images. Coloured elevations were also supplied in digital format for reference.

8.4 On site landscaping details was provided by YRM Architects in digital format. The plans and sections provided showed levels in mAOD format together with delineated material boundaries and finishes.

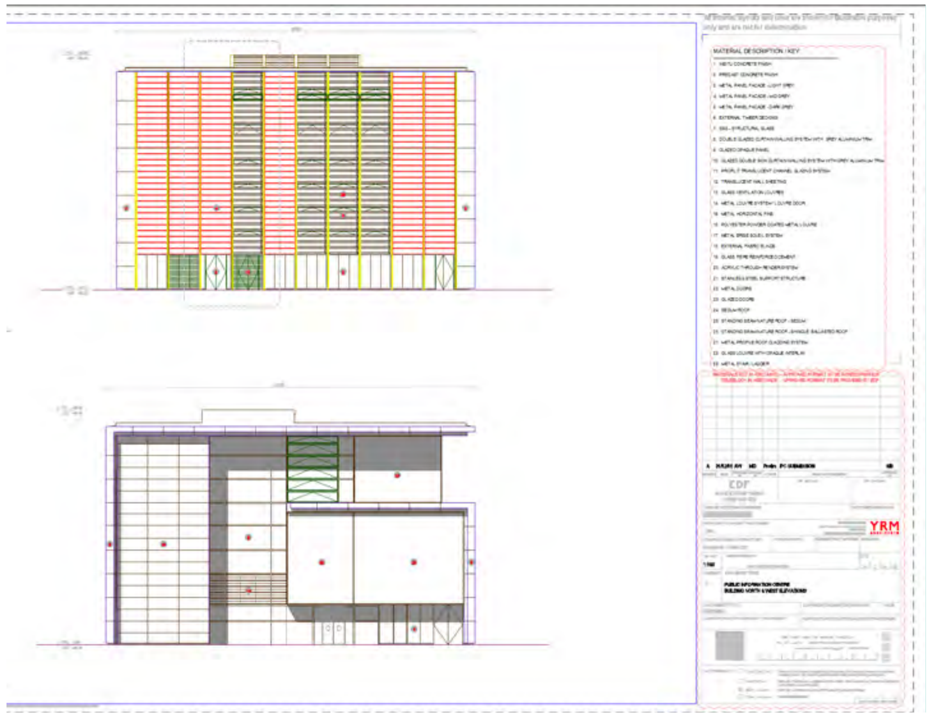
8.5 Off site landscaping details were provided by Gillespies Landscape Architects. Plans in digital format showing the location of each area of planting were provided. Further plans were provided in 3D digital format of the proposed landform terrain.

8.6 Precedent images and species information were provided by Gillespies Landscape Architects for each element of landscaping. Growth heights for each area were provided in tabular format.

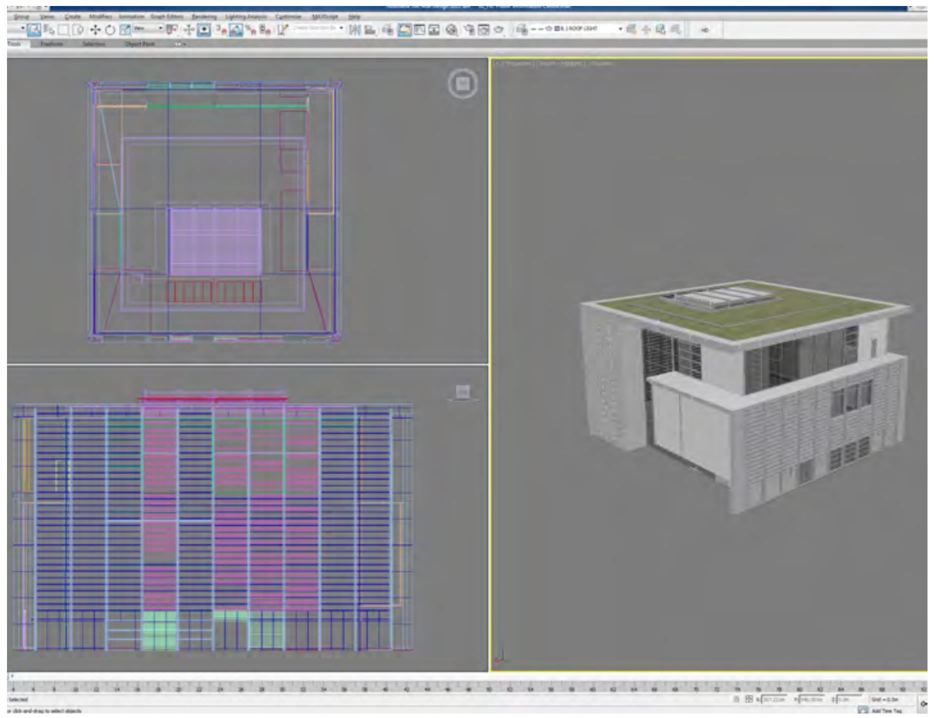
8.7 It was requested that part of the site be shown with landscape growth at 15 years, part at 20 years and part at 25 years to allow for advance planting works that would take place prior to construction of the main site.

8.8 All of the supplied information was modeled in 3D using 3DS Studio Max modeling software. The information was checked internally by Hayes Davidson against the provided information and externally by YRM and Gillespies.

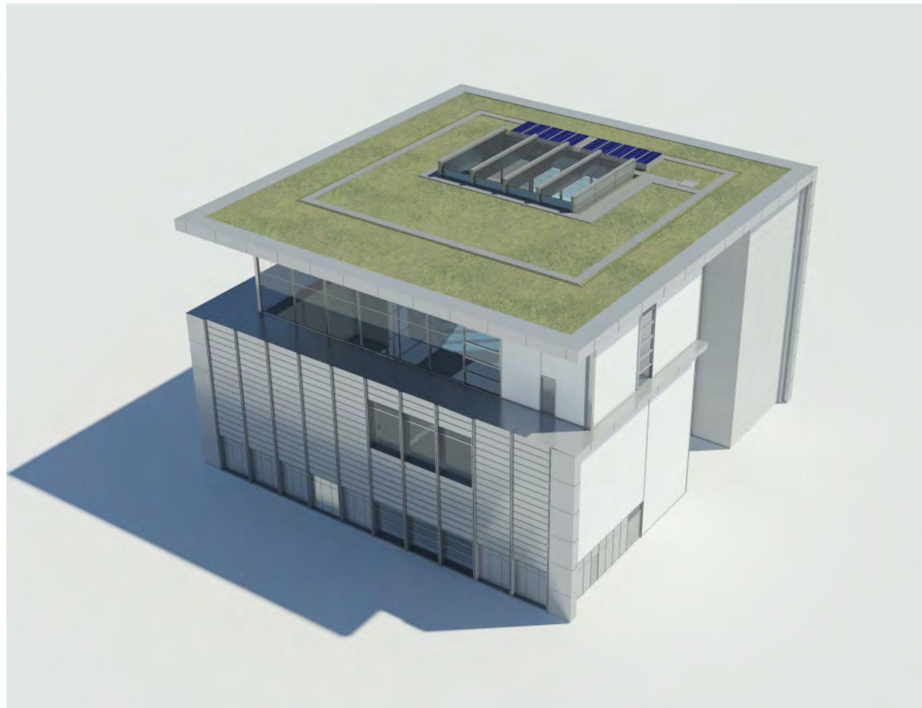
8.9 Appendix 3 shows the buildings located on the final masterplan.



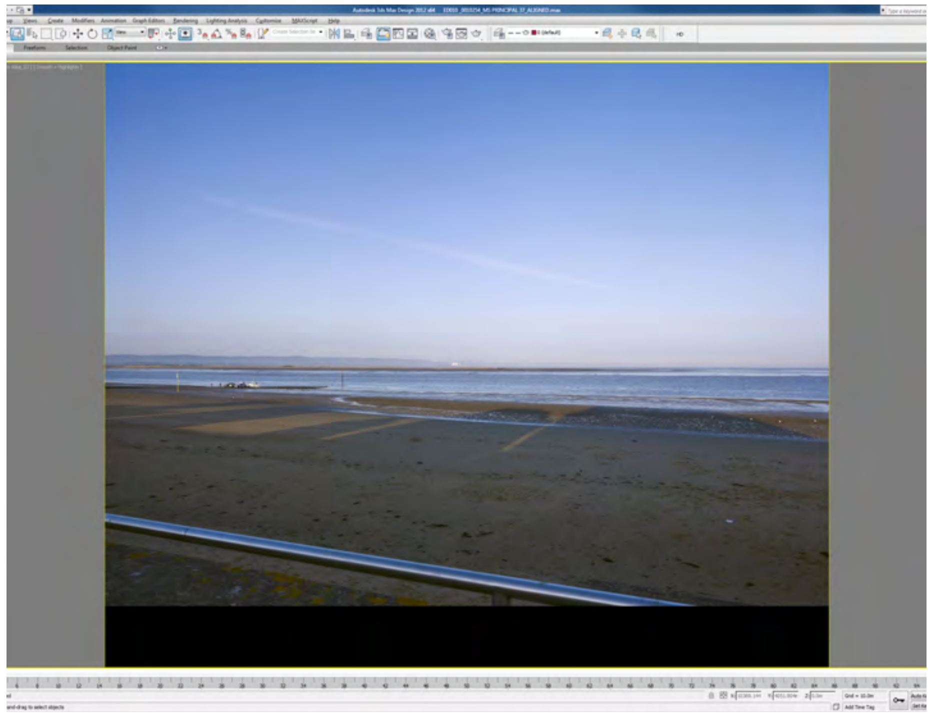
Supplied 2D drawings



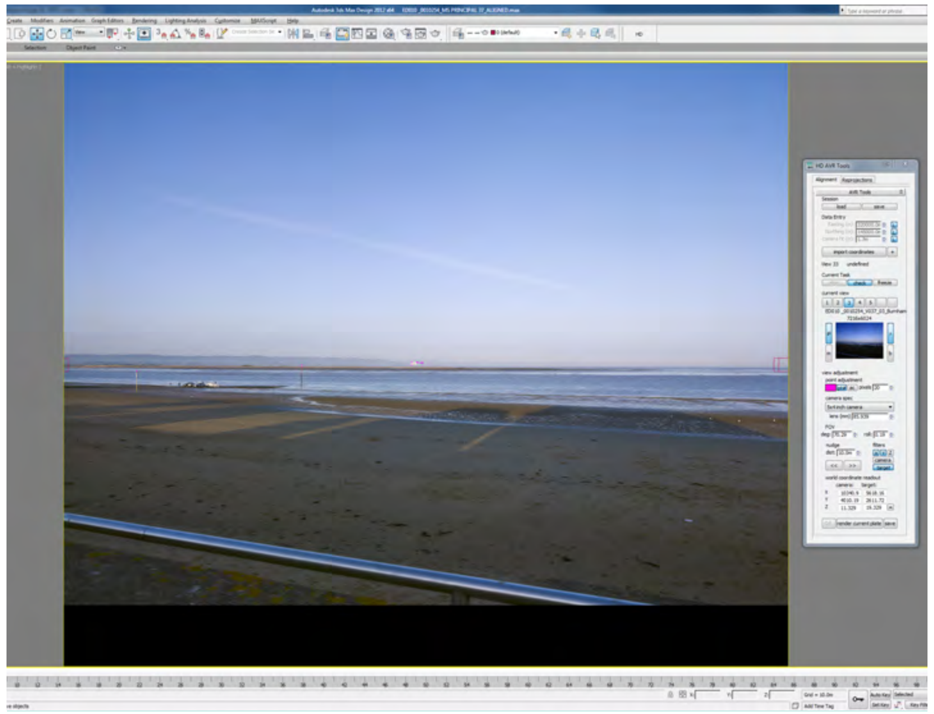
Modelling of structures



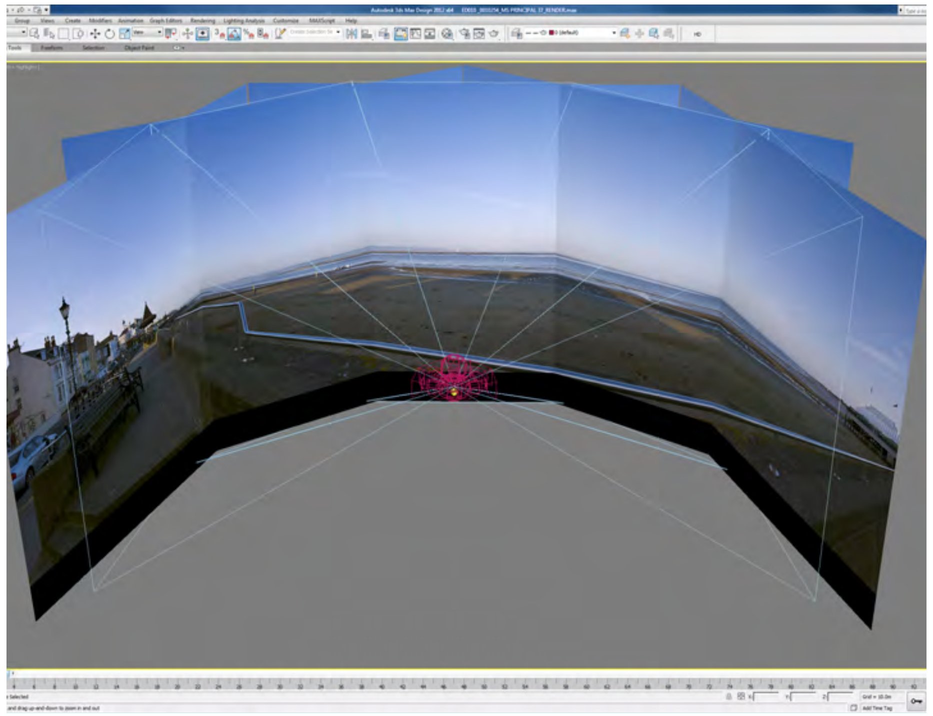
3D model



Background plate



Alignment script



Multi-lens

Surveyed context

9 Camera matching / alignment

9.0 For each view position a virtual camera was set up in the 3D software using the coordinates provided by the surveyor. The 3D coordinates of the additional surveyed verification points were used to create an accurate model of the contextual surveyed parts of the scene.

9.1 The scene was verified by matching the contextual surveyed points between the data scene and the photographers corrected baseline photograph. The contextual survey points were used as a check against the target position and the field of view of the virtual camera.

9.2 Where multiple images are required to create wider scenes, Hayes Davidson use a technique developed in-house called Multi-Lens.

9.3 Each individual image was aligned using the process above. The virtual cameras are then merged into a single scene in the 3D software, thus creating a merged wide image. This technique reduces the distortion caused by using wider lenses.

9.4 The 3D models of the proposal are then referenced to each verified camera scene.

10 Image production

10.0 During image production, the computer generated images, or 'render' of the proposed building are combined with the background photographs using proprietary digital compositing software.

10.1 Whilst position, height and scale will be objectively accurate, subjective judgement must be used when lighting is being assessed and therefore a definitive and objectively verified agreement on lighting is not possible.

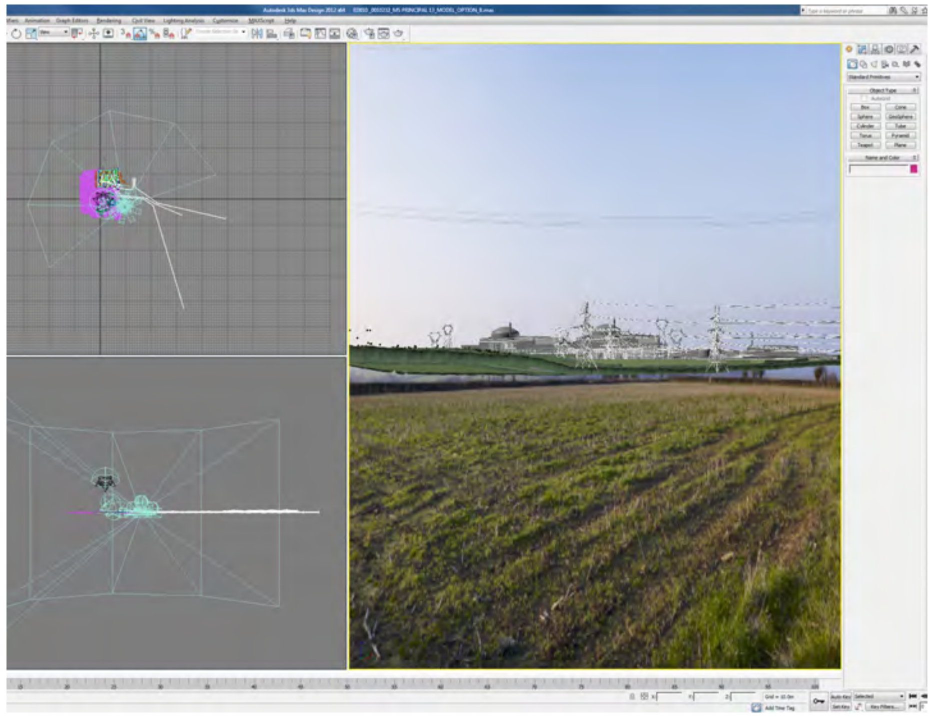
10.2 In fully rendered views, a lighting simulation is used to determine the direct sunlight component within the scene. The simulation model is a mathematical process that uses latitude, longitude, building orientation, date and time to create an accurate sun position within the 3D computer scene.

10.3 Material characteristics were applied to the models to replicate those being used in the proposed buildings. Materials within the photograph, similar in nature to those being proposed, were examined to establish how the new building would look in the photograph.

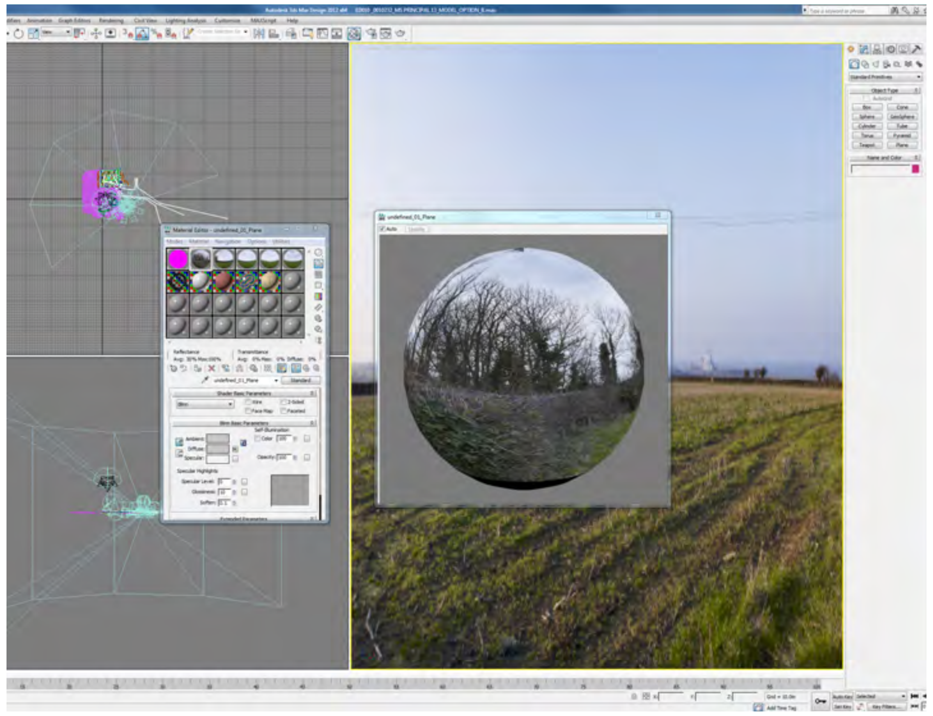
10.4 Using the verified camera described previously, the computer produces an image, known as a render, of the proposals using the geometry, material and lighting definitions specified. The materials and appearance is then approved by the architectural team.

10.5 Buildings with a similar orientation to the proposed building within the scene were used as a reference to obtain visual clues as to how the light would react with the proposed building. Materials within the scene, similar in nature to those being proposed, were also examined to establish how they react to the prevailing lighting condition. Consideration was also given to the proposed building surface types, level of transparency/reflection of the building envelopes and the angle of the reflective surfaces to the camera.

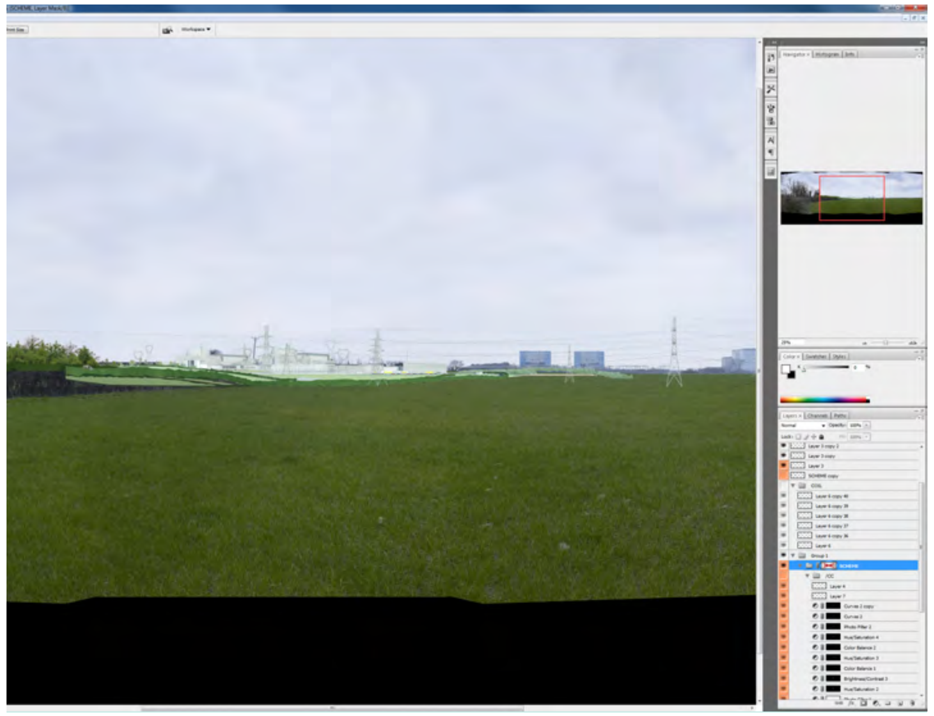
10.6 Hayes Davidson analysed each scene and assessed tonal values. We used the computer software functionality to take multiple digital samples of values for hue, saturation and brightness from a number of scenes in the photograph. From this an analysis and assessment of the likely tonal and colour values in the scene was made.



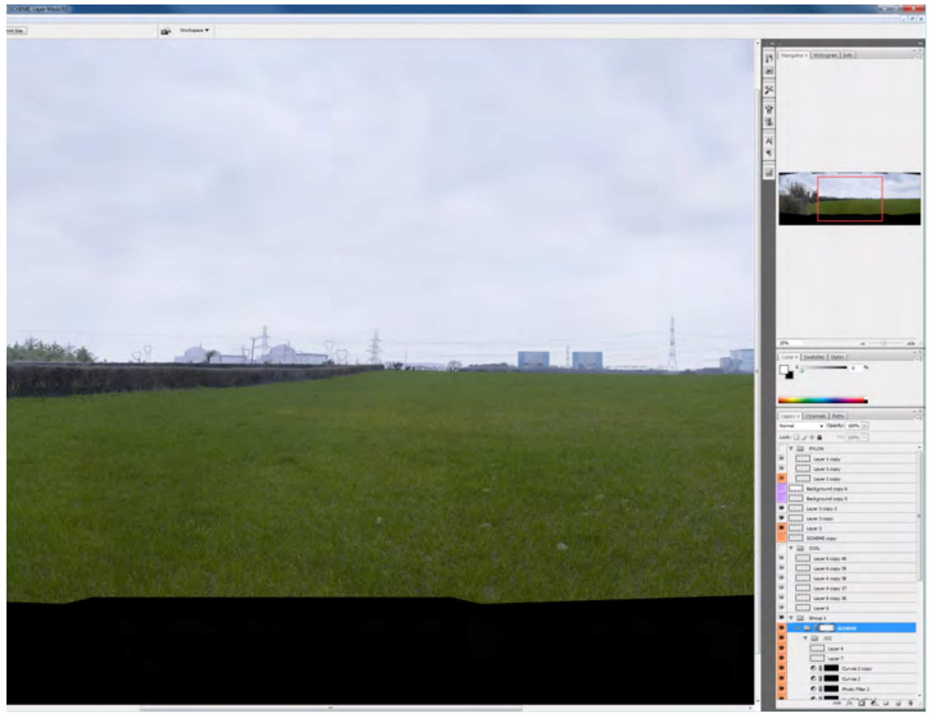
On-site photography



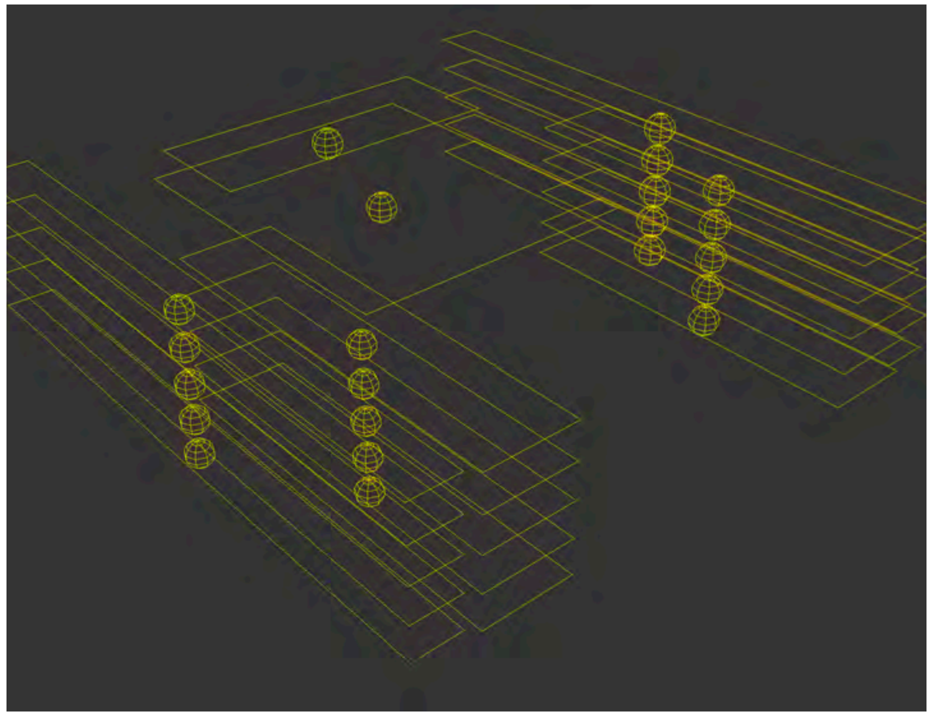
Modelling of structures

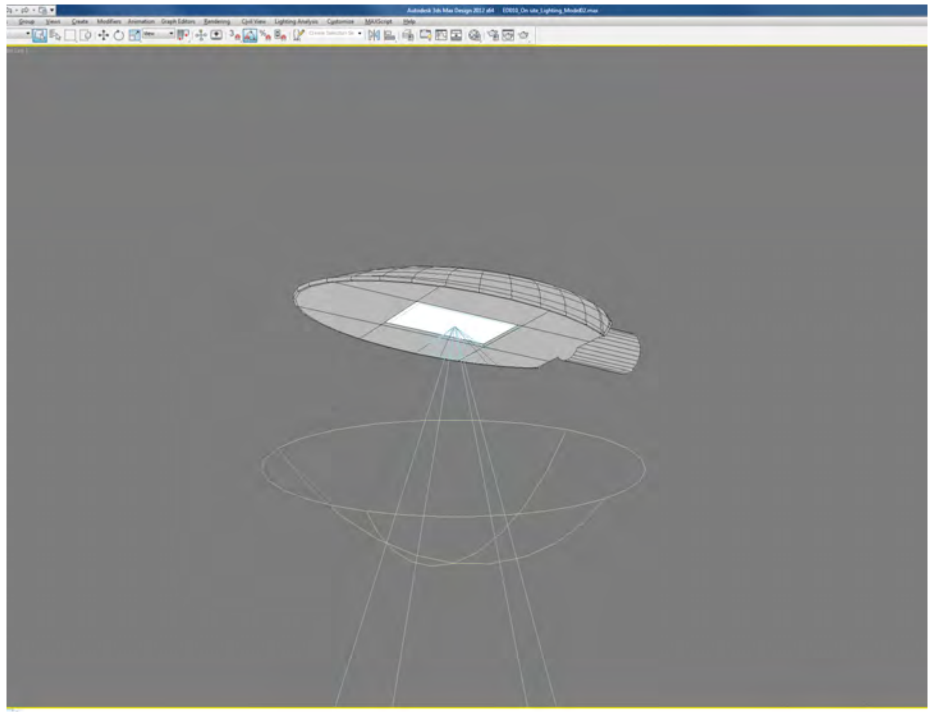


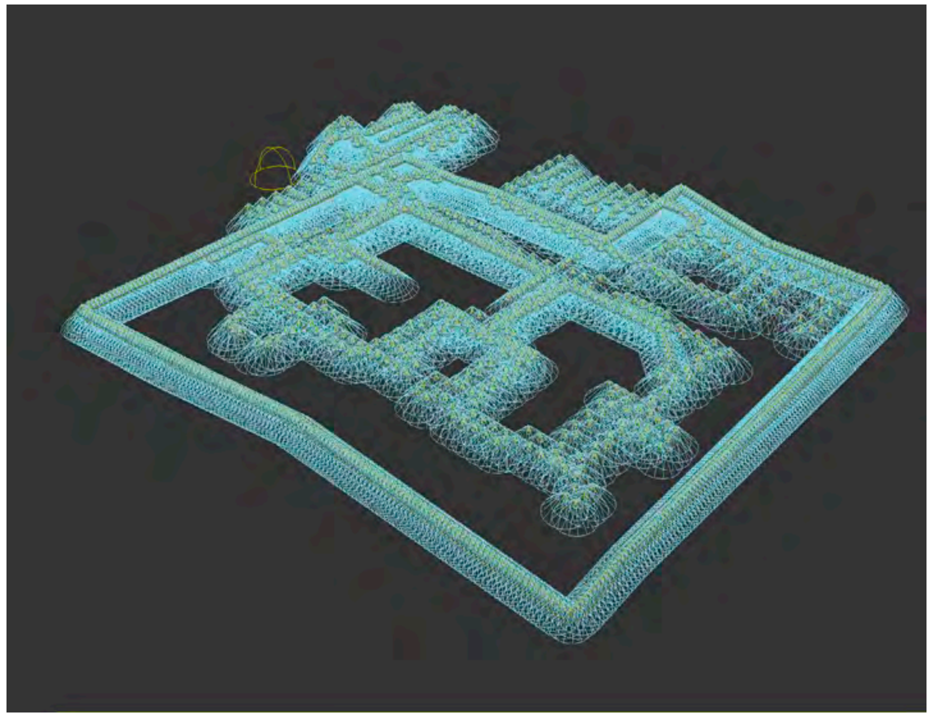
Accurate viewpoint location



Terrain modelling


Lights positioned in floor plates


Modelled exterior light fixture


Position and influence of exterior lighting in 3D


Dusk view close-up

11 Dusk Images

11.0 Thirteen of the agreed viewpoints were required to be shown in dusk lighting conditions.

11.1 The 13 viewpoints were agreed with the statutory and local consultees,

11.2 Each viewpoint was visited by the photographer at dusk, the photographer setting up over the agreed view position marker as previously described.

11.3 Each scene was captured in the same way as previously described using a series of overlapping image panels.

11.4 It was essential that the photographer achieved a clear view of the proposed site area at a time where physical elements would still be visible in order to aid the camera matching process.

11.5 The digital 3D models built for each part of the proposal and used in the production of the daylight images were used for the production of the dusk images.

11.6 In order to represent light spill from the interior of proposed buildings, floor plates and lighting were added to the interior of each building where light spill would be seen.

11.7 For each enclosed floor area a single light at a lux/lumen value of 500 has been placed in the centre of the area. A lux/lumen value of 500 is recommended as being appropriate for interior office environments by The Chartered Institution of Building Services Engineers.

11.8 For exterior lighting, 2D drawings and specifications were provided by YRM for each individual ground placed lighting column. Each of these lights was positioned in the 3D model at the provided location.

11.9 The physical geometry of each light was modelled to accurately reflect the behaviour of the light when placed in real world conditions. This was deemed more accurate than using simulated lighting via a 3D rendering package.

11.10 All lumen outputs, heights intensities and directions were modelled based on the supplied 2D information.

12 Real scale viewing

12.0 It is important to remember that Accurate Visual Representations should be treated as an aid to visual assessment and are not a substitute to site based assessment of an individual scene.

12.1 When assessing a development using Visually Verifiable Images the scale of the development in the scene should be taken into account together with what the human eye will experience at the scene.

12.2 The aim of Visually Verifiable Images is to represent the landscape or townscape context or proposed develeopment that is under consideration as accurately as is practically possible.

12.3 The Visually Verifiable Images produced by Hayes Davidson for the Hinkley Point C development have been produced in accordance with Landscape Institute Guidelines advice note 01/2011, based on the following criteria that the images should :

- be reproduced at a size and level of geometric accuracy to permit impact assessment, which must include inspection at the location where the photograph was taken;

- be based on a replicable, transparent and structured process, so that the accuracy of the representation can be verified, and trust established;

- use techniques, with appropriate explanation, that in the opinion of the landscape professional best represent the scheme under consideration and its proposed environment accurately as possible;

- be easily understood, and usable by members of the public and those with a non-technical background;

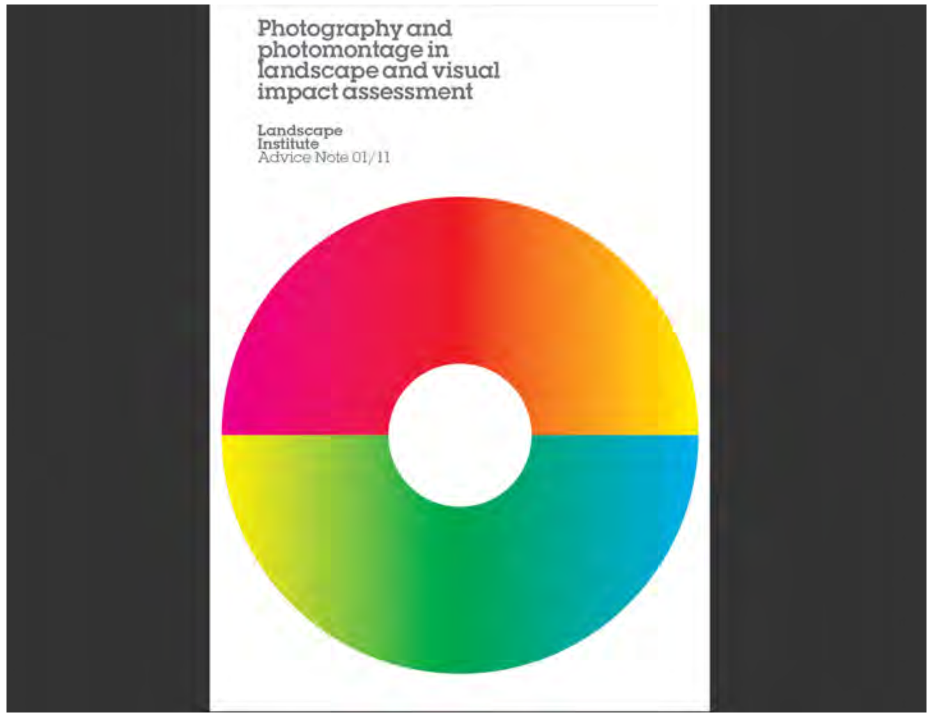
- be based on a good quality photographic image taken in representative weather conditions

12.4 In order to assess the images at a size and resolution suitable for use in assessment work in the field the images have been prepared with a field of view and viewing distance that accurately reconstructs the perspective and scale of elements experienced at the scene.

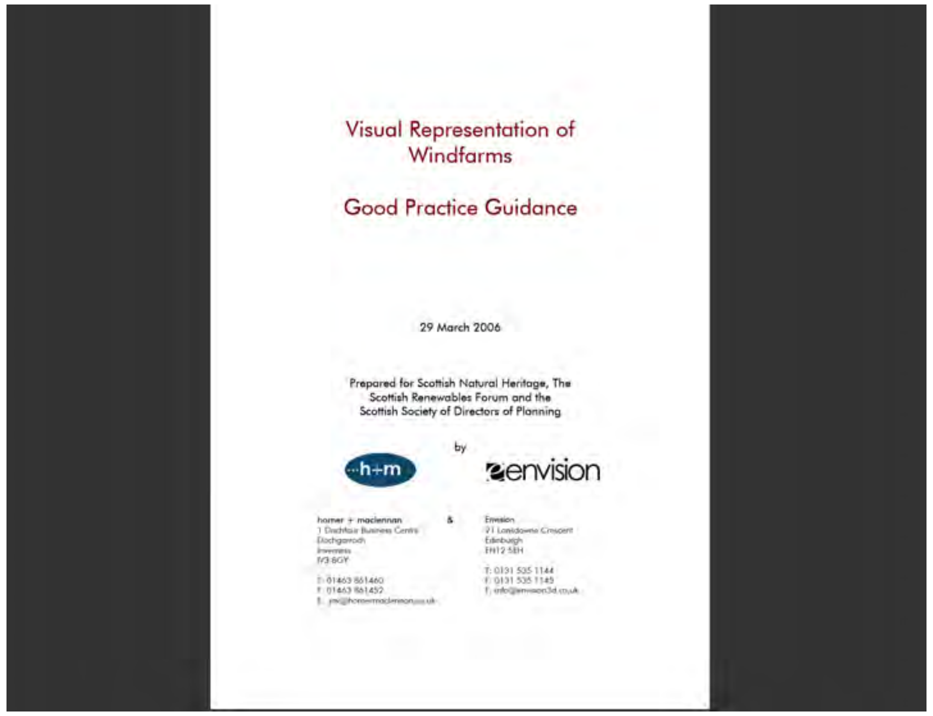
12.5 A viewing distance of 400mm was chosen for the final printed versions fo each of the Visually Verifiable Images. This distance is at the middle of the recommended 300-500mm viewing distance proposed by the Landscape Institute Advice Note 01/2011.

12.6 A horizontal field of view of 160 degrees and a vertical field of view of 55.5 degrees was chosen for each of the final printed versions of the Visually Verifiable Images. Combined with the vewing distance of 400mm this gives the assessor the opportunity view the proposed development a t a scale, resolution and perspective that closely matches that experienced at the scene.

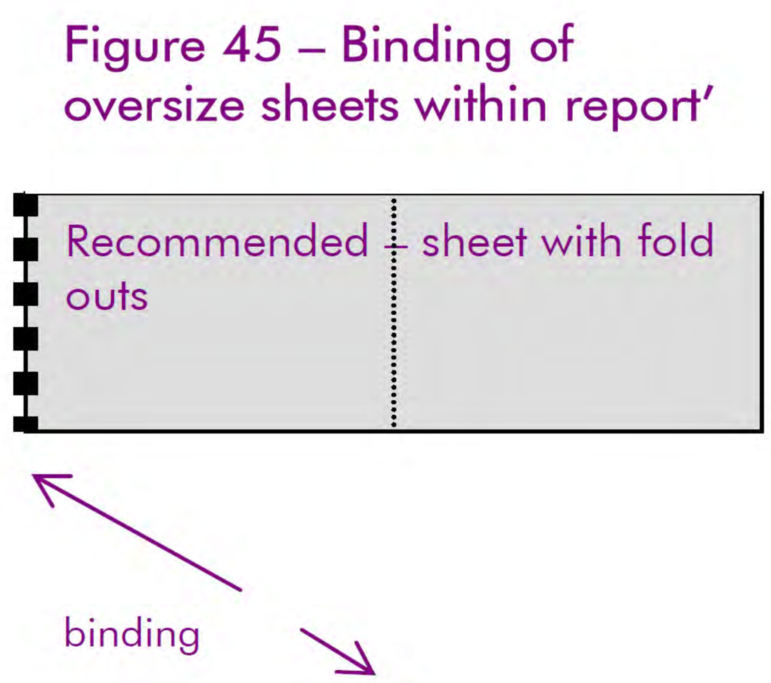
12.7 As advised by the Landscape Institute Advice Note 01/2011 the method for determining the viewing distance has been calculated using Scottish Natural Heritage's Good Practice guide for the representaion of windfarms SNH 2006, para 126.



Landscape Institute Guidelines



SNH Good Practice Guide



SNH recommended printing and binding of panoramic images

Panoramic image examples

13 Notes

Subject to accurate survey information, the position and scale of a building in a scene can be verified mathematically. Whilst position, height and scale will be objectively accurate, subjective judgement must be used when lighting is being assessed and therefore a definitive and objectively verified agreement on lighting is not possible.

The computer can accurately assess the relative contrast between the faces of a building at a particular time. The computer can also render approximate material definitions. However, not every aspect of what is seen visually on screen is able to be simulated using an automatic or wholly objective process. Reflected light, local lighting conditions, detailed material definitions, climatic conditions including moisture content of the air both across the scene as a whole and locally cannot be accurately assessed or simulated by current computer technology. We therefore turn to the scene for visual clues in order to set the render of the proposed development into the photograph.

EDF Energy Hinkley Point C

Visually Verifiable Images - methodology

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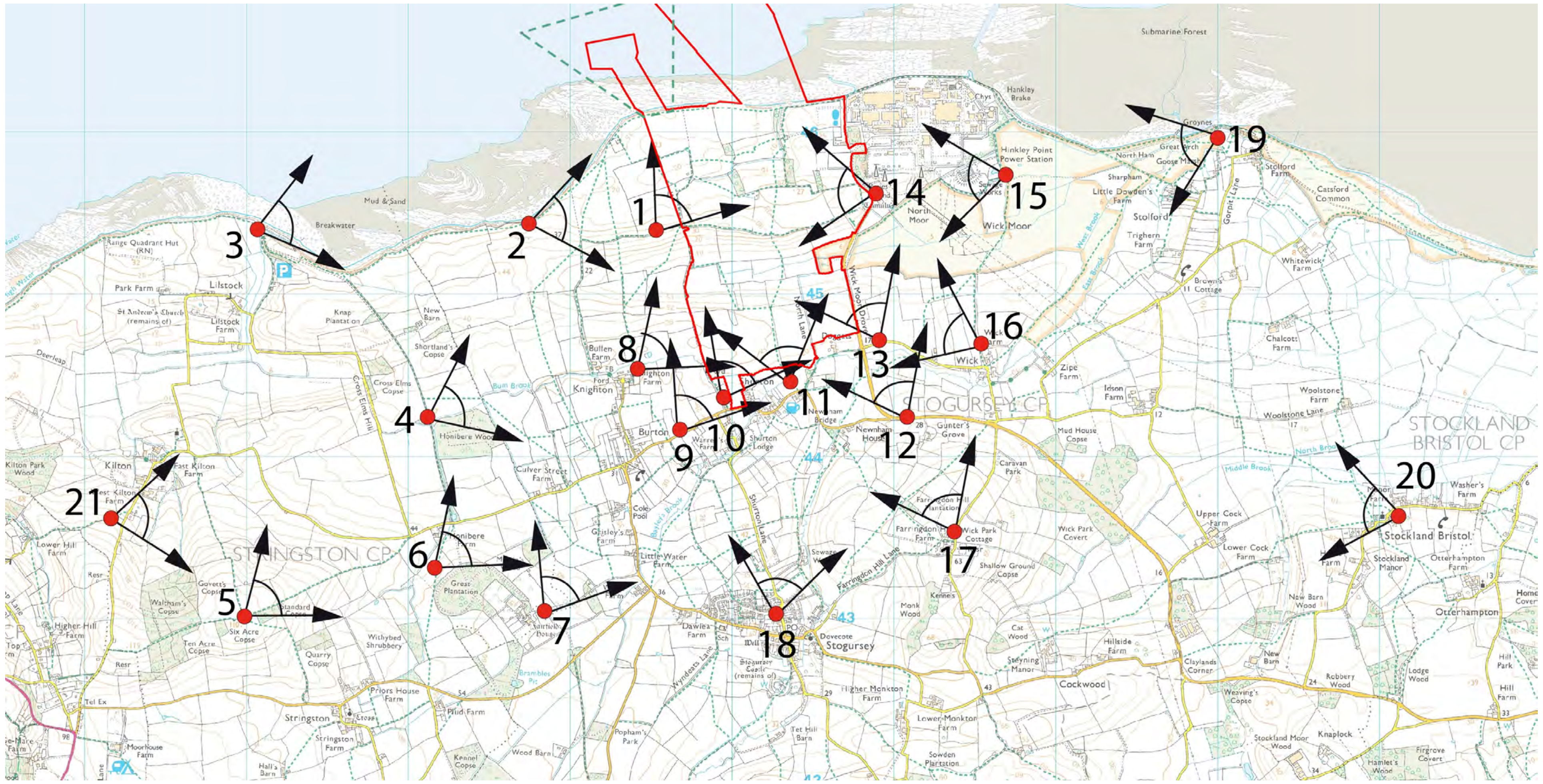
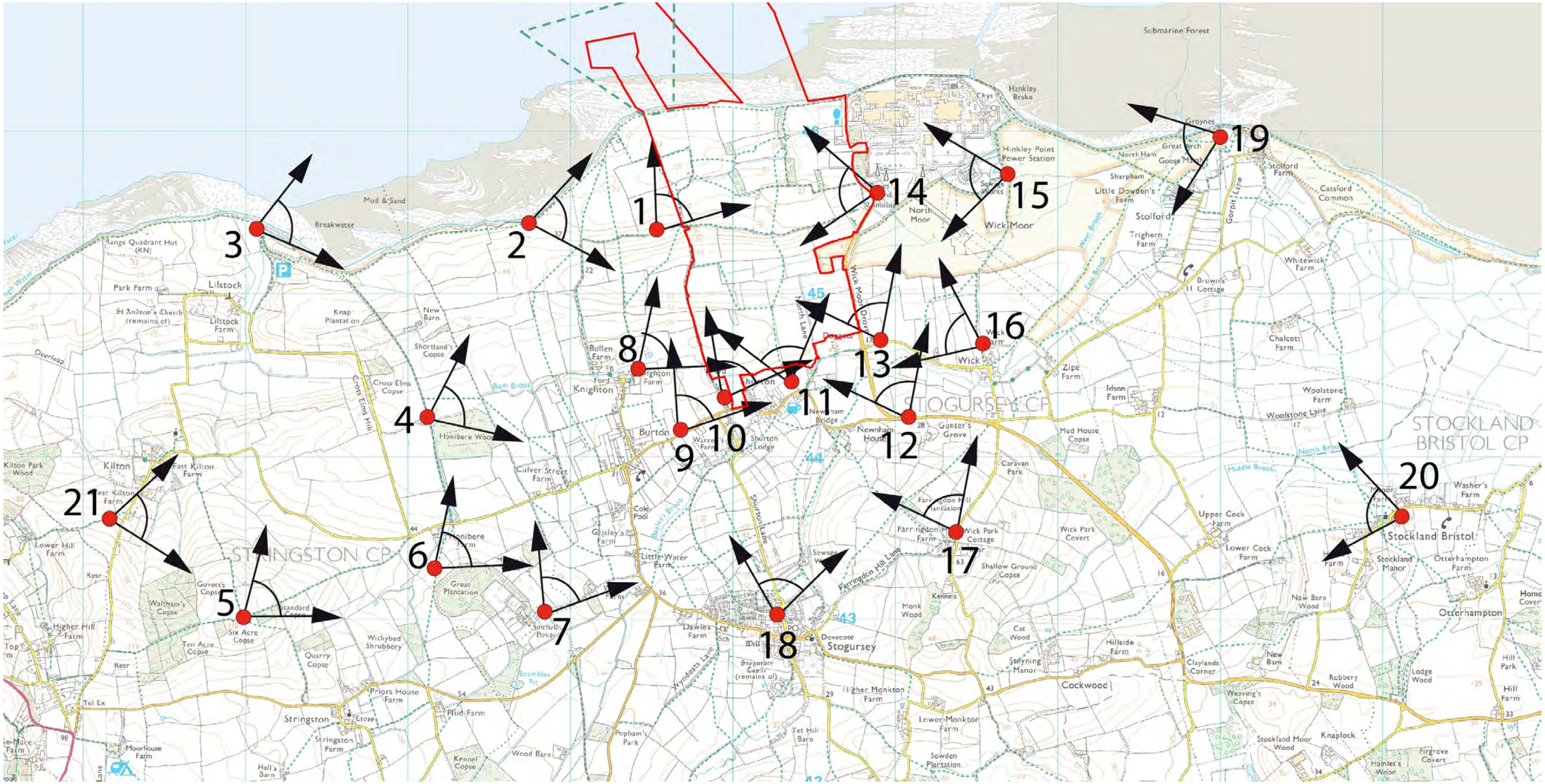
Appendix A

Viewpoints - all views



Viewpoints - local views



View Number	Day View	Dusk View	Camera/ Tripod Height (m)	HFOV (degrees)	VFOV (degrees)	Lens Used (mm)	Day Date	Day Time	Dusk Date	Dusk time	Easting (m)	Northing (m)	Elevation (mAOD)	Eye level (mAOD)
MS PRINCIPAL 01	Yes	No	1.7	160	55.5	35mm	28/02/2011	13:40	N/A	N/A	319604.031	145399.625	34.968	36.668
MS PRINCIPAL 02	Yes	No	1.7	160	55.5	35mm	03/03/2011	12:50	N/A	N/A	318775.579	145447.916	26.583	28.283
MS PRINCIPAL 03	Yes	Yes	1.7	160	55.5	35mm	04/03/2011	12:10	01/07/2011	22:20	317149.41	145397.931	8.8	10.5
MS PRINCIPAL 04	Yes	No	1.7	160	55.5	35mm	03/03/2011	15:50	N/A	N/A	318139.571	144212.753	26.119	27.819
MS PRINCIPAL 05	Yes	No	1.7	160	55.5	35mm	04/03/2011	09:30	N/A	N/A	317047.81	143025.154	106.647	108.347
MS PRINCIPAL 06	Yes	No	1.7	160	55.5	35mm	08/03/2011	10:20	N/A	N/A	318180.359	143258.296	50.24	51.94
MS PRINCIPAL 07	Yes	Yes	1.7	160	55.5	35mm	08/03/2011	08:55	14/06/2011	22:10	318886.662	143059.606	43.426	45.126
MS PRINCIPAL 08	Yes	No	1.7	160	55.5	35mm	04/04/2011	16:15	N/A	N/A	319392.437	144483.336	23.448	25.148
MS PRINCIPAL 09	Yes	Yes	1.7	160	55.5	35mm	06/04/2011	11:45	03/07/2011	22:22	319518.472	144212.335	27.156	28.856
MS PRINCIPAL 10	Yes	Yes	1.7	160	55.5	35mm	03/03/2011	10:35	15//06/2011	22:01	319944.096	144343.864	23.264	24.964
MS PRINCIPAL 11	Yes	Yes	1.7	160	55.5	35mm	01/03/2011	16:20	02/07/2011	22:22	320400.676	144422.657	18.267	19.967
MS PRINCIPAL 12	Yes	Yes	1.7	160	55.5	35mm	01/03/2011	14:45	27/006/2011	22:05	321094.478	144237.55	27.612	29.312
MS PRINCIPAL 13	Yes	No	1.7	160	55.5	35mm	01/03/2011	16:55	N/A	N/A	320955.325	144715.532	16.093	17.793
MS PRINCIPAL 14	Yes	No	1.7	160	55.5	35mm	04/03/2011	12:00	N/A	N/A	320898.517	145591.479	13.248	14.948
MS PRINCIPAL 15	Yes	No	1.7	160	55.5	35mm	01/03/2011	11:45	N/A	N/A	321684.764	145720.174	4.954	6.654
MS PRINCIPAL 16	Yes	Yes	1.7	160	55.5	35mm	06/04/2011	09:30	28/06/2011	22:05	321525.201	144668.001	12.468	14.168
MS PRINCIPAL 17	Yes	No	1.7	160	55.5	35mm	04/03/2011	16:00	N/A	N/A	321383.085	143565.697	60.402	62.102
MS PRINCIPAL 18	Yes	Yes	1.7	160	55.5	35mm	06/04/2011	10:30	04/07/2011	22:14	320307.788	143047.327	33.481	35.181
MS PRINCIPAL 19	Yes	Yes	1.7	160	55.5	35mm	08/03/2011	12:00	16/06/2011	22:03	322940.398	145987.046	8.81	10.51
MS PRINCIPAL 20	Yes	No	1.7	160	55.5	35mm	08/03/2011	09:25	N/A	N/A	323966.156	143595.463	15.431	17.131
MS PRINCIPAL 21	Yes	No	1.7	160	55.5	35mm	10/03/2011	14:45	N/A	N/A	316215.534	143623.705	61.089	62.789

View Number	Day View	Dusk View	Camera/ Tripod Height (m)	HFOV (degrees)	VFOV (degrees)	Lens Used (mm)	Day Date	Day Time	Dusk Date	Dusk Time	Easting (m)	Northing (m)	Elevation (mAOD)	Eye level (mAOD)
MS PRINCIPAL 22	Yes	No	1.7	160	55.5	35mm	04/03/2011	14:50	N/A	N/A	313755.421	144032.418	19.585	21.285
MS PRINCIPAL 23	Yes	No	1.7	160	55.5	35mm	14/06/2011	14:00	N/A	N/A	313775.519	143697.896	42.265	43.965
MS PRINCIPAL 24	Yes	No	1.7	160	55.5	35mm	08/03/2011	12:10	N/A	N/A	317232.679	140531.294	100.465	102.165
MS PRINCIPAL 25	Yes	No	1.7	160	55.5	35mm	10/03/2011	10:45	N/A	N/A	318997.436	140295.054	81.962	83.662
MS PRINCIPAL 26	Yes	No	1.7	160	55.5	35mm	06/04/2011	16:00	N/A	N/A	312451.666	140993.869	310.385	312.085
MS PRINCIPAL 27	Yes	Yes	1.7	160	55.5	35mm	07/04/2011	14:10	29/06/2011	22:15	315740.418	140771.624	130.805	132.505
MS PRINCIPAL 28	Yes	No	1.7	160	55.5	35mm	06/04/2011	17:30	N/A	N/A	315651.104	140079.76	239.508	241.208
MS PRINCIPAL 29	Yes	Yes	1.7	160	55.5	35mm	09/03/2011	17:40	30/06/2011	22:05	317422.22	139412.869	197.651	199.351
MS PRINCIPAL 30	Yes	No	1.7	160	55.5	35mm	09/03/2011	09:40	N/A	N/A	314839.019	138368.071	327.93	329.63
MS PRINCIPAL 31	Yes	No	1.7	160	55.5	35mm	04/04/2011	13:00	N/A	N/A	316532.516	135155.302	384.242	385.942
MS PRINCIPAL 32	Yes	No	1.7	160	55.5	35mm	06/04/2011	18:50	N/A	N/A	319045.275	132690.215	330.301	332.001
MS PRINCIPAL 33	Yes	No	1.7	160	55.5	35mm	06/04/2011	13:40	N/A	N/A	321418.579	133298.575	288.988	290.688
MS PRINCIPAL 34	Yes	Yes	1.7	160	55.5	35mm	07/04/2011	15:00	26/06/2011	22:22	322130.318	134312.479	216.246	217.946
MS PRINCIPAL 35	Yes	No	1.7	160	55.5	35mm	09/03/2011	11:30	N/A	N/A	324664.751	140473.941	76.777	78.477
MS PRINCIPAL 36	Yes	No	1.7	160	55.5	35mm	04/04/2011	10:30	N/A	N/A	331728.816	141041.278	39.555	41.255
MS PRINCIPAL 37	Yes	Yes	1.7	160	55.5	35mm	09/04/2011	07:38	13/06/2011	22:07	330340.924	149010.192	9.629	11.329
MS PRINCIPAL 38	Yes	No	1.7	160	55.5	35mm	09/04/2011	10:29	N/A	N/A	334075.795	150915.34	138.712	140.412
MS PRINCIPAL 39	Yes	No	1.7	160	55.5	35mm	09/04/2011	08:15	N/A	N/A	329096.002	153646.748	7.016	8.716
MS PRINCIPAL 40	Yes	No	1.7	160	55.5	35mm	09/04/2011	09:10	N/A	N/A	329480.732	158807.829	63.938	65.638
MS PRINCIPAL 41	Yes	No	1.7	160	55.5	35mm	09/04/2011	11:25	N/A	N/A	334642.873	157629.528	124.611	126.311
MS PRINCIPAL 42	Yes	No	1.7	160	55.5	35mm	08/04/2011	10:50	N/A	N/A	338688.844	155823.497	177.6	179.3

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Visually Verifiable Images - methodology

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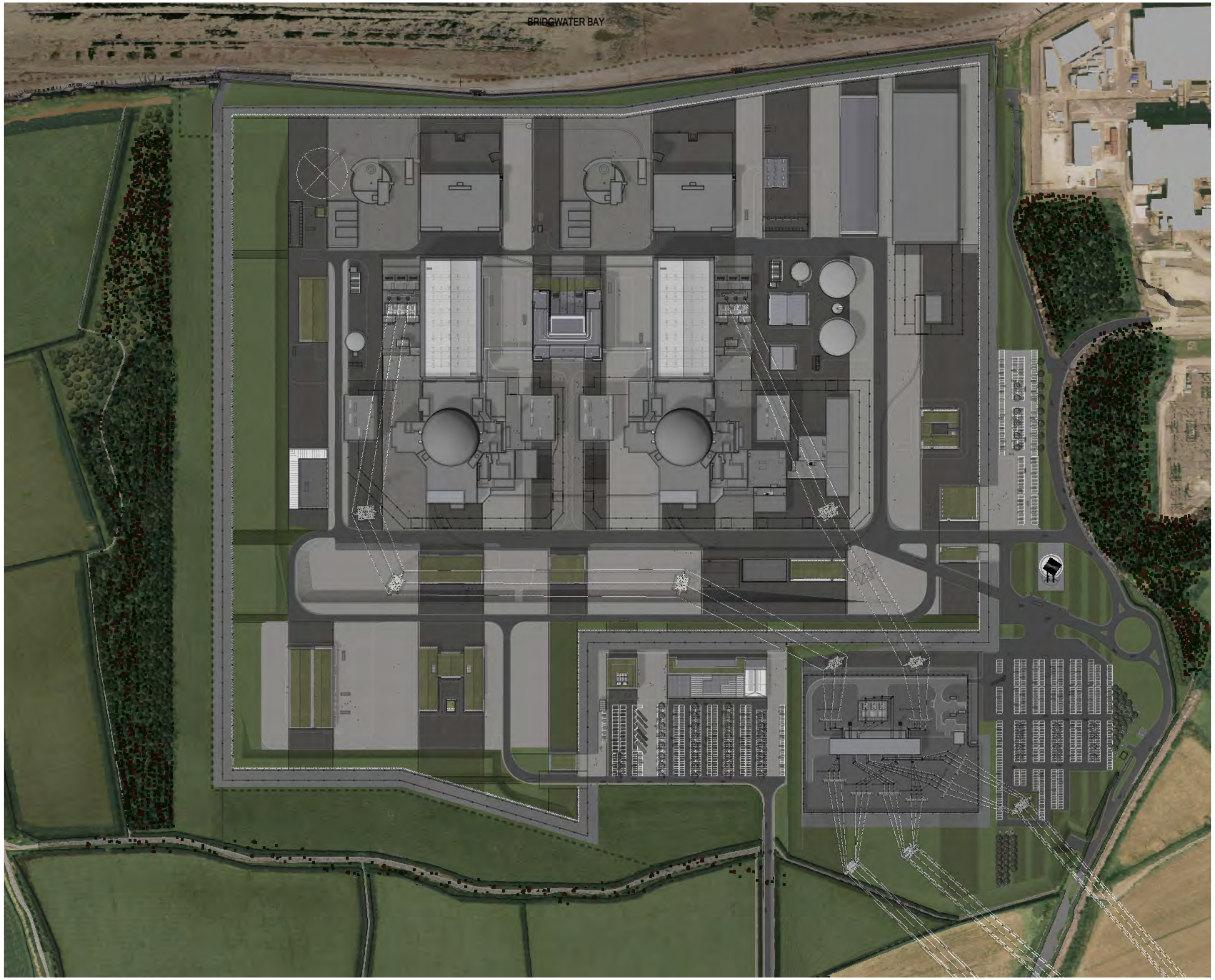
Appendix C

Masterplan overlay



Calculating the correct viewing distance

B22 The correct viewing distance is the distance at which the perspective in a photograph (or photomontage) correctly reconstructs the perspective seen from the location from which the photograph was taken. It also follows that, as seen from the correct viewing distance, the photographic image will occupy the same horizontal angle as the horizontal field of view it represents. This is true of both single-frame and panoramic photographs.

B23 The single-frame case is simpler geometrically. Seen from above, the photograph is merely a straight line of length **w**. We can construct an isosceles triangle with the apex representing the viewpoint and the height of the triangle, **d**, representing the viewing distance. At the correct viewing distance the apex angle, **A**, of the triangle must correspond to the horizontal field of view of the photograph. The correct viewing distance is then given by:

$$d = \frac{w}{2\tan\left(\frac{A}{2}\right)}$$

(single frame only)

where:

d is the correct viewing distance in mm
w is the image width in mm
A is the horizontal field of view in degrees
tan is the trigonometric tangent function

B24 If the horizontal field of view and the required viewing distance is known, then the formula rearranges thus to give the image width:

$$w = 2d\tan\left(\frac{A}{2}\right)$$

(single frame only)

B25 Finally, if the image width and viewing distance are known, the formula can also be arranged to give the horizontal field of view. (This version of the formula is useful to determine the horizontal field of view that can be accommodated on a fixed page size.):

$$A = 2\arctan\left(\frac{w}{2d}\right)$$

(single frame only)

B26 In the case of a panorama, the image is assumed to be wrapped around the inside surface of a cylinder whose radius is the correct viewing distance. The horizontal field of view must by definition therefore correspond to the arc of the cylinder subtended by the image.

B27 Given the width of the image and the horizontal field of view, the correct viewing distance is given by:

$$d = \frac{180w}{\pi A}$$

(panorama only)

where:

d is the correct viewing distance in mm
w is the image width in mm
A is the horizontal field of view in degrees
π has its usual geometrical meaning

B28 Given the viewing distance and the horizontal field of view, the image width is given by:

$$w = \frac{\pi A d}{180}$$

(panorama only)

B29 Lastly, if the image width and viewing distance are known, this formula can also be arranged to give the horizontal field of view:

$$A = \frac{180w}{\pi d}$$

(panorama only)

178 179

APPENDIX 22C: TREE AND HEDGEROW SURVEYS AND ASSESSMENTS

Appendix 22.C

Tree and Hedgerow Surveys and Assessments

Woodland

All woodland blocks within the HPC development site have been surveyed to BS 5837; 2005 Trees in relations to construction - Recommendations. Please refer to Tree Survey Hinkley Point C Development Site March 2011. The site is generally exposed to the prevailing north-westerly salt-laden winds from the Bristol Channel. As a result, the coastal woodland brakes have a wind-sculpted profile. Individual trees have strongly asymmetrical crown spreads, and achieve limited height. Brakes adjacent to the coast have waterlogged soil, and many brakes are on thin soil. Elm trees are subject to Dutch Elm Disease as they grow up. Agricultural activity in adjacent fields within tree root zones further limits establishment. Consequently many trees are prone to windthrow, and tree quality within the coastal brakes has been assessed as generally low. Bishops Wood south of Green Lane is in a more sheltered position, further inland. Recently planted on former agricultural land, Bishops Wood has better quality trees, but no trees have achieved 150mm diameter yet.

All woodland has also been assessed to establish the value of the woodland as ecological habitat through a Woodland Condition Survey. Please refer to Hinkley Phase 1 Habitat Survey Report August 2009. The Woodland Condition Survey concludes that the woodlands characteristics of small size, isolated location and species-poor composition are of local to district value for biodiversity.

Woodlands on site have been assessed, and there are no ancient woodlands (defined as land continuously wooded since 1600 AD). For more details of historic landscape please refer to the Cultural Heritage Desk-Based Assessment July 2009 and ES Chapter 23 Historic Environment.

Hedgerows

All hedgerows on site have been assessed under The Hedgerows Regulations 1997 to establish their importance in terms of ecology and archaeology. The Hedgerow Regulations identify the criteria against which the ecological and historic importance of hedges can be assessed.

The hedgerows were assessed for ecological importance. This assessment covers all hedgerows considered to be over 30 years old. For each hedgerow a 30m section (per 100m of hedgerow) was surveyed and information on location, dimensions, number of woody species, any hedgerow features, connectivity to other features and ground flora species were recorded.

The ecological hedgerow assessment concluded that two-thirds of the hedgerows were found to be ecologically important, including Green Lane and parts of Benhole Lane and Wick Moor Drove hedgerows. For more details, please refer to Hinkley Phase 1 Habitat Survey Report August 2009.

The hedgerows were assessed for archaeological importance. This assessment identifies all hedgerows over 30 years old which also satisfy at least one of the relevant archaeological criteria, such as forming part of an historic boundary or pre-enclosure field system. For more details please refer to the HPC Cultural Heritage Desk-Based Assessment July 2009.

The archaeological hedgerow assessment concluded that one-third of the hedgerows were found to be archaeologically important, including Green Lane and part of Wick Moor Drove hedgerows, and other hedgerows on the coastal slopes.

Further Surveys

Trees and hedgerows to be retained and managed within the proposals for Construction Works have been surveyed to BS 5837 2005; 2005. This survey covers Green Lane, Benhole Lane and Wick Moor Drove hedgerows and trees. Please refer to Tree Survey Hinkley Point C Development Site July 2010.

The outcome of this survey identifying the quality and value of these trees and hedgerows will inform their management. The survey identifies the Root Protection Area which will inform the location of the tree protection required during the construction period to the standards set out in BS 5837 2005. All construction access/works will be excluded within those areas, apart from arboricultural management. The protective fencing footings will be outside of the root protection area.

Further Surveys

The Tree Retention and Removal drawing identify the tree blocks and the pattern of hedgerows across the site. The complexity and scale of Hinkley Point C project requires that the majority of the vegetation within the construction site would be removed within the application site for construction of HPC.

The woodland and hedgerows proposed to be removed are identified on Figure 1 Construction Works Tree & Hedgerow Retention and Removal.

Existing hedgerows and trees which form the boundaries of the site will be retained, protected and managed for landscape amenity and biodiversity values. They will also provide habitat connectivity for foraging bats and visual screening of the site.

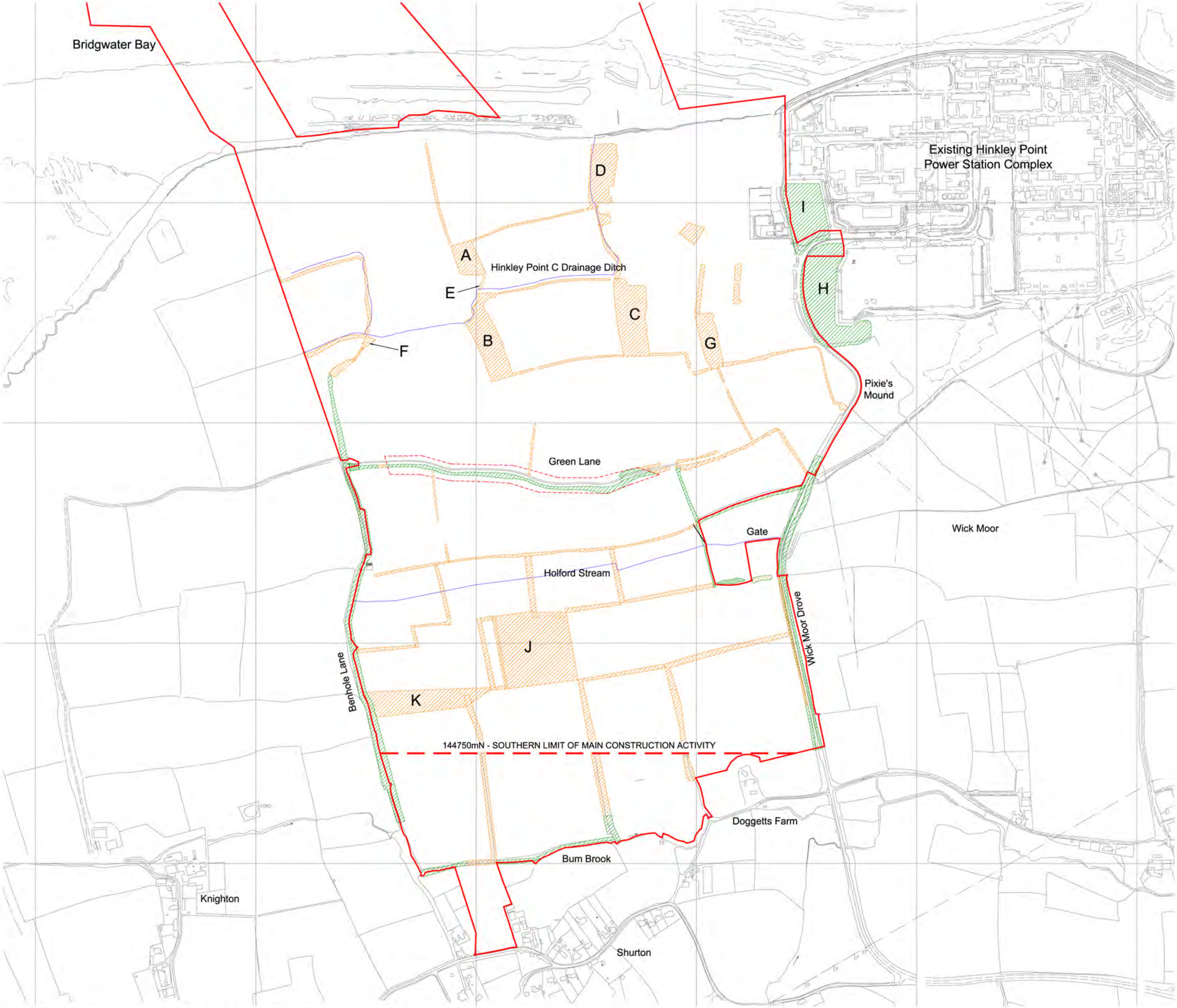
Green Lane and its hedgerows are recognised both as a prominent historic feature as well as an important east-west bat corridor, and will be largely retained, protected and managed throughout the construction period through an exclusion zone marked with a fence to BS 5837:2005. Two breaches in the hedgerows are proposed for access to site areas north and south.

The eastern end of Green Lane will also be removed but adjacent hedgerows will be retained to provide habitat connectivity for bats to the east.

Benhole Lane hedgerows are recognised for their historic value as part of the historic trackway and will be retained and protected.

Wick Moor Drove western hedgerow will be largely retained, protected from the impacts of construction and managed during the construction period. Sections of the hedgerow will have to be removed to provide access to the site from Wick Moor Drove; these areas are identified as removed on the tree retention and removal drawing. A diverted footpath within a 4m zone is proposed to run inside the Wick Moor Drove hedgerow for the length of the site. The site security fence will form the inside boundary to the footpath.

The landscape restoration has been designed to mitigate for the temporary loss of valuable wildlife habitats such as woodland and hedgerows. The restoration landscape includes an increase in species-rich hedgerows, and an increase of more than 350% in broad-leaved woodland, in order to mitigate for the long time taken for these slow growing habitats to establish.



Key

- HPC Development Site Boundary
- Green Lane Protection Zone Fence
- Trees and Hedgerows to be Removed
- Trees and Hedgerows to be Retained

Woodlands:

A - Newclose Covert
B - Haysgrove Brake
C - Seaburton Brake
D - Whitewall Brake
E - Unnamed woodland
F - Unnamed woodland
G - Govetts Copse
H - Branland Copse
I - Branland Copse North
J - Bishops Wood
K - Unnamed woodland

W E S

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
ENVIRONMENTAL STATEMENT
VOLUME 2 CHAPTER 22

FIGURE TITLE:

TREE AND HEDGEROW RETENTION AND REMOVAL PLAN

FIGURE NO:		REVISION:
FIGURE 1		01
DATE:	DRAWN:	SCALE:
SEPT 2011	AE	NTS@A3

SCALE BAR
0 25m 100m 200m 300m 400m

Tree Survey March 2011
Hinkley Point C Development Site
Hinkley Point Nuclear Power Station, Somerset

Report by: Linda Henderson BSc (For) M.Arbor.A
Checked by: Ian Braddock BSc (Hons) Arb
Date: March 2011

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CONTENTS

APPENDICES

1. INTRODUCTION

This report and associated tree survey was commissioned by EDF Energy in March 2011 in response to a request by West Somerset Council made under Regulation 19 of the Town and Country Planning (Environmental Impact Assessment) Regulations1999 for a BS5837 Survey to cover the whole of the application site. This report supplements the previous survey (Adas, 2010) *Tree Survey Hinkley Point C Development Site* and reports on the following areas (plans are show in the appendices):

- Whitewall Brake (also known as Woodland 1),
- Seaburton Copse (Woodland 2),
- Govetts Copse (Woodland 3),
- Haysgrove Brake (Woodland 8),
- Newclose Covert (Woodland 9),
- Bishops Wood (Woodland W); and,
- Bum Brook (Area 1)
- Trees within Hedgerow Nos 36, 38 and 49 and adjacent to Bum Brook

Between them, these surveys provide coverage of the groups of trees on the area of the site covered by the Preliminary Works application. All of these areas are either within or border the site of the proposed development of a new nuclear power station, known as Hinkley Point C. This will lie adjacent to the existing Hinkley Point Nuclear Power Station complex in Somerset on the Severn Estuary.

The report provides a survey of trees, and other landscape features such as hedges, according to the guidance within British Standard (BS) 5837 (2005) 'Trees in Relation to Construction – Recommendations'. In order to make an unbiased assessment of the trees on site, and inline with the recommendations within BS 5837 (2005), ADAS has not been advised of the proposed planned tree removal under the current planning consent for the site.

Information about the ecological value of the trees and groups of trees has been submitted as part of the original planning application: the hedgerows and woodland on site have been surveyed and assessed by *(Entec UK Ltd, 2009) EDF Energy Hinkley Habitat Survey Report*. This report includes a Hedgerow Assessment compliant with The Hedgerow Regulations 1997, and a Woodland Condition Survey to determine biodiversity value.

2. LIMITATIONS

A topographical survey of the area, identifying trees and other landscape features, was made available during the survey. The positioning of trees on the plans was limited by the ability of the global positioning system (GPS) equipment to gain sufficient satellite signal under the dense canopies of trees within and surrounding the woodlands. Therefore, the position of these features cannot be regarded as being completely accurate.

Only features that were apparent at the time of inspection could be considered and no liability can be accepted regarding trees, hedges or their parts that were inaccessible or obscured in part or in whole.

Whilst hedges have been identified, unless there are groups of trees within them, they have not been assessed, as the grading system within BS5837 is inappropriate because it will always result in a Category C rating for the hedge. The ecological value of the hedges has been assessed according to the requirements of The Hedgerow Regulations 1997 *(Entec UK Ltd, 2009) EDF Energy Hinkley Habitat Survey Report.*

Thoughout 2007 to 2010 the site has been assessed for its potential to support terrestrial and freshwater legally protected and notable species by Entec Ltd. Where it was concluded that this potential existed, detailed species specific surveys were completed. In relation to the woodland within the site, it was concluded that there was potential for the European Protected Species (EPS) bats and dormouse to occur and comprehensive surveys for these species/species groups have been completed. For bats, this included both external and internal tree roost assessments. The results of these surveys are reported in Appendices 11-4 and 11-6 of the Site Preparation Application. A number of the trees assessed for bat roosts have tree tag identifiers and these have been noted in the tree survey result tables.

The woodlands also support badger (Meles meles) and further information is provided in Appendix 11-7 of the Site Preparation Application. Mitigation works are ongoing under a Natural England licence to relocate the badgers and this has necessitated some shrub clearance within the woodlands. Where this may affect the woodlands it has been noted in the tree survey tables.

3. SURVEY METHODOLOGY

The survey was carried out by Linda Henderson of ADAS between Monday 7th and Thursday 17th March 2011, and Thursday 30th March and Friday 1st April 2011, and with the assistance of Wynn Davis of ADAS between Monday 14th and Tuesday 15th March 2011.

The survey consisted of an inspection of the vegetation within Whitewall Brake (W1), Seaburton Copse (W2), Govetts Copse (W3), Haysgrove Brake (W8), Newclose Covert (W9), Bishops Wood (WW)and the Bum Brook (A1). The Arboricultural Survey Plan in Appendix 1 shows the extent of this survey and the detailed plans of the areas are in Appendix 2.

Section 4.2, subsection 4.2.4 fo the British Standard states that:

4.2.4 ***Trees forming groups*** *and* ***areas of woodland*** *(including orchards, wood pasture and historic parkland)* ***should be identified*** *and considered as* ***groups where the arboriculturist determines that this is appropriate,*** *particularly if they* ***contain a variety of species*** *and* ***age classes*** *that could aid long-term management. It may be* ***appropriate to assess the quality*** *and* ***value of such groups as a whole****, rather than individuals. However,* ***an assessment of individuals within any group should still*** *be under taken if they are open-grown or* ***if there is a need to differentiate between them.***

The above bold and underlining is ADAS' own emphasis.

As a result, the survey has identified hedgerows; groups of trees that are of a similar age class, and have been subject to the same management regime and are located in close proximity to each other; and significant individual trees. On this occasion it was considered inappropriate to place any of the trees into a woodland classification given the variation of the tree populations within the areas.

The vegetation was inspected from ground level, by eye.

The weather conditions were generally dry, bright, windy and with good visibility.

All height measurements were taken using a Haglof clinometer where there was clear visibility of the stem, base and top of the tree to be measured. Where this was not possible, height measurements were estimated by reference to heights of nearby measured trees.

The stem diameters of single stem trees were taken at 1.5m above ground level, or just above the root flare for multi-stemmed trees. Where trees were not easily accessible the diameters have been estimated; and for group of trees an average stem diameter within the group has been recorded.

4. TREE SURVEY TERMS

The survey recorded the following information for each individual tree or group of trees:

a) <u>Reference number</u>

All individual trees, groups of trees, hedges and woodlands have been given a unique reference number. Each number is prefixed by a letter.

T = Individual tree

G = Group of trees

H = Hedgerow

b) <u>Species</u>

The English common name has been used.

c) <u>Single or Multi-stemmed</u>

'S' represents a tree which has a single clear stem to at least 1.5m above ground level, whilst 'M' represents a tree where the main stem divides into at least two stems below 1.5m above ground level.

d) <u>Height in metres</u>

Tree heights are measured to the nearest half metre using a Haglof clinometer, where possible. In some instances such as in close groups of trees, one height may be measured and other nearby trees estimated from this height.

e) Stem diameter

Measured in millimetres at 1.5m above ground level for single stemmed trees or for multi-stemmed trees immediately above the root flare. Where site factors such as dense vegetation and fences restrict access to the base of a tree, the stem diameter has been estimated. This is highlighted in the tree survey schedule.

Groups of trees have been given an average stem diameter.

f) Branch spread in metres

Measured in metres to the four cardinal compass points.

g) Crown Clearance

Measured in metres between the lowest branch and the highest adjacent ground level.

h) Age class

The stage at which the tree is within its lifecycle (Y = young, MA = middle aged, M = mature, OM = over mature, V = veteran)

i) Physiological condition

An assessment of the overall health and vitality of the tree or group of trees is made and this is recorded as being either: Good, Fair, Poor or Dead.

j) Structural Condition

An assessment of the overall structural condition of the tree is made and any significant defects or features are recorded.

k) Preliminary management

Despite the fact that most of these trees will be removed, recommendations have been made where management work is required for reasons of health and safety or sound arboricultural management as this is required by the Standard. These recommendations are accompanied by timescales in which the work should be undertaken.

l) <u>Estimated remaining contribution in years</u>

An estimation of how long the tree or group of trees will contribute to its surroundings. This is recorded in bands of either <10 years, 10 – 20 years, 20 – 40 years and >40 years.

m) <u>Category Grading</u>

The trees are graded to the categories prescribed within BS5837:2005 (R, A, B & C); details of this system can be found within Appendix 3.

n) <u>Root Protection Area (RPA)</u>

Given as a radius in metres from either (1) the stem of an individual tree, (2) the edge tree of a group, or (3) the stem of a hedge. [If less than the Branch Spread, this may be extended to protect the spread of the crown].

5. TREE SURVEY RESULTS

See following page.

Whitewall Brake - W1

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W1 G1	8-10x* field maple (*Acer campestre*) 6-8x* crack willow (*Salix fragilis*)	M	5 ^	250 ^	2	2	2	2	0	OM	Dead	Poor and dead, trees located within the north western corner, west of a water courses that runs south to north through W1 to the sea, the trees are failing due to windthorw, water logged soils, exposer to salt spray and water from the sea, a few of the fallen willows have layered themselves resulting in lateral braches gaining apical dominance and there are significant amounts of plastic debris on the woodland floor that has been deposited from the sea	None	<10	R	19.6	2.5
H1	blackthorn (*Prunus spinosa*), common hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*) and spindle (Euonymus europaeus)	M	3 ^	750	0	0	0	0	0	Y	Fair	Fair, the hedge located to the east of a public footpath within W1 adjoining the agricultural field to the east, it is very unlikely that any significant roots will beneath the field	None	10-20	C3	176.7	7.5
G2	elder (*Sambucus nigra*) blackthorn (*Prunus spinosa*) and common hawthorn (*Crataegus monogyna*)	M	4 ^	250 ^	2	2	2	2	1	EM	Poor	Poor and dead, some of the trees have failed due to windthrow and there large amount of ivy (*Helix hedera*) within the trees	None	10-20	C2	19.6	2.5
G3	2x field maple (*Acer campestre*)	M	5	400	3	3	3	3	2	M	Poor	Poor and dead, some of the trees are yet dead but are within a moribund condition, there are snags, tears deadwood and ivy within the trees	None	10-20	C1	50.3	4.0
T1	field maple (*Acer campestre*)	M	8	580	3	5	4	6	2	M	Fair	Fair, crossing lateral branches, lost of apical dominance and ivy within the tree	None	10-20	C1	105.7	5.8
T2	field maple (*Acer campestre*)	M	-	620	-	-	-	-	-	OM	Dead	Dead, fallen deadwood	None	<10	R	120.8	6.2
T3	field maple (*Acer campestre*)	S	8	470	3	4	2	1	3	OM	Poor	Poor, has a adaptive growth of lean of 45 degrees toward the east, lost of apical dominance and ivy within the tree	None	10-20	C1	99.9	5.6
T4	field maple (*Acer campestre*)	M	7	460	3	3	3	3	2	OM	Poor	Poor, lost of apical dominance, snags, tears, deadwood and ivy within the tree	None	10-20	C1	66.5	4.6
T5	field maple (*Acer campestre*)	M	7	620	2	3	2	2	2	OM	Dead	Dead, large amount of deadwood within the crown	Ensure that there is no public access underneath the tree if not possible consider removal of dead wood	<10	R	120.8	6.2
T6	field maple (*Acer campestre*)	M	6	650	2	4	5	3	3	OM	Poor	Poor, co-dominant western apical is dead, snags, tears deadwood and ivy within the tree and it has been identified by the bat ecologist and given the tree tag number 969	None	10-20	C1	132.7	6.5
G5	common ash (*Fraxinus excelsior*) and field maple (*Acer campestre*)	S	9	300	2	2	2	2	2	EM	Fair	Fair, the trees are located within the northern section of the woodland within an area of no significant ground cover, the trees are recently planted some the trees still have their tree guards around them and there is ivy within some of the trees	None	>40	C1	40.7	3.6
T7	English oak (*Quercus robur*)	S	10	950	3	12	7	4	2	M	Fair	Good, asymmetrical crown, snags, tears deadwood and ivy within the tree and it has been identified by the bat ecologist and given the tree tag number 138	None	>40	A3	408.3	11.4

Whitewall Brake - W1

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
T8	field maple (*Acer campestre*)	S	9	500	5	8	2	3	3	LM	Fair	Good, asymmetric crown	None	20-40	B2	113.1	6.0
T9	English oak (*Quercus robur*)	S	9	540	5	8	6	5	2	LM	Poor	Fair, asymmetric, snags, tears deadwood and ivy within the tree	None	>40	A3	131.9	6.5
T10	field maple (*Acer campestre*)	M	8	650	2	7	3	4	2	LM	Poor	Poor, snags, tears, deadwood and ivy within the tree	None	10-20	C1	132.7	6.5
T11	field maple (*Acer campestre*)	M	7	350	3	5	3	3	1	M	Poor	Poor, deadwood within the tree	None	10-20	C1	38.5	3.5
T12	English oak (*Quercus robur*)	S	10	680	4	5	5	4	5	M	Fair	Good, snags and ivy within the tree	None	>40	A3	209.2	8.2
T13	English oak (*Quercus robur*)	S	10	600	4	5	4	3	4	M	Fair	Good, a large western lateral branch has failed in the past, ivy within the tree and it has been identified by the bat ecologist and given the tree tag number 997	None	>40	B2	162.9	7.2
T14	English oak (*Quercus robur*)	S	12	720	3	7	5	4	4	M	Fair	Good, snags, tears deadwood and ivy within the tree. It has been identified by the bat ecologist and given the tree tag number 144	None	>40	A3	234.5	8.6
T15	field maple (*Acer campestre*)	S	9	600	5	5	4	3	1	LM	Poor	Fair, cavities, snags, tears, deadwood and ivy within the tree. Some of the deadwood is within failure distance of the public footpath	Ensure that there is no public access underneath the tree if this is not practable consider the removal of dead wood	10-20	C1	162.9	7.2
T16	English oak (*Quercus robur*)	S	0	900	0	0	0	0	0	OM	Dead	Dead, laying dead wood it has been identified by the bat ecologist and given the tree tag number 132	None	<10	R	366.5	10.8
G6	common ash (*Fraxinus excelsior*), elder (*Sambucus nigra*) and field maple (*Acer campestre*)	M	7 ^	400 ^	3	3	3	3	2	EM	Fair	Fair and good, located in the southern section of W1, trees that have been planted within the last 10/15 years some of them are still within their tree guards there are significant areas of gaps where the planted trees have failed and there also areas dense area of brambles (*Rubus fruticosus*)	Control bramble remove tree guards and stakes	>40	C1	50.3	4.0
G7	2x white willow (*Salix alba*)	M	6	600 ^	4	3	3	3	2	EM	Good	Fair, recently exposed due to the surrounding vegetation being removed to allow for badger mitigation works	None	20-40	C1	113.1	6.0
G8	English elm (*Ulmus procera*)	S	6 ^	200 ^	1	1	1	1	2	OM	Dead	Dead, located to the west of the main water course from the south western corner up to G1, this area is a wetwood that has an understory of hawthorn within some sections	None	<10	R	18.1	2.4

<u>Notes</u>
*Estimated; ^Average

Seaburton Copse - W2

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W2-G1	2x crack willow (*Salix fragilis*)	S	12 ^	600 ^	3	9	3	5	2	M	Fair	Fair, ivy (*Helix hedera*) upon the stem and within the crown, recently removed large (40cm diameter) southern apical, tree is located within the north-western corner this area can become water logged and it is just north of recent investigation works which have taken place within its RPA	None	10-20	C1	162.9	7.2
W2-T1	field maple (*Acer campestre*)	M	8	800 *	3	4	5	4	2	OM	Poor	Poor, ivy upon the stem and within the crown lost of apical dominance and it is surrounded to east by a large amount of brambles (*Rubus fruticosus*) and to the west recent investigation works have taken place within its RPA	None	<10	R	201.1	8.0
W2-G2	field maple (*Acer campestre*)	M	12	760	5	8	5	7	2	M	Fair	Fair, lapsed layered hedge row on top of an old stone fence, the trees are located approximately 50cm below the level area of the adjoining agriculture field to the east, the trees have cavities, snags, tears, and deadwood within them, ivy is within tsome of the trees western crowns. Some of the trees identified by the bat ecologist and have had metal tree tags attached	None	>40	A3	181.5	7.6
W2-G3	2x field maple (*Acer campestre*), 30x* hawthorn (*Crataegus monogyna*) & blackthorn (*Prunus spinosa*)	M	6	300 ^	2	2	2	2	3	EM	Fair	Fair, located within the northern section of the woodland, evidence of past coppice operations on some of the trees with recent planting some of which are still within their tree guards	None	10-20	C2	28.3	3.0
W2-T2	common ash (*Fraxinus excelsior*)	M	14	1500	6	8	8	4	2.5	M	Good	Good, located on the eastern boundary, lapsed coppice stool, that now has multiple apical leaders some of which have damage and missing cambium	None	>40	A3	707.0	15.0
W2-T3	field maple (*Acer campestre*)	S	8	540	3	2	5	3	3	M	Poor	Fair, appears to be pollarded at 1.6m above ground level it now has 4 apical leaders, snags, tears and deadwood within the crown and insect bore holes within some of the lateral branches	None	20-40	B2	131.9	6.5
W2-T4	English oak (*Quercus robur*)	S	14	610	6	8	4	4	3	M	Poor	Fair, snags, tears, deadwood and ivy within the tree	None	>40	A1	168.4	7.3
W2-T5	field maple (*Acer campestre*)	S	12	490	5	5	5	6	3	M	Poor	Fair, bifurcates at 1.4m above ground level snags, tears, deadwood and ivy within the tree	None	10-20	C1	108.6	5.9
W2-T6	field maple (*Acer campestre*)	S	12	640	6	7	8	7	3	OM	Poor	Poor, large cavity within from ground level to 1m above ground level depth of 20cm on its north stem	None	10-20	B2	185.3	7.7

Seaburton Copse - W2

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W2-G4	common elder (*Sambucus nigra*) & common hawthorn (*Crataegus monogyna*)	M	8	400 ^	3	3	3	3	2	M	Fair	Fair, this group is located within the middle of W2	None	20-40	C2	50.3	4.0
W2 G5	common elder (*Sambucus nigra*) & common hawthorn (*Crataegus monogyna*)	M	4	250 a	2	2	2	2	1	M	Fair	Fair, this group is located to the north and west of W2 these trees have excessive amounts of ivy within them, their growth is being limited by exposed to the wind and salt spray	None	10-20	C2	19.6	2.5

Notes
*Estimated; ^Average

Govetts Copse - W3

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W3-G1	7x common ash (*Fraxinus excelsior*)	M	15 ^	760 ^	7	7	7	7	2	LM	Fair	Fair, ivy (*Helix hedera*) on stem and within crown, snags, tears and dead wood, birds' nest, squirrel dreys and possible habitat for bats	None	>40	A3	181.5	7.6
W3-G2	7x common hawthorn (*Crataegus monogyna*)	M	8 ^	200 ^	2	2	2	2	0	M	Poor	Fair, understory of G1, ivy upon and within the stem and crown suppressing the recently planted trees some of which are still within their tree guards	None	10-20	C2	12.6	2.0
W3-T1	field maple (*Acer campestre*)	M	10	540	3	3	3	3	1	M	Fair	Fair, ivy within the tree	None	20-40	B2	91.6	5.4
W3-G3	common ash (*Fraxinus excelsior*)	S	2 ^	75 ^	1	1	1	1	1	Y	Fair	Good, recently planted trees some of which are still within their tree guards	None	>40	C3	2.5	0.9
W3-T2	English oak (*Quercus robur*)	S	6	290	4	4	4	4	3	EM	Fair	Good, ivy upon stem and within canopy, asymmetrical crown.	None	>40	B2	38.1	3.5
W3-S1	blackthorn (*Prunus spinosa*), common hawthorn (*Crataegus monogyna*) & common ash (*Fraxinus excelsior*)	M	4 ^	125 ^	1	1	1	1	0	Y	Good	Good, recently planted woodland edge planting opposite a historic woodland embankment.	None	>40	C2	4.9	1.3
W3-G4	6x common hawthorn (*Crataegus monogyna*) & 3x common ash (*Fraxinus excelsior*)	M	6 ^	600 ^	3	3	3	3	2	EM	Fair	Fair, recently planted densely stocked understory that has a large amount of bramble within it. DBH from single 260mm to multi-stemmed 930mm	None	20-40	B2	113.1	6.0
W3-G5	common elder (*Sambucus nigra*), common hazel (*Corylus avellana*), common holly (*Ilex aquifolium*), English oak (*Quercus robur*) & silver birch (*Betula pendula*)	M	4 ^	300 ^	2	2	2	2	0	Y	Good	Good, recently planted trees some of which are still within their tree guards within an area of mature large shurbs	None	20-40	B3	28.3	3.0
W3-T3	common ash (*Fraxinus excelsior*)	M	10	950	3	6	8	6	2	M	Good	Good, identified with the tree tag number 106 by the bat ecologist	None	20-40	B1	283.6	9.5
W3-T4	common ash (*Fraxinus excelsior*)	S	10	450	4	4	4	4	2.5	M	Fair	Fair, has developed a lean towards the east and due to recent tree and shrub removals it has been exposed to new wind forces this has increase the risk of it failing due to windthorw	Inspect the trees root plate after wind events for evidence of movement to considered appropriate management of the tree.	20-40	B2	91.6	5.4
W3-T5	common ash (*Fraxinus excelsior*)	M	10	850	6	5	6	6	2	M	Fair	Fair, due to recent tree and shrub removals it has been exposed to new wind forces this has increase the risk of it failing due to windthorw	Inspect the trees root plate after wind events for evidence of movement to considered appropriate management of the tree.	20-40	B2	227.0	8.5

Govetts Copse - W3

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W3-T6	English oak (*Quercus robur*)	S	13	850	5	9	5	4	2	M	Good	Fair, asymmetrical crown, due to recent tree and shrub removals it has been exposed to new wind forces this has increase the risk of it failing due to windthorw and there is possiblity that the tree is used by bats as a roost	Inspect the trees root plate after wind events for evidence of movement to considered appropriate management of the tree.	>40	A3	326.9	10.2
W3-T7	common hawthorn (*Crataegus monogyna*)	S	5	290	1	5	1	0	2	M	Poor	Poor, the tree has devloped a 45 degree lean towards the east, there is a large amount of ivy upon the stem and within the crown due to recent tree and shrub removals it has been exposed to new wind forces this has increase the risk of it failing due to windthorw and there is possiblity that the tree is used by bats as a roost	Inspect the trees root plate after wind events for evidence of movement to considered appropriate management of the tree.	<10	R	38.1	3.5
W3-T8	common ash (*Fraxinus excelsior*)	M	8	720	1	3	4	3	3	LM	Fair	Fair, loacted on top of the western historic woodland embankment, lapsed coppice stool, heartwood decay has resulted in a partial hollow main stem.	None	20-40	B2	162.9	7.2
W3-T9	common ash (*Fraxinus excelsior*)	S	14 ^	540 ^	5	4	4	5	2	M	Fair	Good, ivy upon the stem and within the crown, asymmetrical crown over the access track	None	20-40	B1	131.9	6.5
W3-T10	common ash (*Fraxinus excelsior*)	M	14	780	3	4	5	4	2	M	Fair	Good, on top of the western historic woodland embankment	None	20-40	B1	191.2	7.8
W3-G6	English elm (*Ulmus procera*)	S	10 ^	225 ^	2	2	2	2	2.5	OM	Poor	Poor & Dead, located within northern section of the woodland nearest expose of salt spray	None	<10	R	22.9	2.7
W3-G7	common ash (*Fraxinus excelsior*)	S	10 ^	225 ^	2	2	2	2	2.5	EM	Fair	Fair, located within northern section of the woodland nearest exposes of salt spray	None	20-40	B2	22.9	2.7
W3-G8	common ash (*Fraxinus excelsior*)	S	8 ^	250 ^	2	3	2	2	3	EM	Fair	Fair, self set trees located upon the boundary wire mesh fence, the majority of the trees have an asymmetrical form towards the east and the open field.	None	>40	C2	28.3	3.0
W3-G9	common hawthorn (*Crataegus monogyna*)	M	6 ^	300 ^	2.5	2.5	2.5	2.5	1	M	Fair	Fair, planted upon the historic western woodland embankment	None	20-40	C2	28.3	3.0

Notes
*Estimated; ^Average

Haygrove Brake - W8

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W8-G1	English elm (*Ulmus procera*)	M	5 ^	200 ^	1	1	1	1	0	OM	Dead	Dead, lapsed layered hedge located on top of south western woodland embankment, there is evidence upon the bark of some of the trees of Dutch elm disease (*Ophiostoma novo-ulmi*)	Ensure that no person with inappropriate PPE has access under the trees if this is not possible remove the dead and diseased trees	<10	R	12.6	2.0
W8-H1	blackthorn *(Prunus spinosa*)	M	1.5	100 ^	0	0	0	0	0	EM	Fair	Fair, located on the edge of the agricultural field that surrounds the southern and western sections of the woodland, regularly maintain agricultural hedge	None	20-40	C3	3.1	1.0
W8-G2	English elm (*Ulmus procera*)	S	10 ^	200 ^	1	1	1	1	6	OM	Dead	Poor and dead, this group forms the majority of the tree stock within W8 in the southern and western sections approximately 30% of this group is dying or moribund and the other 70% is dead. It appears that these trees have been planted in last 10/20 years a few of the planted rows have been felled to waste approximately 5/10 years ago. The growth of these trees have been limited due to the water logged soils, salt spray, high winds and Dutch elm diseases	Ensure that no person with inappropriate PPE has access under the trees if this is not possible remove the dead and diseased trees	<10	R	18.1	2.4
W8-T1	English oak (*Quercus robur*)	S	9	300	4	4	2	2	1	MA	Fair	Fair, located north of the southern drainage ditch on top of an embankment	None	>40	B2	40.7	3.6
W8-G3	field maple (*Acer campestre*) common hazel (*Corylus avellana*) common hawthorn (*Crataegus monogyna*), common elder (*Sambucus nigra*) and grey willow (*Salix cinerea*)	M	6 ^	400 ^	2	2	1	2	0	M	Fair	Fair, located to the north and south of the southern drainage ditch adjoining agricultural fields to the north and south	None	20-40	C3	50.3	4.0
W8-T2	crack willow (*Salix fragilis*)	M	15	1500	3	9	9	8	3	M	Good	Fair, lost of apical domainace with multiple apical leaders, recently a mature apical leade failed into the southern field this has now been removed, another eastern apical failed in the past forming a layed tree were multiple form laterial branchs have gain apical domanaince and there are a number of brids nest within the crown	None	10-20	C1	707.0	15.0
W8-T3	field maple (*Acer campestre*)	M	8	300	4	4	4	3	3	M	Fair	Fair, located on top of eastern woodland embankment	None	10-20	C1	28.3	3.0
W8-T4	field maple (*Acer campestre*)	M	8	800	4	4	4	4	3	LM	Fair	Fair, cavities, snags, tears, deadwood and ivy within the tree.	None	20-40	A3	201.1	8.0

Haygrove Brake - W8

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W8-T5	field maple (*Acer campestr* e)	S	10	530	6	5	6	4	3	LM	Fair	Fair, cavities, snags, tears, deadwood and ivy within the tree	None	20-40	A3	127.1	6.4
W8-T6	English oak (*Quercus robur*)	S	12	530	3	8	7	6	4	EM	Fair	Good, located within the northern section of the woodland within an area that has been managed in the past for pheasants, the tree has an asymmetrical crown	None	20-40	A3	127.1	6.4
W8-T7	English oak (*Quercus robur*)	S	8	550	5	5	6	3	3	M	Poor	Poor, poor extension growth of its apical leader, crown is being suppressing by the surrounding taller trees and ivy within the tree	None	20-40	A3	136.9	6.6
W8-G4	3x common hazel (*Corylus avellana*)	M	6 ^	650 ^	3	3	3	3	3	M	Poor	Poor, understory of the northern section of the woodland and ivy within the trees	Coppice	10-20	C2	132.7	6.5
W8-G5	7x common hawthorn (*Crataegus monogyna*)	S	6 ^	200 ^	2	2	2	2	2	M	Poor	Poor, understory of the northern section of the woodland	None	10-20	C2	18.1	2.4
W8-T8	English oak (*Quercus robur*)	S	8	600	3	4	3	3	2	OM	poor	Poor, asymmetrical leaning to the east co-doiamant at 1.5m above groundleve, cavities snags, tears and deadwood	None	20-40	A3	162.9	7.2
W8-T9	field maple (*Acer campestre*)	S	8	520	4	4	4	4	2	M	Fair	Fair, on top of eastern woodland embankment	None	20-40	A3	122.3	6.2
W8-T10	field maple (*Acer campestre*)	S	8	380	3	3	3	3	2	M	Fair	Fair, cavities, snags, tears, deadwood and ivy within the tree.	None	20-40	A3	65.3	4.6
W8-T11	field maple (*Acer campestre*)	M	8	1500 *	3	3	3	3	1	M	Fair	Fair, loacted on top of the form eastern woodland embankment now within an area that has been cleared for badger mitgation works.	None	20-40	A3	707.0	15.0

Notes
*Estimated; ^Average

Newclose Covert - W9

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
W9-H1	common hawthorn (*Crataegus monogyna*)	S	3 ^	150 ^	0	1	1	1	0	M	Poor	Fair, hedge on top of northern woodland embankment the growth of which is being limited by the high winds and salt spray	None	20-40	C3	10.2	1.8
W9-T1	common ash (*Fraxinus excelsior*)	M	10	1100	4	5	5	3	3	M	Fair	Fair, located in the far northern section of the woodland, wind and salt pruned, lapsed coppice that has 5 apical leaders, deadwood and ivy (*Helix hedera*) within the tree	None	20-40	B2	380.2	11.0
W9-T2	common ash (*Fraxinus excelsior*)	M	9	960	5	4	5	3	4	M	Poor	Poor, located in the far northern section of the woodland 2m south of cleared badger set, wind and salt pruned, lapsed coppice that has 5 apical leaders, deadwood and ivy within the tree	None	10-20	C2	289.6	9.6
W9-G1	common ash (*Fraxinus excelsior*)	M	7.5 ^	850 ^	3	3	3	3	3	LM	Poor	Poor, located within the northern section of the woodland lapsed coppice stools that have multiple apical leaders, deadwood and ivy within the trees	None	20-40	B2	227.0	8.5
W9-G2	4x common ash (*Fraxinus excelsior*)	M	13	1500	3	7	5	4	3	M	Fair	Fair, located within the northern eastern section of the woodland lapsed coppice stools that have multiple apical leaders, deadwood and ivy within the trees	None	20-40	B2	707.0	15.0
W9-G3	English elm (*Ulmus procera*)	S	9 ^	240 ^	2	2	2	2	2	MA	Fair	Good, recently planted 10/15 years ago	None	10-20	C2	26.1	2.9
W9-G4	English elm (*Ulmus procera*)	S	9 ^	180 ^	1	1	1	1	-	OM	Dead	Dead, on top eastern woodland embankment	Fell	<10	R	14.7	2.2
W9-T3	English oak (*Quercus robur*)	S	10	510	3	1	4	5	5	M	Poor	Poor, very small portion of alive crown	None	10-20	B2	117.7	6.1
W9-G5	8-10x common ash (*Fraxinus excelsior*)	S	0	0	0	0	0	0	0	OM	Dead	Dead, located within the southern section of the woodland, laying deadwood failed due to windthrow	None	10-20	R	0.0	0.0
W9-G6	English elm (*Ulmus procera*)	S	10	200 ^	2	2	2	2	4	MA	Fair	Fair, ivy within the trees	None	10-20	C2	18.1	2.4
W9-G7	field maple (*Acer campestre*) and English elm (*Ulmus procera*)	M	6 ^	400 ^	2	2	2	2	1	M	Fair	Fair, lapsed layered hedge on top of southern woodland embankment	None	20-40	B3	50.3	4.0
W9-G8	English elm (*Ulmus procera*)	S	9 ^	200 ^	1	1	1	1	4	OM	Poor	Dead, within south eastern section of the woodland and on top of woodland embankment	None	10-20	C2	18.1	2.4

Newclose Covert - W9

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)		Stem Diameter [*Estimate; ^Average] (mm)		Branch Spread (m)				Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area	
							N	E	S	W								(m²)	(radius in m)
W9-H2	common hawthorn (*Crataegus monogyna*) field maple (*Acer campestre*), myrobalan plum (*Prunus cerasifera*) blackthorn (*Prunus spinosa*), dogwood (*Cornus sanguinea*) and 1xcommon ash (Fraxinus excelsior)	M	3	^	250	^	0	0	0	0	0	M	Fair	Fair, hedge below and on top of western woodland embankment growth is being limited by wind and salt spray, the one remaining layered ash is in the north western coroner	None	10-20	C3	19.6	2.5

Notes
*Estimated; ^Average

Bishops Wood - WW

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
H1	blackthorn (Prunus spinosa)	M	2 *	750 *	0	0	0	0	0	Y	Good	Fair, located on southern boundary of the woodland adjoining agricultural land, the hedge is managed regular	None	>40	C3	176.7	7.5
G1	grey willow (*Salix cinerea),* common ash (*Fraxinus excelsior*), field maple (*Acer campestre*) and common hawthorn (*Crataegus monogyna*)	S	6 ^	250 ^	2	2	2	2	0/2	EM	Fair	Fair, located on northern boundary adjoining a agricultural ditch	None	>40	B2	28.3	3.0
G2	common ash (*Fraxinus excelsior*), field maple (*Acer campestre*) and common hawthorn (*Crataegus monogyna*)	S	6 ^	250 ^	2	2	2	2	2	EM	Fair	Fair, located on the small eastern and western boundary embankments, separate from G3 by a 2m ride around the edge, some of tree have asymmetrical crowns towards W2 and ivy within them	None	>40	B2	28.3	3.0
G3	field maple (*Acer campestre*), blackthorn (*Prunus spinosa*), privet (*Ligustrum Ovalifolium*), common hawthorn (*Crataegus monogyna*),common hazel (*Corylus avellana*), common holly (*Ilex aquifolium*), English oak (*Quercus robur*) & silver birch (*Betula pendula*), grey willow (*Salix cinerea*), beech (*Fagus sylvatica*), silver birch (*Betula pendula*),common dogwood (*Cornus sanguinea*), myrobalan plum (*Prunus cerasifera*), wild cherry (*Prunus avium*), common ash (*Fraxinus excelsior*) and common alder (*Alnus glutinosa*)	S	4 ^	100 ^	1	1	1	1	0/2	Y	Good	Good, located within a former agricultural field the trees have been planted on a 3x3m spacing and 20% of the newly created wood plantation has been left as open space, there is at least on pheasant pen within the woodland this area was planted as part of a agricultural or woodland grant scheme to create new native woodland	Remove tree guards and stakes	>40	C2	4.5	1.2

Notes
*Estimated; ^Average

Bum Brook, Shurton - A1

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
T1	crack willow (*Salix fragilis*)	M	7	600 *	3	5	6	3	3	M	Fair	Fair, located on the north eastern embankment of Bum brook east of the access bridge and approximately 2m lower than the level of the adjoining field, co-dominant tree that has failed at this union point the crack is approximately 50cm long	Remove northern crown to union point or fell	<10	R	113.1	6.0
T2	common ash (*Fraxinus excelsior*)	M	8.5	800 *	3	3	4	4	4	EM	Fair	Fair, ivy upon tree	None	>40	A3	201.1	8.0
T3	crack willow (*Salix fragilis*)	M	8	300 *	2	2	2	2	3	MA	Fair	Fair,	None	20-40	C1	28.3	3.0
T4	common alder (*Alnus glutinosa*)	S	9	400 *	2	2	2	2	2	MA	Good	Good	None	20-40	B1	72.4	4.8
G1	8x crack willow (*Salix fragilis*)	M	15 ^	500 ^	4	5	3	3	2	M	Good	Fair, located on the north western embankment of Bum brook west of the access bridge and approximately 2m lower than the level of the adjoining field, some of the trees have been pollarded in the past	Re-pollard	20-40	B2	78.6	5.0
G2	horse chestnut (*Aesculus hippocastanum*), common hazel (*Corylus avellana*), English oak (*Quercus robur*), common beech (*Fagus sylvatica*), common alder (*Alnus glutinosa*), common ash (*Fraxinus excelsior*) & common hawthorn (*Crataegus monogyna*)	S	2 ^	1250 ^	1	1	1	1	0	Y	Fair	Good, located east of the access bridge of Bum brook, recently planted native trees still within their tree guards and staked	None	>40	C2	707.0	15.0
G3	3x crack willow (*Salix fragilis*)	M	6 ^	600 *	1	1	1	1	0	EM	Fair	Fair, coppiced	None	10-20	C2	113.1	6.0
G4	3x crack willow (*Salix fragilis*)	M	11 ^	700 *	2	2	2	2	4	EM	Fair	Fair, coppiced	None	10-20	C2	154.0	7.0
G5	4x crack willow (*Salix fragilis*)	M	6 ^	500 ^	2	2	2	2	0	EM	Fair	Fair, coppiced	None	10-20	C2	78.6	5.0

Notes

*Estimated; ^Average

Hedgerow Trees - H36

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)		Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
T1	English oak *(Quercus robur*)	M	7	600	*	3	5	6	3	3	EM	Fair	Fair, located within a 5m wide hedge	None	>40	A3	113.1	6.0
T2	English oak *(Quercus robur*)	M	8	700	*	3	5	4	2	2	EM	Fair	Fair, located within a hedge on top of an embankment of a ditch	None	>40	A3	154.0	7.0
T3	field maple (*Acer campestre*)	M	6	600	*	1	1	2	1	1	EM	Fair	Fair, hedge row tree, ivy upon the tree	None	20-40	C1	113.1	6.0
T4	apple (*Malus domestica*)	S	7	600	*	3	4	5	4	2	EM	Fair	Fair, hedge row tree	None	20-40	B1	162.9	7.2
T5	English oak *(Quercus robur*)	M	8	700	*	2	4	6	4	3	EM	Fair	Fair, hedge row tree	None	>40	A3	154.0	7.0
G1	field maple (Acer campestre) & sycamore (*Acer pseudoplatanus*)	M	4	500	*	1	2	1	2	2	EM	Fair	Fair, layered hedge row trees that are above the ground level of the surrounding fields	None	20-40	B3	78.6	5.0
G2	3x common ash (*Fraxinus excelsior*)	M	8	800	*	2	2	4	2	3	EM	Fair	Fair, layered hedge row trees that are above the ground level of the surrounding fields	None	10-20	C2	201.1	8.0
G3	4x field maple (*Acer campestre*)	M	6	400	*	2	2	2	2	1	EM	Fair	Fair, layered hedge row trees that are above the ground level of the surrounding fields	None	10-20	C2	50.3	4.0
G4	3x field maple (*Acer campestre*)	M	6	400	*	3	3	3	3	1	EM	Fair	Fair, layered hedge row trees that are above the ground level of the surrounding fields	None	10-20	C2	50.3	4.0
H1	field maple *(Acer campestre*), blackthorn (*Prunus spinosa*), common hawthorn (*Crataegus monogyna*),common ash (*Fraxinus excelsior*), goat willow (*Salix caprea*) & wild plum (*Prunus domestica*)	S	2	100	^	N/A	N/A	N/A	N/A	0	Y	Good	Good, recently planted native trees still within their tree guards and staked	Remove tree guards and stake	>40	C2	4.5	1.2

Notes

*Estimated; ^Average

Hedgerow Trees - H38

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
G1	1x field maple (*Acer campestre*), 2x blackthorn *(Prunus spinosa*), 3x common hawthorn (*Crataegus monogyna*)	M	3 ^	200 ^	1	1	1	1	1	LM	Fair	Fair, the trees are in groups and there are gaps between them it is likely that large section of the hedge row tree were removed in the past	None	>40	C2	12.6	2.0
G2	8x field maple (*Acer campestre*) & 4x common hawthorn (*Crataegus monogyna*)	S	3 ^	250 ^	2	2	2	2	1	LM	Fair	Fair, the trees are in groups and there are gaps between them it is likely that large section of the hedge row tree were removed in the past	None	20-40	C2	28.3	3.0
G3	10x English elm (*Ulmus procera*)	S	4 ^	100 ^	1	1	1	1	0	OM	Fair	Dead, located within H1	Remove	10-20	R	4.5	1.2
G4	4x English elm *(Ulmus procera*)	S	6 ^	400 ^	2	2	2	2	0	OM	Fair	Dead, located in the eastern section of H1, large amount of ivy within the tree,	Remove	10-20	R	72.4	4.8
H1	field maple *(Acer campestre*), blackthorn (*Prunus spinosa*), common hawthorn (*Crataegus monogyna*)	M	2 ^	100 ^	N/A	N/A	N/A	N/A	0	MA	Good	Good, planted native hedge located on top of an embankment of a ditch	Remove tree guards and stake	>40	C2	3.1	1.0

<u>Notes</u>

*Estimated; ^Average

Hedgerow Trees - H49

Tree Ref No.	Species	Single or Multiple Stem (S or M)	Height [*Estimate; ^Average] (m)	Stem Diameter [*Estimate; ^Average] (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
T1	common ash (*Fraxinus excelsior*)	M	5	400 *	1	3	1	1	0	EM	Good	Fair, located within a hedge on top of an embankment 2m above the adjoining field that has a ditch to the north, layered tree	None	20-40	B3	50.3	4.0
G1	3x field maple (*Acer campestre*)	M	3 ^	300 *	2	2	2	2	2	EM	Fair	Fair, hedge row trees, ditch to the north	None	20-40	C2	28.3	3.0
G2	5x field maple (*Acer campestre*)	M	4 ^	300 *	2	2	2	2	2	EM	Fair	Fair, hedge row trees, ditch to the north	None	20-40	C2	28.3	3.0
G3	24m section of English elm (Ulmus procera) & field maple (*Acer campestre*)	M	6 ^	200 *	1	1	1	1	3	M	Poor	Poor and dead elm, hedge row trees	Remove dead elm	10-20	C2	12.6	2.0
G4	field maple (Acer campestre) & common hawthorn (Crataegus monogyna)	M	4 ^	200 *	1	1	1	1	0	EM	Fair	Fair, located within a hedge on top of an embankment that has ditch to the north, layered trees	None	20-40	C2	12.6	2.0
G5	common ash (*Fraxinus excelsior*)	M	6 ^	400 ^	1	3	1	1	0	EM	Fair	Fair, located within a hedge on top of an embankment 2m above the ground level of the adjoining field that has a ditch to the north, layered trees	None	20-40	C2	50.3	4.0
G6	field maple (*Acer campestre*),blackthorn (Prunus spinosa) & common elder (*Sambucus nigra*)	M	3 ^	150 ^	1	1	1	1	0	MA	Fair	Fair, hedge row trees, ditch to the north, two standing dead field maple within the western section	None	10-20	C2	7.1	1.5

Notes

*Estimated; ^Average

6. DISCUSSION

6.1. General

The site is generally exposed to the prevailing north-westerly wind from the Severn Estuary. As a result many of the trees have formed adaptive growth. This has resulted in uncharacteristically small canopy spreads to the north and west, yet larger canopy spreads generally to the east; thus forming an asymmetrical crown. The winds also limit the potential height of the trees that are located on higher ground. Some of these trees which are also on thin or waterlogged soils are also prone to windthrow. All of the woodlands, with the exception of Bishop's Wood, have either fully or partially retained their original boundary earthworks, which consist of a bank and ditch. This landscape feature in conjunction with the species mix, age and method of management (the trees have often been laid) infers that the woodland is at least 100 years old. It is probable that these woodlands were originally intended to provide game cover. The majority of the woodland embankments adjoining agricultural land have experienced a change in land level (lynchet). This has been caused by ploughing and erosion moving soils away from the boundary. These factors, along with agricultural crops, which have shallow rooting systems that compete for moisture within the rooting zone of the trees, are likely to limit the ability of trees to establish and maintain roots within the adjoining agricultural land.

6.2. Wildlife

The site was assessed for its potential to support terrestrial and freshwater legally protected and notable species and, where it was concluded this potential existed, because of the habitat types present, local distribution of species, the location of the site within the UK and Europe etc, surveys were completed. In terms of the trees and woodland, it was concluded that there was potential for the European Protected Species (EPS) bats and dormouse to occur and comprehensive surveys for these species/species groups were completed between 2007 and 2010 (Appendices 11-4 and 11-6 of the Site Preparation Application).

Metal tags have been placed on those trees that have been identified as suitable bat habitat. If one of these trees has been identified within this survey, then the metal tag number has also been recorded in the tree schedule.

Further information on the bat habitat potential is contained within the report titled ‘Tree Survey for Bats Hinkley Point’ that was undertaken by Entec.

Mitigation works to remove European badgers (*Meles meles*) was evident in all the woodlands, except for Bishops Wood. These mitigation works have resulted in small to large areas of shrub and tree clearance within the majority of the woodlands.

The trees that were identified as having bat habitat potential remain *in situ*. The entrances to the badger setts have been covered with chain link to prevent the badgers returning. These areas have now been fenced off using the type of chain link fencing that is recommend within BS 5837 (2005). New deer fencing has been erected around the woodlands to exclude red deer (*Cervus elaphus*).

6.3. Statutory Controls

None of the woodland has been designated Ancient, according to a Land Information Search of the Forestry Commission's website.

Woodlands W2, W3 and WW are part of a Woodland Grant Scheme.

There are no records of Tree Preservation Orders (TPO) within the Company's management records for the woodlands. However, West Somerset Council proposed a Woodland TPO, reference W/3/118(W/1), on part of Whitewall Brake on the 4th March 2011.

6.4. Whitewall Brake (W1)

This one hectare woodland adjoins pasture to the west and east. To the south it adjoins a stone track that is also a public footpath. To the north is the South West Coast Path which is adjacent to the beach. Another public footpath runs north to south along the eastern boundary of the wood.

In the western section there are a number of water courses and drains that flow south to north, towards the Severn Estuary. Within the southern section is an area of dense brambles together with open areas. Given the water course and the Severn Estuary to the north, the majority of the western and northern sections of the woodland are considered to be wet woodland. This saturation of the soil is causing the affixation of the roots, which is resulting trees becoming moribund and dying, as within W1-G8. Furthermore, the saturation of the soil will cause root instability, and increase the risk of the trees falling over (windthrow). Examples of this are present within the northern and western sections of the woodland within W1-G1.

The trees and shrubs within the northern section of the woodland are significantly smaller than the internal trees. This stunted growth is probably caused by a combination of the soil conditions, prevailing north-westerly winds and salt spray. There are a number of fallen and decomposing large willows, oaks and field maples within the central eastern section, probably a result of windthrow.

An area of recently planted trees, which are still within their tree guards, is present in the southern section, east of the water course. Large gaps are present throughout the group, where some of these new trees have died, and these areas have become colonised by dense bramble.

Mature and over-mature oaks and field maples are present within a small area towards the central eastern section of the woodland.

The woodland contains many dead, dying or dangerous trees; indeed there are not many trees that do not fit this description, the survey tables indicate that all the trees should either be removed or are of low quality and value. The few trees that are classed as category B or above, including a number of sessile oaks have also been identified as potential bat habitat and are therefore protected from felling unless a disturbance licence is granted by Natural England. There has been a limited amount of badger mitigation work within W1; the largest area has been in and around W1-G7.

6.5. Seaburton Copse (W2)

This 0.80 hectare woodland adjoins agricultural pasture to the west and east, to the south it adjoins a mud tack and to the north is the public footpath.

There are remains of woodland embankments surrounding the woodland. The northern section of the eastern embankment is approximately one metre below the adjoining field. There are the remains of a wall in this section, on top of which are a group (W2-G2) of mature and over-mature laid field maple. These trees form the most significant landscape, and wildlife feature, of the woodland. Some of the trees have been identified as potential bat habitat.

Within the woodland there are four sites of recent ground investigation works. Hardstanding has been installed in these areas, which has extended into the Root Protection Area of some of the retained trees.

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The majority of the woodland is made up of the trees within groups W2-G3, W2-G4 and W2-G5. The trees within these groups have probably had their growth stunted by a combination of the saturated soil, prevailing winds and salt spray.

6.6. Govetts Copse (W3)

This 0.40 hectare woodland adjoins agricultural pasture to the west, east and south and it adjoins the public footpath to the north. It contains mainly Ash, with some Field Maple and English Oak. The understorey is typically Thorn and Blackthorn with Elder. The trees are mainly in fair or good condition although some of the taller trees (T 4 to 7) are showing signs of windthrow and should be inspected before working close to them.

6.7. Haysgrove Brake (W8)

This 0.9 hectare woodland is surrounded by agricultural pasture to the east and south and by water course and ditches to the north and west. There are remains of woodland embankments surrounding the woodland, however some of these are no longer the boundary given additional planting. A large section is the east of the woodland has been removed to allow Badger mitigation works. These works have exposed the remaining mature Field Maples, Hawthorn and English Elm, however given the low height of the trees and the prevailing wind is from the north-west there is not a significant increase in the risk of these trees failing due to windthrow. The areas of woodland in close proximity to the water course and the ditches can be considered as a wetwood. The majority of the woodland consists of the group W8-G2 in the southern and western sections of the wood. Approximately 30% of this group is dying or moribund and the other 70% is dead. It appears that these trees have been planted in last 10/20 years a few of the planted rows have been felled approximately 5/10 years ago. The growth of these trees have been limited due to the water logged soils, salt spray, high winds and Dutch Elm disease. There are a number of mature individual Field Maple, Oak, Hawthorn, Crack Willow trees on the remaining eastern woodland embankment and within the north eastern section of the woodland. These trees provide the significant value to the landscape and wildlife and some of them have been identified as possible habitat for bats and birds.

6.8. Newclose Covert (W9)

This 0.35 hectare woodland has woodland embankments upon all of its boundaries which are surrounded by agricultural land. It consists principally of Ash and English Elm surrounded by a mixed hedge of Hawthorn, Field Maple, Blackthorn and Dogwood. Most of the trees are in poor physiological and structural condition.

6.9. Bishops Wood (WW)

This 2.8 hectare new native woodland has been planted on agricultural land in the last 5 years or so. The majority of the trees are still tied and staked within their tree guards. There is no damage to the trees and none of the trees have a diameter greater than 150mm. The pheasant pen within the woodland, does not appear to have been used in the recent past.

6.10. Bum Brook, Shurton (A1)

A section of hedge that forms the southern boundary of the Company's ownership. That consists of a large Willow in poor condition and a group of Willows that have been pollarded.

6.11. Hedgerow Trees

A small number of the existing hedgerows within the site contain hedgerow trees. These hedges (Nos 36, 38, 49 and alongside Bum Brook) are marked on the plan.

7. TREE PROTECTION ZONE (TPZ)

The resulting Root Protection Area (RPA) and TPZ for the trees using the standard calculation within BS 5837 (2005) is considered inappropriate for the majority of the trees surveyed. All the trees within the woodland areas could be considered as open grown trees and therefore up to 20% of their RPA can be offset in one direction.

The formation of a lynchet around the trees within the woodland embankments will also have restricted the ability of tree roots to establish and develop within the fields. The trees in close proximity to the water course, and within waterlogged ground, will also have had their root growth inhibited due to the lack of oxygen and nutrients within these environments. Similarly, trees located adjoining established tracks and areas of hard standing will have had their root growth inhibited by these compacted substrates.

Tree protection fencing should take into account the existing landscape features. The fencing should be positioned on the far side of areas of hardstanding, to prevent access beneath the branch spread of the adjacent trees. The fencing within the fields should be positioned outside the widest branch spread, or to five metres, whichever is the greater distance.

8. CONCLUSION

The submission of this report, combined with the previous report (*(Adas, 2010) Tree Survey Hinkley Point C Development Site*) completes the survey for all the principal groups of trees within the proposed development site.

Tree Protection Zones (TPZ) should be installed around all trees that will be retained. This should be installed prior to construction and maintained until all development works are complete. The recommended Protective Barrier construction shown in Figure 2 of BS 5837 (2005), should be adopted as a minimum standard.

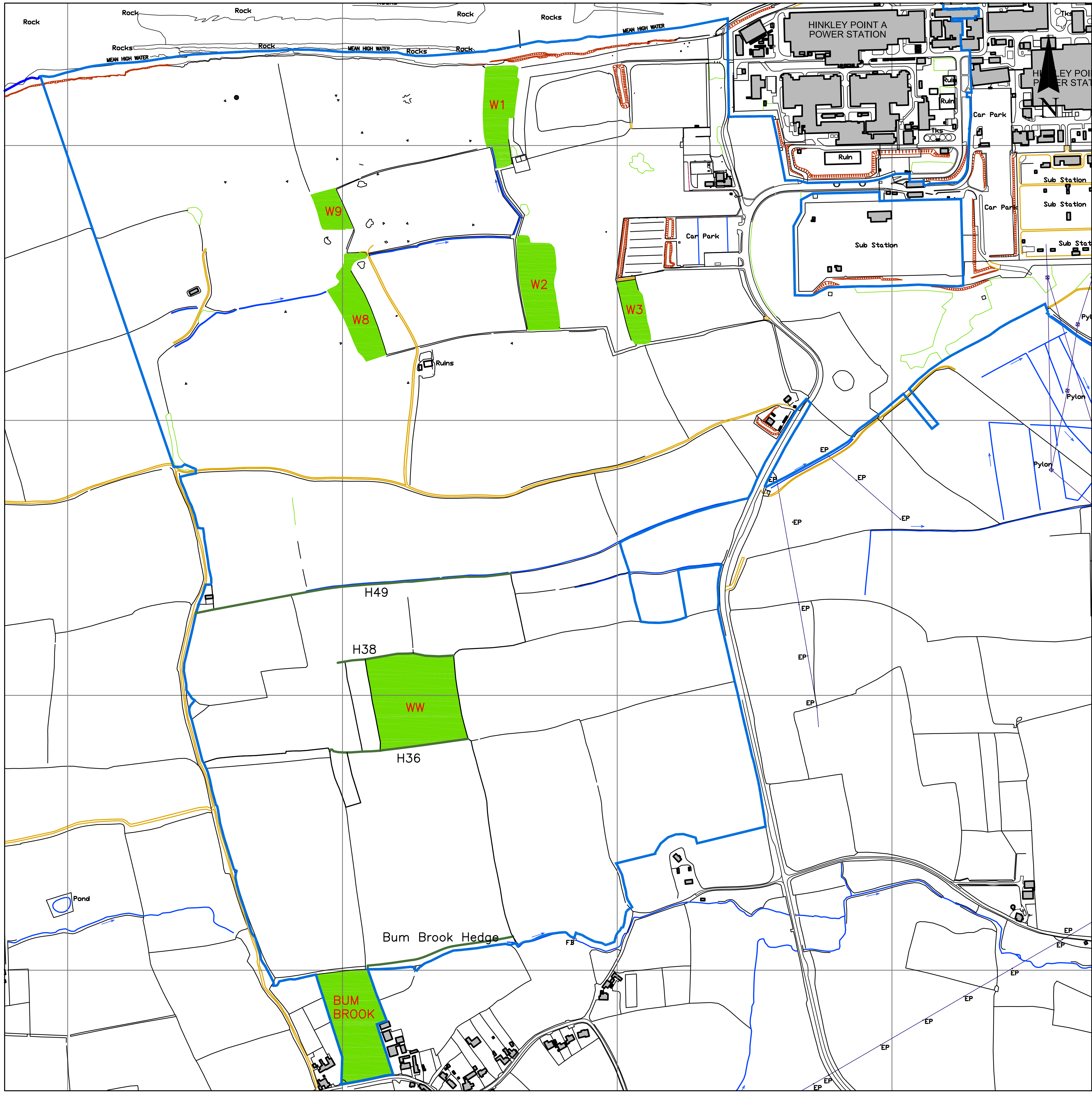
It is recommended that all standing and / or collapsing trees, which could fail across the TPZ are removed, as these pose a risk to members of the public and the work force.

TPZ are not required around those trees or groups which are to be removed as part an approved planning application; unless specifically requested as part of planning conditions.

Mitigation planting should be taken into consideration where trees and woodlands are proposed to be removed. This mitigation should aim to replace like for like; however the use of English elm should be avoided, due to the poor health of the trees within the current woodlands.

APPENDIX 1 – OVERALL TREE SURVEY PLAN

See following page.



W1	Whitewall Brake
W2	Seaburton Copse
W3	Govetts Copse
W8	Haygrove Brake
W9	Newclose Covert
WW	Bishops Wood
	Hedgerows Containing Trees

Job Title

Hinkley Point C
Preliminary Works
Arboricultural Survey

Drawing Title

Overall Site Layout Plan

Drawing No

HPC01/CUL4005/SLP01

Scale: Not to Scale

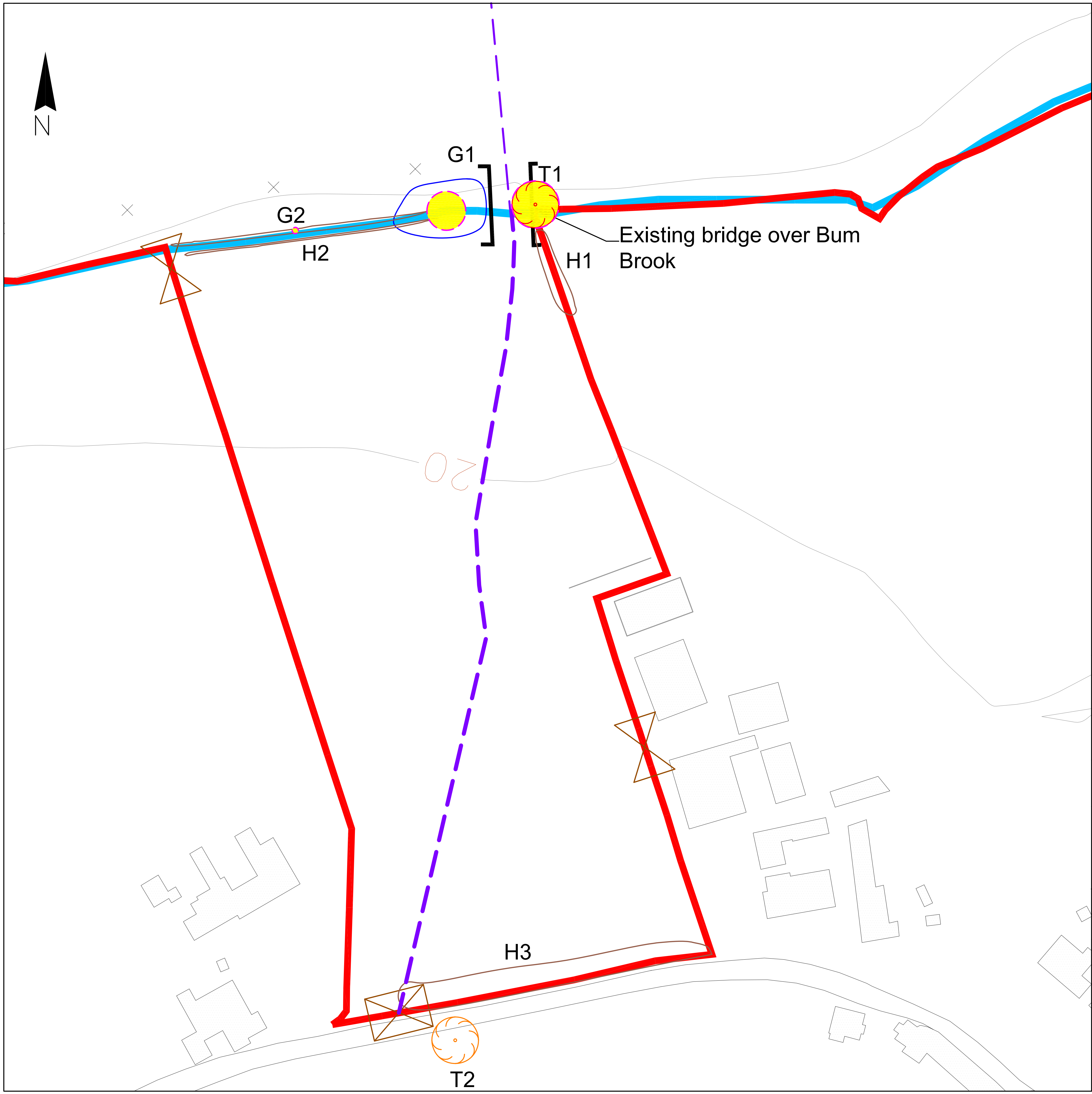
Drawn by:		Checked by:			
DW	07/04	MW	07/04		

LRQ 0936648

ADAS 11d MILTON PARK, MILTON, ABINGDON, OXFORD, OX14 4RS
tel: 01235 438900, fax: 01235 438909.

APPENDIX 2 – INDIVIDUAL TREE SURVEY PLANS

See following page.



key

- Planning Application Site Boundary
- Proposed Alternative Route
- Existing Gate
- Running Water - Bum Brook

Tx	Individual Tree
Gx	Group of Trees
Hx	Hedge

TREE CATEGORIES

Category A
Those of high quality and value: in such a condition as to be able to make a substatial contribution (a minimum of 40 years is suggested).

Category B
Those of moderate quality and value: those in such a condition as to make a significant contribution (a minimum of 20 years is suggested).

Category C
Those of low quality and value: currently in adequate condition to remain until new planting could be established (a minimum of 10 years is suggested), or young trees with a stem diameter below 150mm.

Category R
Those in such a condition that any existing value would be lost within 10 years and which should, in the current context, be removed for reasons of sound arboricultural management.

Offsite Tree

Recommended 'Root Protection Area' (RPA) of trees proposed for retention calculated using the method set out in para 5.2.2 of BS5837:2005.

NOTE: Quality class description derived from BS5837:2005

Job Title

Hinkley Point C
Preliminary Works
Site Preparation Works

Drawing Title

Tree Survey

Bum Brook, Shurton

Drawing No

HPC01/CUL4005/TS01

Scale: Not to Scale

Drawn by:		Checked by:			
DW	29/03	WL	29/03		

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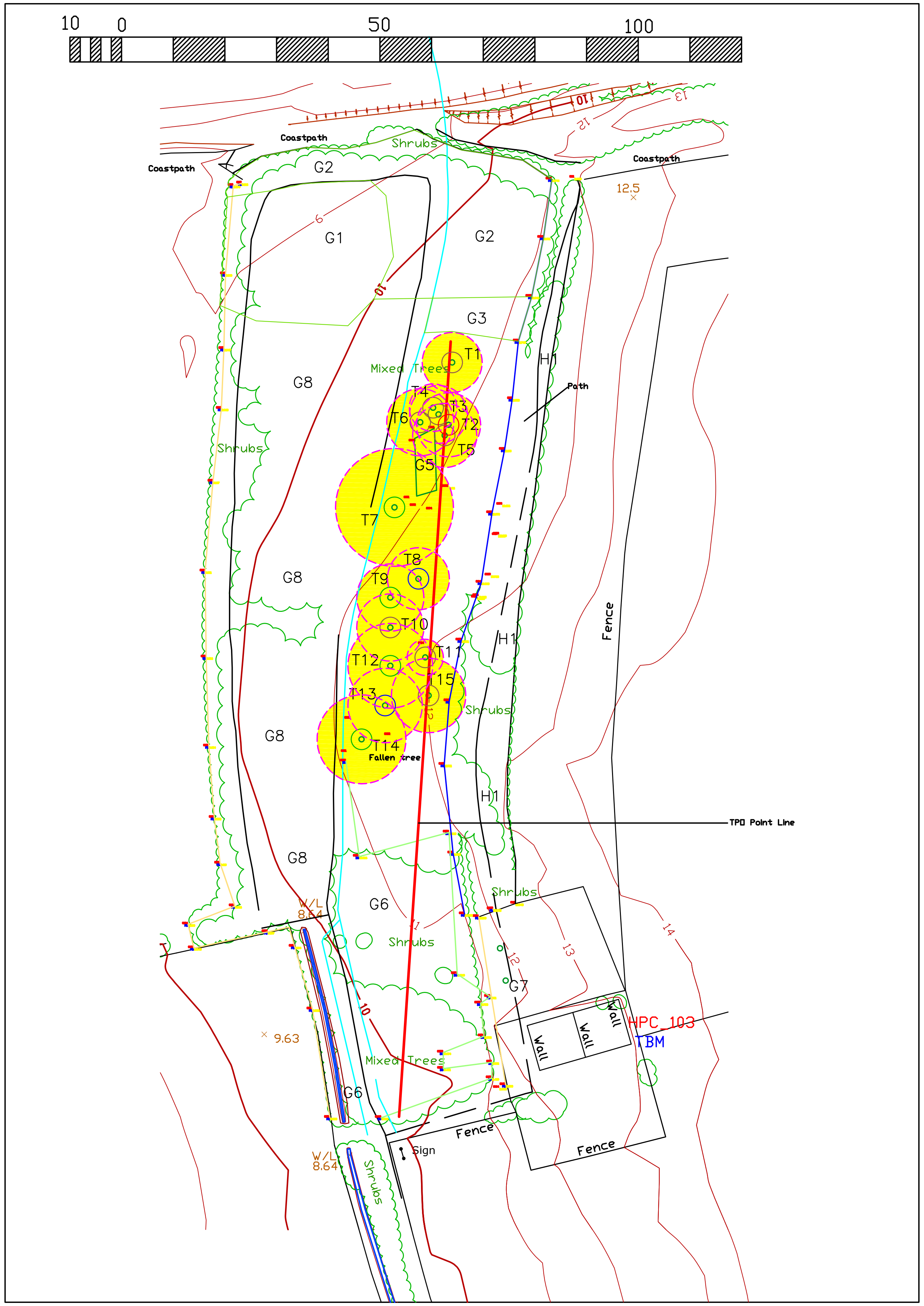

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TREE CATEGORIES

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Recommended 'Root Protection Area' (RPA) of trees proposed for retention calculated using the method set out in para 5.2.2 of BS5837:2005.

NOTE: Quality class description derived from BS5837:2005

Job Title

Hinkley Point C
Preliminary Works
WHITEWALL BRAKE – W1

Drawing Title

TREE QUALITY CONSTRAINTS PLAN

Drawing No

HPC01/CUL4005/TQCP03

Scale: 1/1000 @ A3

Drawn by:		Checked by:			
DW	29/03	WL	29/03		

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NOTE: Quality class description derived from BS5837:2005

Job Title

Hinkley Point C
Preliminary Works
SEABURTON COPSE – W2

Drawing Title
TREE QUALITY CONSTRAINTS PLAN

Drawing No
HPC01/CUL4005/TQCP05

Scale: 1/750 @ A3

Drawn by:		Checked by:			
DW	18/03	WL	18/03		

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ADAS

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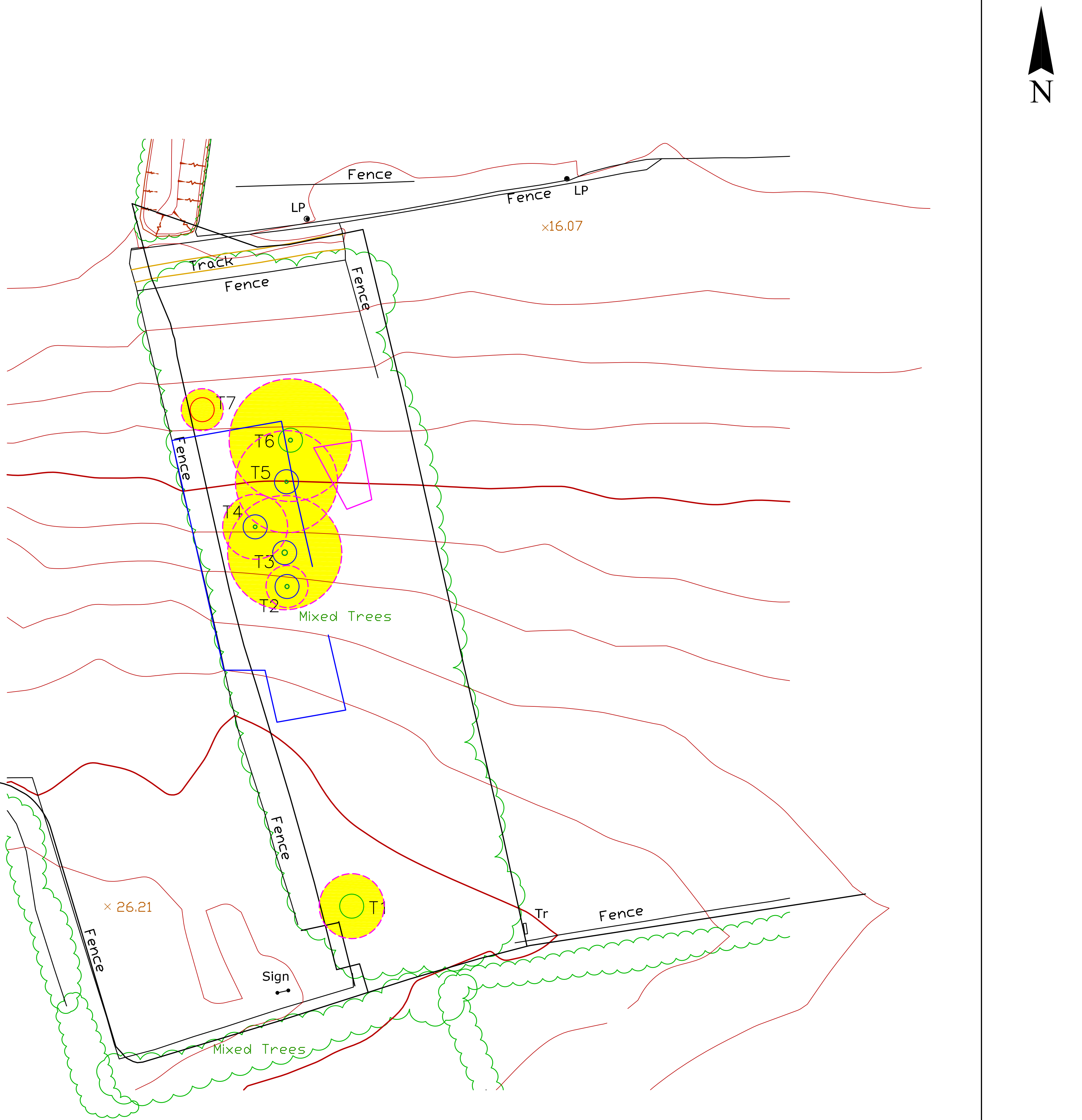

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NOTE: Quality class description derived from BS5837:2005

Job Title

Hinkley Point C
Preliminary Works
GOVETTS COPSE – W3

Drawing Title

TREE QUALITY CONSTRAINTS PLAN

Drawing No

HPC01/CUL4005/TQCP04

Scale: 1/750 @ A3

Drawn by:		Checked by:			
DW	18/03	WL	18/03		

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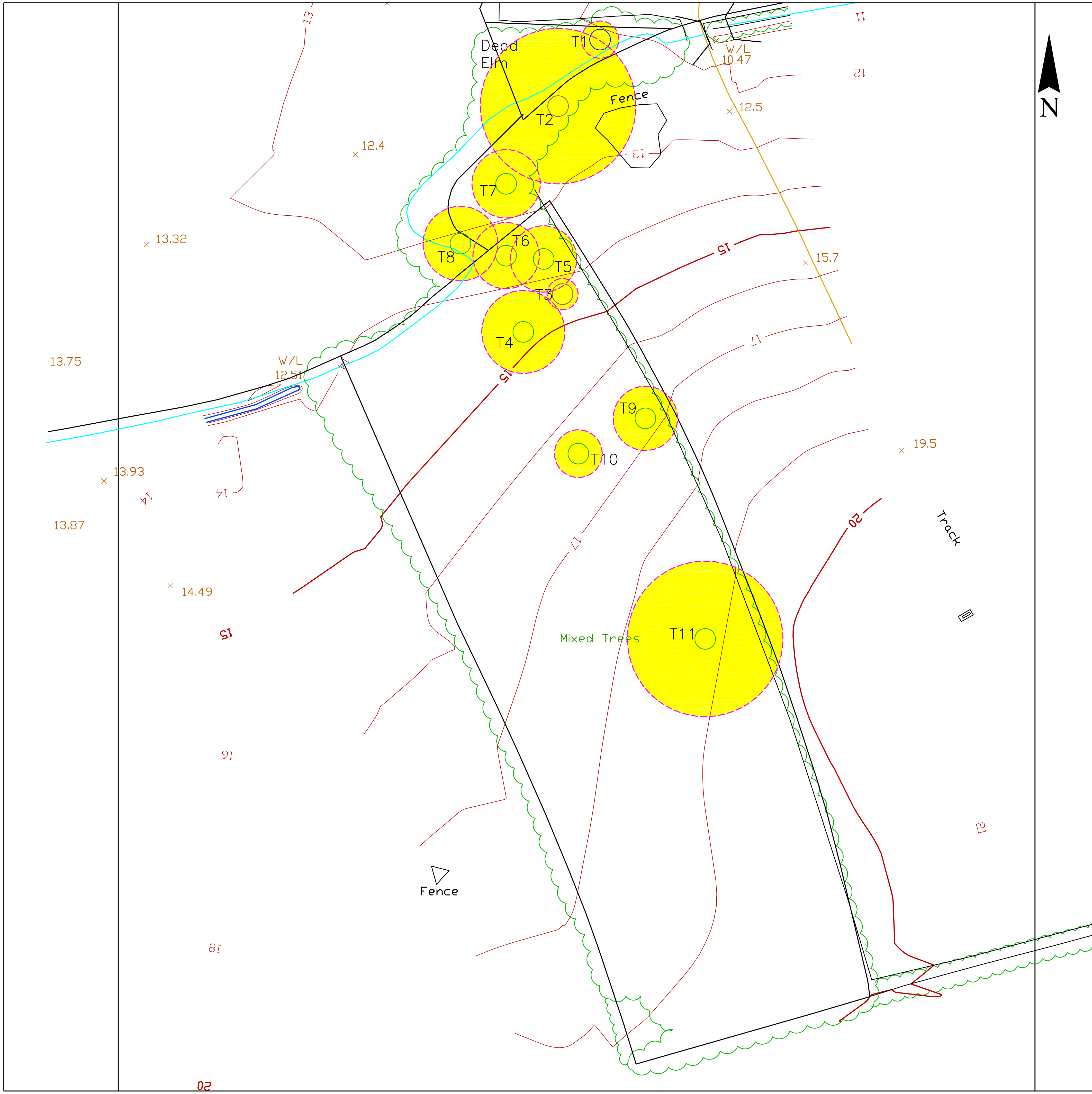

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Recommended 'Root Protection Area' (RPA) of trees proposed for retention calculated using the method set out in para 5.2.2 of BS5837:2005.

NOTE: Quality class description derived from BS5837:2005

Job Title

Hinkley Point C
Preliminary Works
HAYGROVE BRAKE – W8

Drawing Title

TREE QUALITY CONSTRAINTS PLAN

Drawing No

HPC01/CUL4005/TQCP02

Scale: 1/750 @ A3

Drawn by:		Checked by:			
DW	18/03	WL	18/03		

LRQ 0936648

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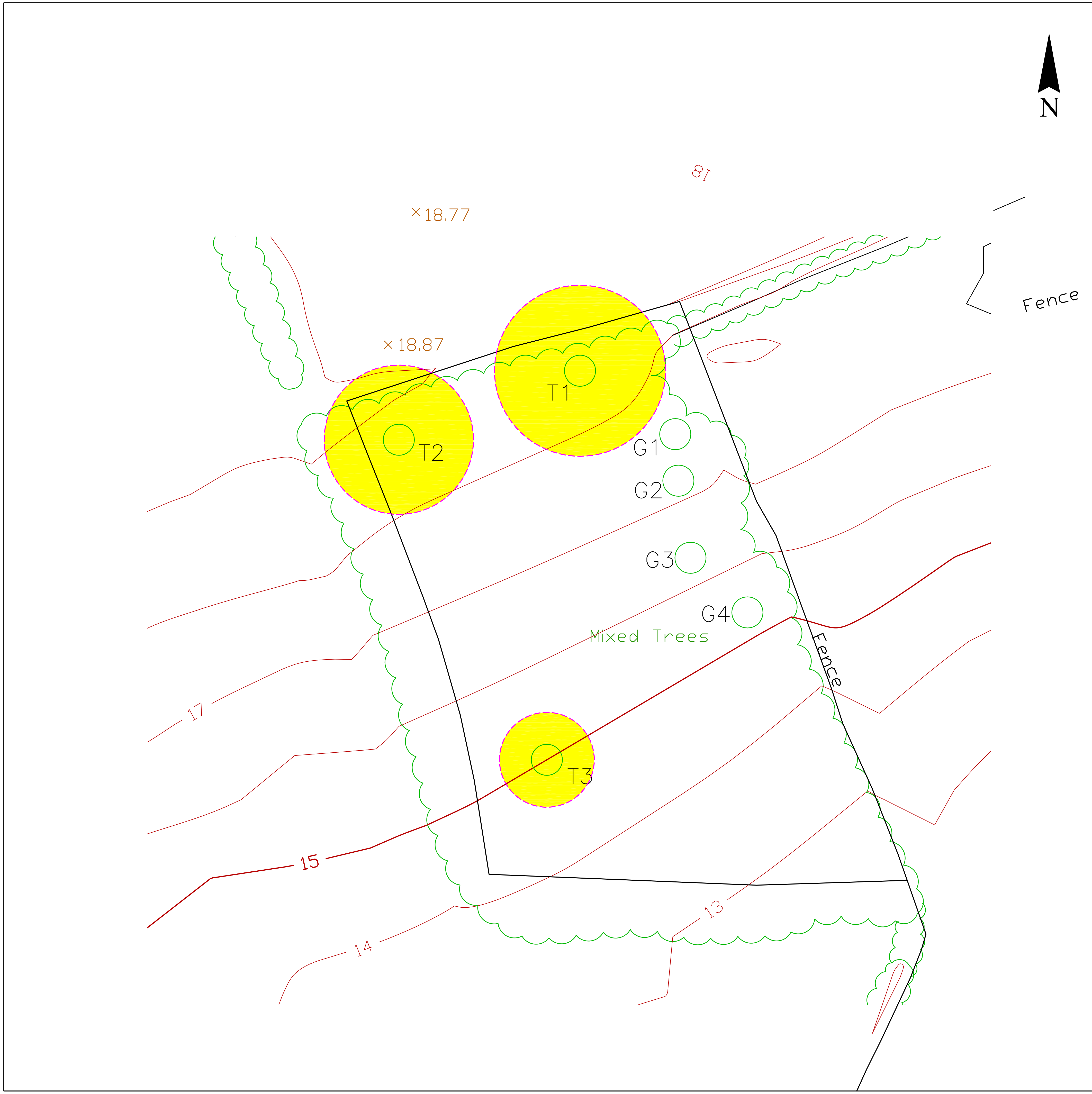
tel: 01235 438900, fax: 01235 438909.



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NOTE: Quality class description derived from BS5837:2005

Job Title	Hinkley Point C Preliminary Works NEWCLOSE COVERT – W9
Drawing Title	TREE QUALITY CONSTRAINTS PLAN
Drawing No	HPC01/CUL4005/TQCP01
Scale: 1/500 @ A3	

Drawn by:		Checked by:			
DW	18/03	WL	18/03		

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APPENDIX 3 – BS 5837 – TREE CATEGORY GRADING

See following page.

Table 1 — Cascade chart for tree quality assessment

TREES FOR REMOVAL

Category and definition	Criteria	Identification on plan
<u>Category R</u> Those in such a condition that any existing value would be lost within 10 years and which should, in the current context, be removed for reasons of sound arboricultural management	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other R category trees (i.e. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby (e.g. Dutch elm disease), or very low quality trees suppressing adjacent trees of better quality NOTE Habitat reinstatement may be appropriate (e.g. R category tree used as a bat roost: installation of bat box in nearby tree).	DARK RED

TREES TO BE CONSIDERED FOR RETENTION

Category and definition	Criteria — Subcategories			Identification on plan
	1 Mainly arboricultural values	2 Mainly landscape values	3 Mainly cultural values, including conservation	
<u>Category A</u> **Those of high quality and value:** in such a condition as to be able to make a substantial contribution (a minimum of 40 years is suggested)	Trees that are particularly good examples of their species, especially if rare or unusual, or essential components of groups, or of formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands which provide a definite screening or softening effect to the locality in relation to views into or out of the site, or those of particular visual importance (e.g. avenues or other arboricultural features assessed as groups)	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)	LIGHT GREEN
<u>Category B</u> **Those of moderate quality and value:** those in such a condition as to make a significant contribution (a minimum of 20 years is suggested)	Trees that might be included in the high category, but are downgraded because of impaired condition (e.g. presence of remediable defects including unsympathetic past management and minor storm damage)	Trees present in numbers, usually as groups or woodlands, such that they form distinct landscape features, thereby attracting a higher collective rating than they might as individuals but which are not, individually, essential components of formal or semi-formal arboricultural features (e.g. trees of moderate quality within an avenue that includes better, A category specimens), or trees situated mainly internally to the site, therefore individually having little visual impact on the wider locality	Trees with clearly identifiable conservation or other cultural benefits	MID BLUE
<u>Category C</u> **Those of low quality and value:** currently in adequate condition to remain until new planting could be established (a minimum of 10 years is suggested), or young trees with a stem diameter below 150 mm	Trees not qualifying in higher categories NOTE Whilst C category trees will usually not be retained where they would impose a significant constraint on development, young trees with a stem diameter of less than 150 mm should be considered for relocation.	Trees present in groups or woodlands, but without this conferring on them significantly greater landscape value, and/or trees offering low or only temporary screening benefit	Trees with very limited conservation or other cultural benefits	GREY

Tree Survey
Hinkley Point C Development Site
Hinkley Point Nuclear Power Station, Somerset

Report by: Ian Braddock BSc (Hons) Arb
Checked by: Jon Abbatt MICFor & William Little

Date: July 2010

Submitted to:
EDF Energy

Prepared by:
ADAS UK Ltd
11D Milton Park
Milton
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Oxfordshire
OX14 4RS

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Fax: 01235 438909

CONTENTS

1. INTRODUCTION

This report was commissioned by Judith Linnane of EDF Energy on 16th June 2010 and concerns vegetation along the west of Wick Moor Drove, the north and south of Green Lane, and the east of Benhole Lane, all of which are either within the site or border the site of the proposed development of a new nuclear power station known as Hinkley Point C, at the existing Hinkley Point Nuclear Power Station in Somerset on the Severn Estuary.

The report provides a survey of trees, and other landscape features such as hedges, closely following the guidance provided in British Standard (BS) 5837 (2005) 'Trees in Relation to Construction – Recommendations'.

2. LIMITATIONS

A topographical survey of the area, identifying trees and other landscape features, was not available at the time of the survey. Consequently, the positions of the features identified on the Tree Survey Plan have been plotted by the combination of aerial photography, GPS, and by eye. Accuracy is sufficient to enable identification of features on site; the buffer zones should be measured and laid out on site using original land survey data.

Only those features that were immediately parallel with Wick Moor Drove, Green Lane and Benhole Lane have been surveyed; such hedges that are perpendicular to these lanes have not been recorded.

Similarly, only features that were apparent at the time of inspection could be considered and no liability can be accepted regarding trees, hedges or their parts that were inaccessible or obscured in part or in whole.

Whilst hedges have been identified, only general information has been recorded for these features. Their quality grading system within BS 5837 (2005) is not appropriate for hedges, and therefore such features have not been assigned a grade. The quality of a hedge would need to be done as part of a specific hedgerow survey, following the requirements of The Hedgerow Regulations 1997.

3. SURVEY METHODOLOGY

The survey was carried out by Ian Braddock of ADAS between the 5th and 7th July 2010.

The survey consisted of an inspection of the vegetation along the western side of Wick Moor Drove (the southern extent is approximately 100m north of the junction with North Lane; and the northern extent is adjacent to the car park within the power station's boundary fence), the north and south sides of Green Lane (between Wick Moor Drove to the east and Benhole Lane to the west), and the eastern side of Benhole Lane (the northern extent is approximately 400m north of the junction of Green Lane and Benhole Lane, where it fades into a field entrance; and the southern extent is approximately 680m north of its junction with the main road through Shurton). These can be seen on the Tree Survey Plan overview attached at Appendix 1.

Following the guidance provided in BS 5837 (2005), the survey has identified individual trees, groups of trees, woodlands, and hedges which would ordinarily have been included on a topographical survey.

The vegetation was inspected from ground level, by eye.

The weather conditions were generally dry and bright, with good visibility.

All height measurements were taken using a TruPulse laser where there was clear visibility of the stem, base and top of the feature to be measured. Where this was not possible, height measurements were estimated.

The stem diameters of single stem trees were taken at 1.5m above ground level, or just above the root flare for multi-stemmed trees. Where trees were not easily accessible the diameters have been estimated; and for group of trees the largest stem diameter within the group has been recorded.

The survey recorded the following information for each tree or group of trees:

Tree No.	-	Individual Tree (T); Group of Trees (G); Hedge (H); Woodland (W).
Species	-	Common and Latin Name of Tree(s);
Stem Count	-	The approximate number of trees within a group (if applicable).
Single or Multiple Stem	-	'S' represents a tree which has a single clear stemto at least 1.5m above ground level, whilst 'M' represents a tree where the main stem divides into at least two stems below 1.5m above ground level.
Height	-	Measured from the adjacent ground level in metres;
Stem Diameter	-	Measured at 1.5m above ground level, or immediately above the root flare for multi-stemmed trees and recorded in millimetres;
Crown Spread	-	Measured in metres to the four cardinal points (north, south, east and west);
Height of Crown Clearance	-	The clearance between the adjacent ground level and the crown of the tree, measured in metres;

Age Class	-	The stage at which the tree, or majority within a group, is in its life cycle (**Y**oung. **M**iddle –**A**ged, **M**ature may be prefixed with 'E' Early or 'L' Late **O**ver –**M**ature, or **V**eteran)
Physiological Condition	-	Its characteristics to normal functioning (Good, Fair, Poor or Dead);
Structural Condition	-	Any physical defects or abnormalities noted;
Preliminary Management Recommendations	-	Any necessary management work prior to development;
Estimated Remaining	-	An estimation of how long the tree(s) or hedge
Contribution	-	will successfully contribute to its surroundings in years (<10, 10-20, 20-40, 40+);
Category Grading	-	The overall quality of the tree(s), sub-fixed with its main value: **R** = Removal, **A** = High quality, **B** = Medium quality, **C** = Low quality and **1** = Arboricultural value, **2** = Landscape value, **3** = Cultural value.
Root Protection Area	-	Given as a radius in metres from the stem of the tree (or the edge tree of a group or stem of a hedge) [on the Tree Survey plan this may be extended to protect the spread of the crown].

4. TREE SURVEY RESULTS

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
T1	Common ash (Fraxinus excelsior)		M	7.0	270	3.0	3.0	3.0	3.0	1.0	MA	Fair	No main leader; large secondary stem at 1.2m on south west	None	20-40	C2	22.9	2.7
T2	Common ash (Fraxinus excelsior)		S	7.0	200	2.0	2.0	3.0	1.5	1.0	Y	Fair	No main leader; forks at 3m	None	20-40	C2	18.1	2.4
T3	Common ash (Fraxinus excelsior)		S	6.5	140	2.0	2.0	2.0	2.0	1.0	Y	Fair	No main leader; forks at 1.3m	None	20-40	C2	8.9	1.7
T4	Goat willow (Salix caprea)		M	8.0	140	1.0	5.0	3.0	2.0	0.0	Y	Poor	Flailed at 2m and on west; stem spliting.	Remove	<10	R	6.2	1.4
T5	Common ash (Fraxinus excelsior)		M	9.0	240	5.0	4.0	4.0	4.0	1.5	EM	Good	Twin stem at base	None	20-40	B2	18.1	2.4
T6	Silver maple (Acer saccharinum)		M	5.0	75	3.0	0.5	1.0	3.0	1.5	Y	Fair	Twin stem close to base; part under hedgerow management	None	10-20	C2	1.8	0.8
T7	Silver maple (Acer saccharinum)		M	5.0	75	2.5	3.0	1.5	1.0	1.5	Y	Fair	Twin stem close to base; part under hedgerow management.	None	10-20	C2	1.8	0.8
T8	Silver maple (Acer saccharinum)		M	5.0	75	1.0	1.5	0.5	0.5	1.5	Y	Fair	Twin stem at 2m; part under hedgerow management	Remove	<10	R	1.8	0.8
T9	White poplar (Populus alba)		S	6.0	80	4.0	1.5	3.0	1.5	0.5	Y	Fair	Heavy lean from base out over road	Remove	<10	R	2.9	1.0
T10	Common ash (Fraxinus excelsior)		M	7.0	120	3.0	4.0	3.0	1.0	2.0	MA	Fair	Twin stem close to base; suppressed on west due to adj hedgerow field maple	None	20-40	C2	4.5	1.2
T11	Common ash (Fraxinus excelsior)		S	5.0	75	2.0	2.0	2.0	1.0	2.5	Y	Fair	Lost leader at 3m	None	20-40	C2	2.5	0.9
T12	Common ash (Fraxinus excelsior)		S	3.0	75	1.0	1.0	2.0	1.0	0.5	Y	Fair	No apical dominance	None	10-20	C2	2.5	0.9
T13	Common ash (Fraxinus excelsior)		S	7.0	75	2.0	2.0	2.5	1.0	1.5	Y	Fair	Loses apical dominance at 3m	None	20-40	C2	2.5	0.9
T14	Common ash (Fraxinus excelsior)		S	6.0	100	2.0	1.5	1.0	1.0	2.0	Y	Fair	Loses apical dominance at 2.5m.	None	20-40	C2	4.5	1.2
T15	Common ash (Fraxinus excelsior)		S	7.0	100	2.0	1.0	2.0	1.0	1.5	Y	Fair	No apical dominance	None	20-40	C2	4.5	1.2
T16	English elm (Ulmus procera)		S	0.0	90	2.0	1.5	1.0	1.5	2.5	Y	Poor	Previouslysuppressed to south; corky bark; historic small branch tear at 2m.	Remove	<10	R	3.7	1.1
T17	Common ash (Fraxinus excelsior)		S	6.5	160	1.5	5.0	4.0	2.0	2.0	MA	Fair	Included secondary branch at 1.5m	Remove branch at 1.5m	>40	B2	11.6	1.9

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
T18	Common ash (Fraxinus excelsior)		S	9.0	250	2.0	7.0	5.0	3.0	1.0	EM	Fair	Low lateral branch at 1.4m on south; no apical dominance.	None	>40	B2	28.3	3.0
T19	Common ash (Fraxinus excelsior)		S	7.0	170	2.0	5.0	4.0	2.5	0.0	MA	Poor	Tumerous cankers throughout; dieback in top; epicormic growth on main stem from base up to 2m	Remove	<10	R	13.1	2.0
T20	Common ash (Fraxinus excelsior)		S	9.0	280	2.0	7.0	3.0	4.0	1.5	MA	Fair	Tumerous canker throughout; some deadwood.	None	10-20	C2	35.5	3.4
T21	Cherry plum (Prunus cerasifera)		M	4.0	120	1.0	3.0	4.0	1.5	0.0	MA	Poor	Low branch forking; loss of central leader; some dieback on north.	Remove	<10	R	4.5	1.2
T22	Wild cherry (Prunus avium)		S	3.0	75	1.0	2.0	3.0	2.0	0.5	Y	Fair	Poor branch formation; no central leader.	Remove	<10	R	2.5	0.9
T23	Common ash (Fraxinus excelsior)		S	9.0	210	4.0	7.0	6.0	4.0	1.0	EM	Fair	Included secondary stem at 1m on south, leans out over road.	Remove secondary stem at 1m	>40	B2	20.0	2.5
T24	Common ash (Fraxinus excelsior)		S	5.0	130	2.0	6.0	3.0	0.5	1.0	MA	Fair	One sided due to prevailing wind; long lateral branch on east at 2m; some deadwood, and lopped branches.	None	20-40	C2	7.6	1.6
T25	Common oak (Quercus robur)		S	5.0	75	2.0	1.0	0.5	1.0	2.0	Y	Fair	Suppressed to south	None	>40	C2	2.5	0.9
T26	Field maple (Acer campestre)		M	9.0	250	5.0	4.0	1.5	3.0	0.5	EM	Fair	Poor form; multi stem at base; outgrown hedgerow tree	None	20-40	C2	19.6	2.5
T27	Field maple (Acer campestre)		M	5.0	260	2.0	3.0	3.0	3.0	0.0	EM	Fair	Poor form; outgrown hedgerow tree	None	20-40	C2	21.2	2.6
T28	White willow (Salix alba)		M	10.0	450	6.0	6.0	5.0	6.0	0.5	M	Fair	Historic collapsed main stem, pollarded close to ground level; subsequent regrowth stems (av 120mm diameter) spreading out	Re-pollard	20-40	C2	63.6	4.5
G1	Common ash (Fraxinus excelsior) and English elm (Ulmus procera)	25	S	11.0	230	4.0	5.0	4.0	5.0	1.5	EM	Fair	Outgrown hedge stock; elm are standing and collapsing dead stems.	Remove dead elm	>40	B2	23.9	2.8

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
G2	White willow (Salix alba)	10	M	20.0	420	7.0	7.0	7.0	9.0	0.0	M	Fair	Some twin stems; all lean to east over road (in line with prevailing wind); some smaller stems topped at 2m	None.	10-20	C2	55.4	4.2
G3	English elm (Ulmus procera)	20	S	8.0	160	1.0	2.0	2.0	2.0	2.0	MA	Dead	Standing and/or collapsing dead stems	Remove all dead stems	<10	R	11.6	1.9
G4	Common ash (Fraxinus excelsior)	3	S	5.0	75	1.0	2.5	3.0	1.5	1.0	MA	Fair	Poor form; outgrowing hedge stock.	None	20-40	C2	2.5	0.9
G5	English elm (Ulmus procera)	80	S	8.0	430	2.0	3.0	4.0	3.0	1.0	EM	Poor	Aprx 15% are dead	Remove all dead stems	10-20	C2	83.7	5.2
G6a	Common ash (Fraxinus excelsior)	3	S	5.5	75	1.0	2.5	0.5	2.0	2.0	Y	Fair	Suppressed to south	None	20-40	C2	2.5	0.9
G6b	Common ash (Fraxinus excelsior)	10	S	5.0	80	1.0	2.0	2.0	2.0	1.5	Y	Fair	Suppressed to south and/or north by surrounding elm.	None	20-40	C2	2.9	1.0
G7	English elm (Ulmus procera)	200	S	10.0	140	3.0	3.0	3.0	3.0	2.0	EM	Poor	Aprx 10-15% dead	Remove all dead stems	10-20	C2	8.9	1.7
G8	English elm (Ulmus procera)	100	S	10.0	140	3.0	3.0	3.0	3.0	1.0	EM	Poor	Aprx 5% dead	Remove all dead stems	10-20	C2	8.9	1.7
G9	Common ash (Fraxinus excelsior)	3	S	9.0	120	3.0	2.5	3.0	2.5	1.0	MA	Fair	Suppressed to east and west by surrounding elm	None	20-40	C2	6.5	1.4
G10	English elm (Ulmus procera), Field maple (Acer campestre)	6	S	5.0	120	1.0	1.0	3.0	1.0	1.0	MA	Fair	Field maple surrounded by elm; elm subsequently suppressed on west and east by adj field maple.	None	10-20	C2	6.5	1.4
G11	English elm (Ulmus procera)	60	S	10.0	160	2.0	3.0	4.0	3.0	1.0	MA	Poor	Aprx 50% are dead	Remove all dead stems	10-20	C2	11.6	1.9
G12	English elm (Ulmus procera)	25	S	6.0	140	2.0	2.0	2.0	2.0	1.0	MA	Poor	Collapsing group; many already felled	Remove all dead stems	10-20	C2	8.9	1.7
G13	English elm (Ulmus procera)	60	S	11.0	240	3.0	3.0	3.0	3.0	1.0	EM	Poor	Collapsing copse; aprx 20% are dead	Remove all dead stems	10-20	C2	26.1	2.9
G15	English elm (Ulmus procera)	40	S	10.0	80	2.5	2.5	2.5	2.5	1.0	MA	Poor	Aprx 5% are dead	Remove all dead stems	10-20	C2	2.9	1.0
G16	English elm (Ulmus procera)	30	S	11.0	250	4.0	4.0	4.0	4.0	1.5	EM	Poor	Aprx 5-10% are dead	Remove all dead stems	10-20	C2	28.3	3.0
G17	English elm (Ulmus procera)	20	S	11.0	260	3.0	4.0	3.0	4.0	0.5	EM	Fair	Aprx <5% dead	Remove all dead stems	10-20	C2	30.6	3.1
G18	Field maple (Acer campestre)	10	M	6.0	120	1.0	1.5	2.0	2.0	0.0	EM	Fair	Poor form; outgrown hedge trees.	None	20-40	C2	4.5	1.2
G19	English elm (Ulmus procera)	45	S	11.0	230	5.0	5.0	5.0	5.0	0.0	EM	Fair	Aprx 5% are dead	Remove all dead stems	10-20	C2	23.9	2.8

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
G20	English elm (Ulmus procera)	6	S	12.0	190	3.5	3.0	4.0	3.0	1.5	EM	Dead	100% dead trees covered in ivy; one top has snapped out and hung up in adj trees.	Remove all dead stems	<10	R	16.3	2.3
G21	English elm (Ulmus procera)	50	S	6.0	100	2.0	2.0	2.0	2.0	1.0	MA	Poor	Aprx 50% are dead	Remove all dead stems	10-20	C2	4.5	1.2
G22	English elm (Ulmus procera)	80	S	11.0	190	2.0	2.0	2.0	2.0	1.0	MA	Poor	Aprx 15% are dead	Remove all dead stems	10-20	C2	16.3	2.3
G23	Common ash (Fraxinus excelsior)	10	S	11.0	210	4.0	5.5	4.0	4.0	1.5	EM	Fair	Outgrown hedge stock.	None.	>40	B2	20.0	2.5
H1	English elm (Ulmus procera), Crab apple (Malus spp.), Blacktorn, Awthorn, Dogwood (Cornus sanguinea), Dog rose (Rosa canina)		M	3.0	NA	1.0	2.0	0.0	1.5	0.0	MA	Fair	NA	NA	NA	NA	NA	NA
H2	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Dogwood (Cornus sanguinea), English elm (Ulmus procera), Common ash (Fraxinus excelsior), Field maple (Acer campestre), Dog rose (Rosa canina).		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H3	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), dogwood, English elm (Ulmus procera), Field maple (Acer campestre), Dog rose (Rosa canina), Goat willow (Salix caprea).		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H4	Goat willow (Salix caprea), Dogwood (Cornus sanguinea)		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m)				Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area	
						N	E	S	W								(m²)	(radius in m)
H5	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Goat willow (Salix caprea), English elm (Ulmus procera), Dog rose (Rosa canina).		M	4.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H6	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), English elm (Ulmus procera)		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H7	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Field maple (Acer campestre), Common ash (Fraxinus excelsior), English elm (Ulmus procera), Dog rose (Rosa canina), Silver maple (Acer saccharinum)		M	4.0	NA	2.0	2.0	2.0	2.0	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H8	Blackthorn (Prunus spinosa), Elder (Sambucus nigra), English elm (Ulmus procera)		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Poor	NA	NA	NA	NA	NA	NA
H9	Common hawthorn (Crataegus monogyna), Holly (Ilex aquifolium), Dogwood (Cornus sanguinea), Common hazel (Corylus avellana), Field maple (Acer campestre), Guelder rose (Viburnum opulus)		M	2.5	NA	1.5	1.5	1.5	1.5	0.0	MA	Good	NA	NA	NA	NA	NA	NA

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
H10	Common hawthorn (Crataegus monogyna),Common hazel (Corylus avellana), Dogwood (Cornus sanguinea), Field maple (Acer campestre), Blackthorn (Prunus spinosa), Guelder rose (Viburnum opulus),		M	2.0	NA	1.0	1.0	1.0	1.0	0.0	MA	Good	NA	NA	NA	NA	NA	NA
H11	Common hawthorn (Crataegus monogyna), Common hazel (Corylus avellana), Blackthorn (Prunus spinosa), Field maple (Acer campestre), Dogwood (Cornus sanguinea), Spindle (Euonymus europaeus).		M	1.8	NA	1.0	1.0	1.0	1.5	0.0	MA	Fair	NA	NA	NA	NA	NA	NA
H12	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Field maple (Acer campestre), Dog rose (Rosa canina), Elder (Sambucus nigra)		M	1.8	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H13	Blackthorn (Prunus spinosa), Common hawthorn (Crataegus monogyna), Elder (Sambucus nigra), Dogwood (Cornus sanguinea), Holly (Ilex aquifolium), Field maple (Acer campestre), Dog rose (Rosa canina), English elm (Ulmus procera)		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
H14	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), English elm (Ulmus procera), Field maple (Acer campestre), Privet (Ligustrum vulgare), Dog rose (Rosa canina),Common gorse (Ulex europaeus), Elder (Sambucus nigra), Wayfaring Tree (Viburnum lantana)		M	4.0	NA	2.0	2.0	2.0	2.0	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H15	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Privet (Ligustrum vulgare), Wayfaring Tree (Viburnum lantana), Dog rose (Rosa canina), Elder (Sambucus nigra), English elm (Ulmus procera).		M	4.0	NA	2.0	2.0	2.0	2.0	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H16	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Dogwood (Cornus sanguineus), Privet (Ligustrum vulgare), Wayfaring Tree (Viburnum lantana), Dog rose (Rosa canina), English elm (Ulmus procera),		M	2.5	NA	2.0	2.0	2.0	2.0	0.0	EM	Fair	NA	NA	NA	NA	NA	NA

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m^2)	(radius in m)
H17	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), English elm (Ulmus procera), Privet (Ligustrum vulgare), Field maple (Acer campestre), Dog rose (Rosa canina)		M	3.0	NA	2.5	2.5	2.5	2.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H18	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Field maple (Acer campestre), Dog rose (Rosa canina), Privet (Ligustrum vulgare), English elm (Ulmus procera).		M	1.5	NA	2.0	2.0	2.0	2.0	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H19	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Elder (Sambucus nigra), Damson (Prunus insititia), Dog rose (Rosa canina), Field maple (Acer campestre), Privet (Ligustrum vulgare), English elm (Ulmus procera).		M	3.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H20	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), English elm (Ulmus procera), Elder (Sambucus nigra), Dog rose (Rosa canina).		M	2.0	NA	1.5	1.5	1.5	1.5	0.0	EM	Poor	NA	NA	NA	NA	NA	NA

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem	Height	Stem Diameter	Branch Spread (m)				Height of Crown Clearance	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution	Category Grading	Root Protection Area	
			(S or M)	(m)	(mm)	N	E	S	W	(m)					(years)		(m^2)	(radius in m)
H21	Common hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Field maple (Acer campestre), Common gorse (Ulex europaeus), Dog rose (Rosa canina), Privet (Ligustrum vulgare).		M	4.0	NA	2.0	2.0	2.0	2.0	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H22	Field maple (Acer campestre), English elm (Ulmus procera), Dogwood (Cornus sanguinea), Blackthorn (Prunus spinosa), Common ash (Fraxinus excelsior), Common hazel (Corylus avellana), Dog rose (Rosa canina).		M	2.5	NA	1.5	1.5	1.5	1.5	0.0	EM	Fair	NA	NA	NA	NA	NA	NA
H23	Common hawthorn (Crataegus monogyna), Field maple (Acer campestre), English elm (Ulmus procera), Blackthorn (Prunus spinosa), Dogwood (Cornus sanguinea), Common ash (Fraxinus excelsior)		M	8.0	NA	2.0	3.5	2.0	3.5	0.0	MA	Fair	NA	NA	NA	NA	NA	NA
H24	Common hawthorn (Crataegus monogyna), Field maple (Acer campestre), English elm (Ulmus procera), Blackthorn (Prunus spinosa), Dogwood (Cornus sanguinea),		M	4.0	NA	1.5	2.5	1.5	2.5	0.0	MA	Fair	NA	NA	NA	NA	NA	NA

Tree Ref No. (T = Individual tree; G = Group of trees; H = Hedge; W = Woodland)	Species	Stem Count (groups only)	Single or Multiple Stem (S or M)	Height (m)	Stem Diameter (mm)	Branch Spread (m) N	E	S	W	Height of Crown Clearance (m)	Age	Physiological Condition	Structural Condition	Prelimary Management Recommendations	Estimated Remaining Contribution (years)	Category Grading	Root Protection Area (m²)	(radius in m)
H25	Common hawthorn (Crataegus monogyna), Field maple (Acer campestre), English elm (Ulmus procera), Blackthorn (Prunus spinosa), Dogwood (Cornus sanguinea),		M	2.5	NA	1.5	2.5	1.5	2	0.0	MA	Poor	NA	NA	NA	NA	NA	NA
W1	Common ash (Fraxinus excelsior), Field maple (Acer campestre), Crab apple (Malus spp.), English elm (Ulmus procera)		S	14.0	560	5	9	4	5	0	LM	Fair	Retrenching late mature ash, some collapsing dead elms; fair to poor woodland structure (lacking ground flora layer).	None.	>40	B2	141.9	6.7

5. DISCUSSION

5.1. General

Much of the site is exposed to the prevailing north-westerly winds, consequently many of the individual and groups of trees have adopted uncharacteristically small canopy spreads to the north and west, yet have compensated this by developing larger canopy spreads generally to the east.

5.2. West Moor Drove

This can be taken in two distinct sections; the first section from north of the junction with North Lane up to the power station main gates, and the second from the main gates up to the main car park south of the Site Induction & Training suite.

The first section is mainly rural roadside hedge with occasional hedgerow trees, and a prominent group of white willow mid section; whilst the second section is more formal hedge and tree planting.

The hedges within both sections were generally species rich. In the first section, where hedge management has taken place this has generally been limited to their western sides where they border arable fields. The hedgerow trees are probably outgrown hedge stock and are generally young to early mature, and as such do not provide a substantial or significant contribution to the local treescape. The exception to this would be the group of mature white willows (G2), but due to their brittle nature and heavy lean over the road, they are unlikely to provide a contribution to the area much past a further 10 years, which in turn limits the grading that can be afforded to them.

The hedges in the second section are regularly trimmed creating a formal box shape. The trees to the rear of these hedges are generally common ash (*Fraxinus excelsior*) and were probably originally planted as 'specimen' trees, but due to the strong prevailing winds have developed poor form; some of which are also suffering badly with tumerous cankers (*Pseudomonas syringae* subsp. s*avastonoi* pv. *fraxini*). This has subsequently affected the quality grading that could be afforded to these trees.

5.3. Green Lane

The majority of the vegetation along Green Lane is situated to its south; the exception being one hedge on the north side, towards the eastern end with Wick Moor Drove.

The hedges along Green Lane are generally species rich, similar to those along Wick Moor Drove.

A significant proportion of the vegetation along Green Lane consists of stands of outgrown English elm (*Ulmus procera*), which is either the cumulative years of regeneration from historic stumps of elm trees prior to the outbreak of Dutch Elm Disease, or possibly the development and maturing of unmanaged hedgerow stock. Unfortunately a significant number of these stems have more recently succumbed to Dutch Elm Disease, and are now standing and/or collapsing dead stems. It is also unfortunate that is highly likely that the remaining stems will too succumb to the same disease in the not too distant future.

5.4. Benhole Lane

The section of Benhole Lane north of Green Lane is largely open to arable fields on the west, and to the east it is bordered again by species rich hedge, with groups of collapsing elm stems.

To the south of a derelict barn along the northern section of Benhole Lane, on the western side, on the north of a field drain is a moderate size multi-stem white willow, regenerating from a single fallen stem historically cut just above ground level. Given its relatively sheltered location it has a fairly even canopy spread.

The southern section of Benhole Lane, beyond Green Lane, consists of mature species rich hedges on both sides. There are also groups of outgrown English elms, probably originating from similar sources to that described for the elms along Green Lane. These too are also succumbing to Dutch Elm Disease, which in turn is creating standing and/or collapsing dead trees.

Towards the southern extent of Benhole Lane is, what has been recorded as, a mature to over-mature woodland (W1 on the Tree Survey Plan), despite the lack of ground flora; and it is in fair to poor condition. The woodland contains an over-mature ash (*Fraxinus excelsior*), which is the largest of the trees surveyed across the site, in terms of stem diameter and canopy spread (up to 8m over the eastern field boundaries). Unconfirmed badger setts were also prevalent throughout this area of woodland.

Ash continued to dominate the hedgerows in the southern section of Benhole Lane, as well as beyond the boundary limits of this survey; albeit not quite as large trees as the one within the woodland.

6. TREE PROTECTION

ADAS have been advised that buffer zones, which will be exclusion zones to construction and storage, will be positioned along the west of Wick Moor Drove, the north and south of Green Lane, and to the majority of the east side of Benhole Lane. It is also understood that these buffer zones will be a minimum of 7m along Wick Moor Drove, 15m on the north and south of Green Lane, and 30m along Benhole Lane.

As none of the root protection areas, or canopy spreads, of the trees or landscape features surveyed extend beyond these buffer zones, it is highly unlikely that any damage to retained trees or features will occur.

As a minimum the buffer zones should be maintained, prior and until all development works are complete, by use of the recommended Protective Barrier construction shown in Figure 2 of BS 5837 (2005); an extract of this illustration has been attached to Appendix 2.

7. CONCLUSION

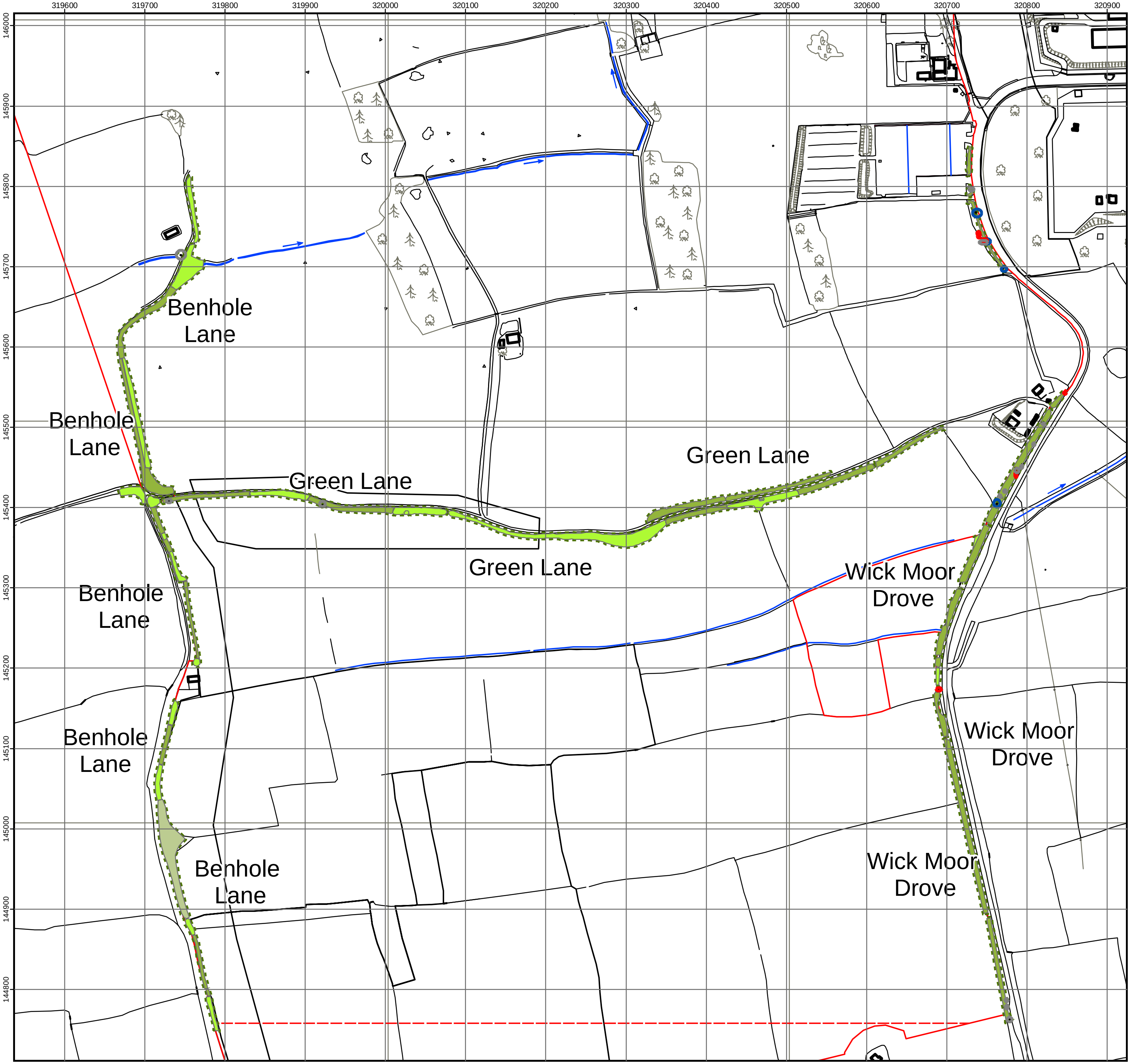
Given the proposed buffer zones along Wick Moor Drove, Green Lane and the majority of Benhole Lane, it is highly unlikely that any retained tree or landscape feature will be affected by the proposed development. Should these zones be removed or amended, then the risk to retained trees and/or landscape features should be re-assessed by an arboriculturist.

The buffer zones should be maintained, prior and until all development works are complete, by use of the recommended Protective Barrier construction shown in Figure 2 of BS 5837 (2005), as a minimum standard; an extract of this illustration has been attached to Appendix 2.

The removal of dead standing and/or collapsing elm stems along Wick Moor Drove is advisable prior to development work commencing; as these could fail beyond the buffer zones.

APPENDIX 1 – TREE SURVEY PLANS

See following page.



ADAS

Hinkley Point C Development Site
Hinkley Point Nuclear Power Station
Somerset

Tree Survey

Category B. Tree of moderate quality + value
Category C. Tree of low quality + value
Category R to be remove

Tree protection zone

Group of trees
Hedge
Woodland

Plan Not To Scale

Drawn by	Ian Braddock	Date	09/07/2010
Verified by	Ian Braddock	Date	09/07/2010

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Metres

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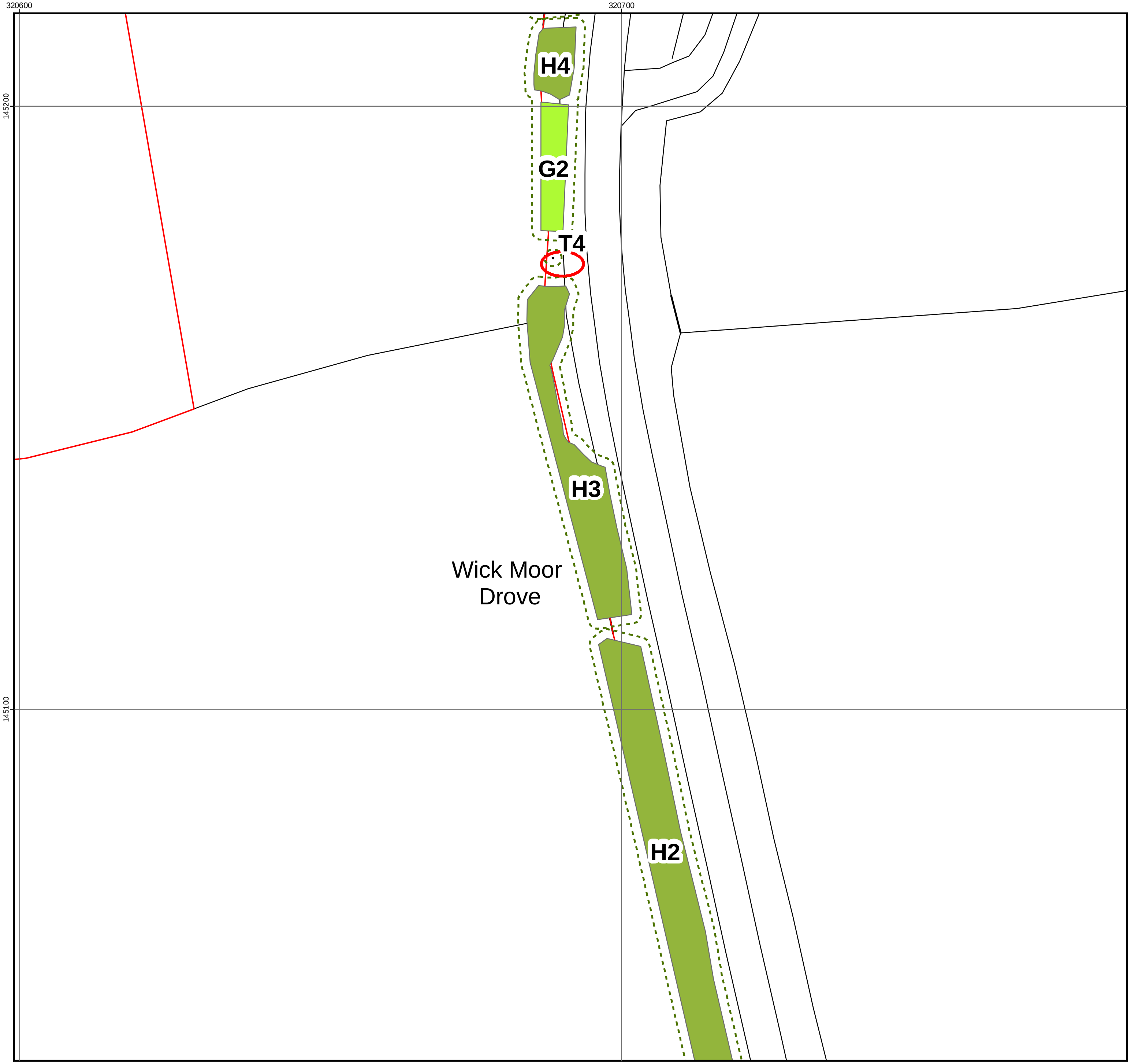

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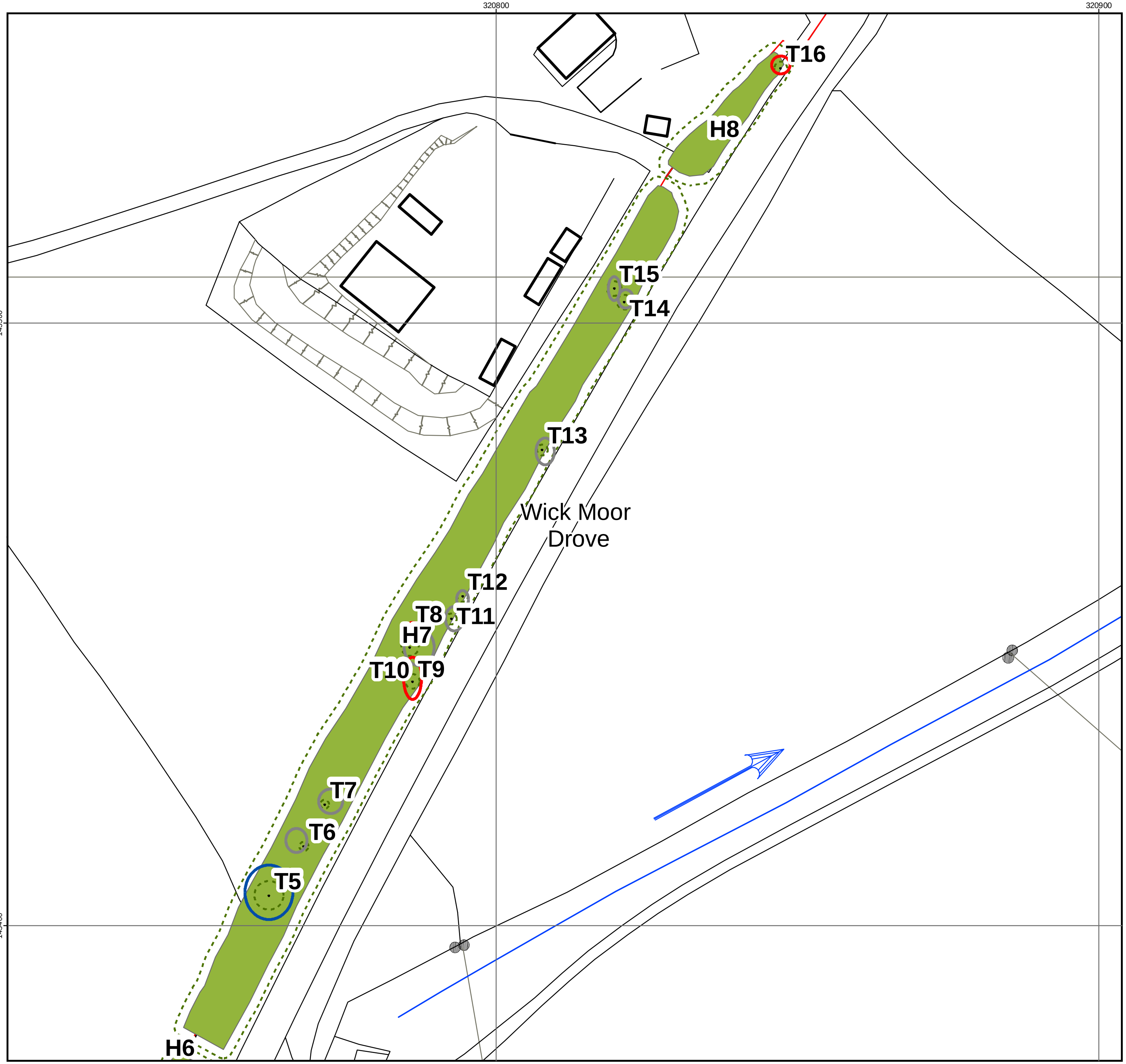

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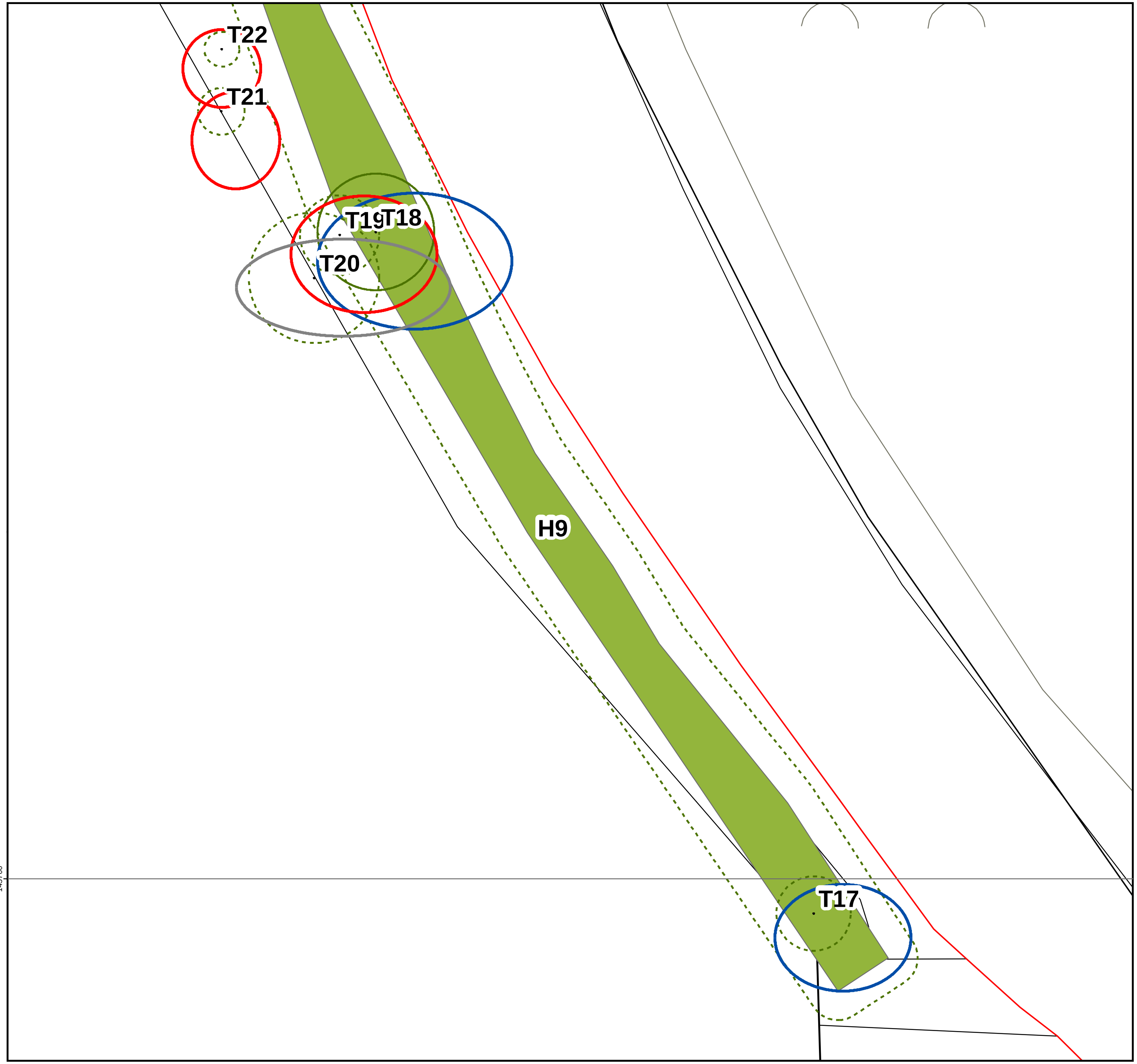

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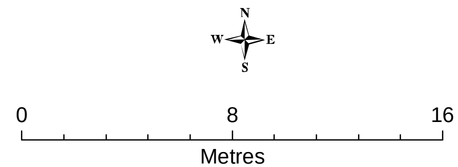

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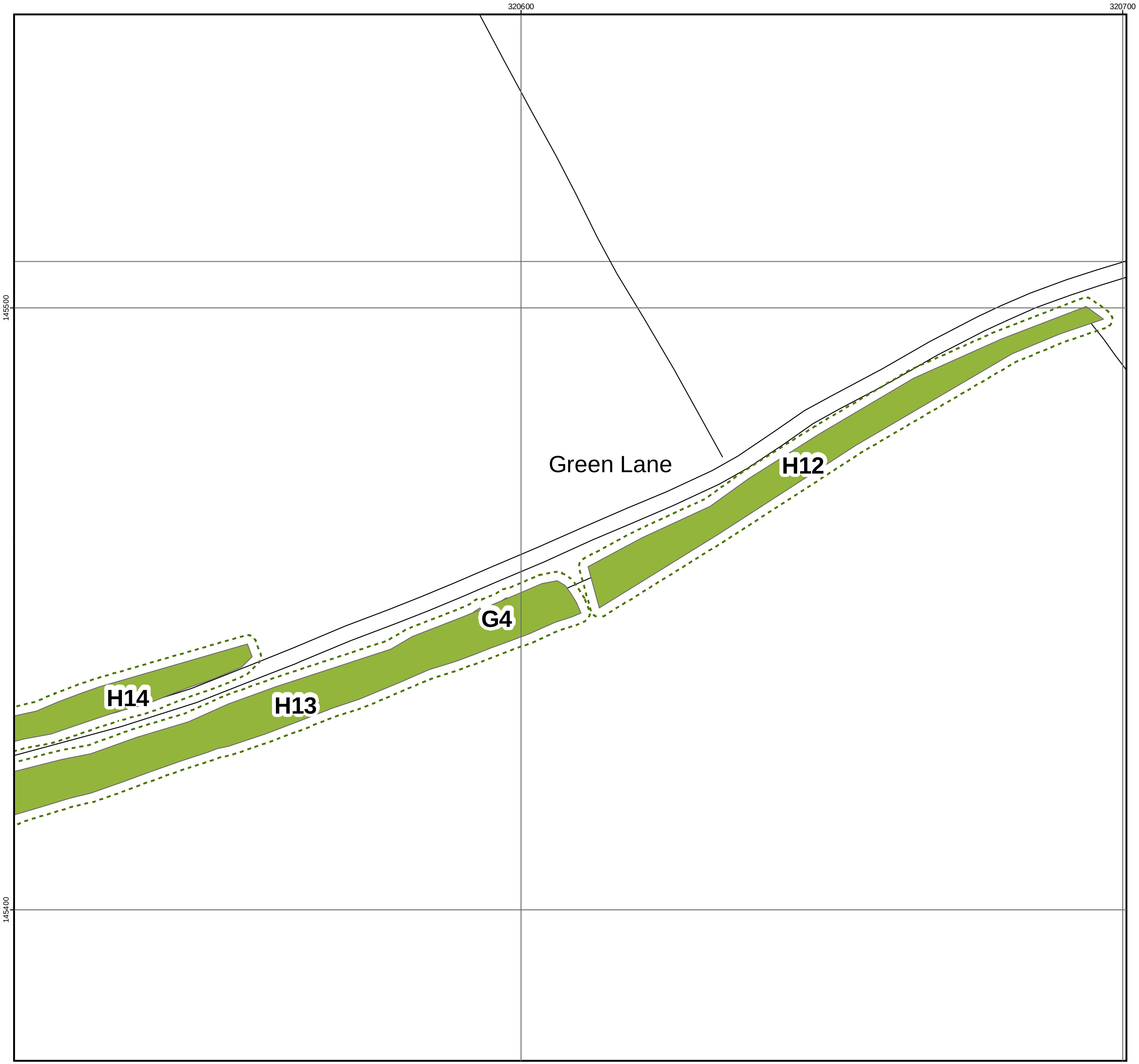

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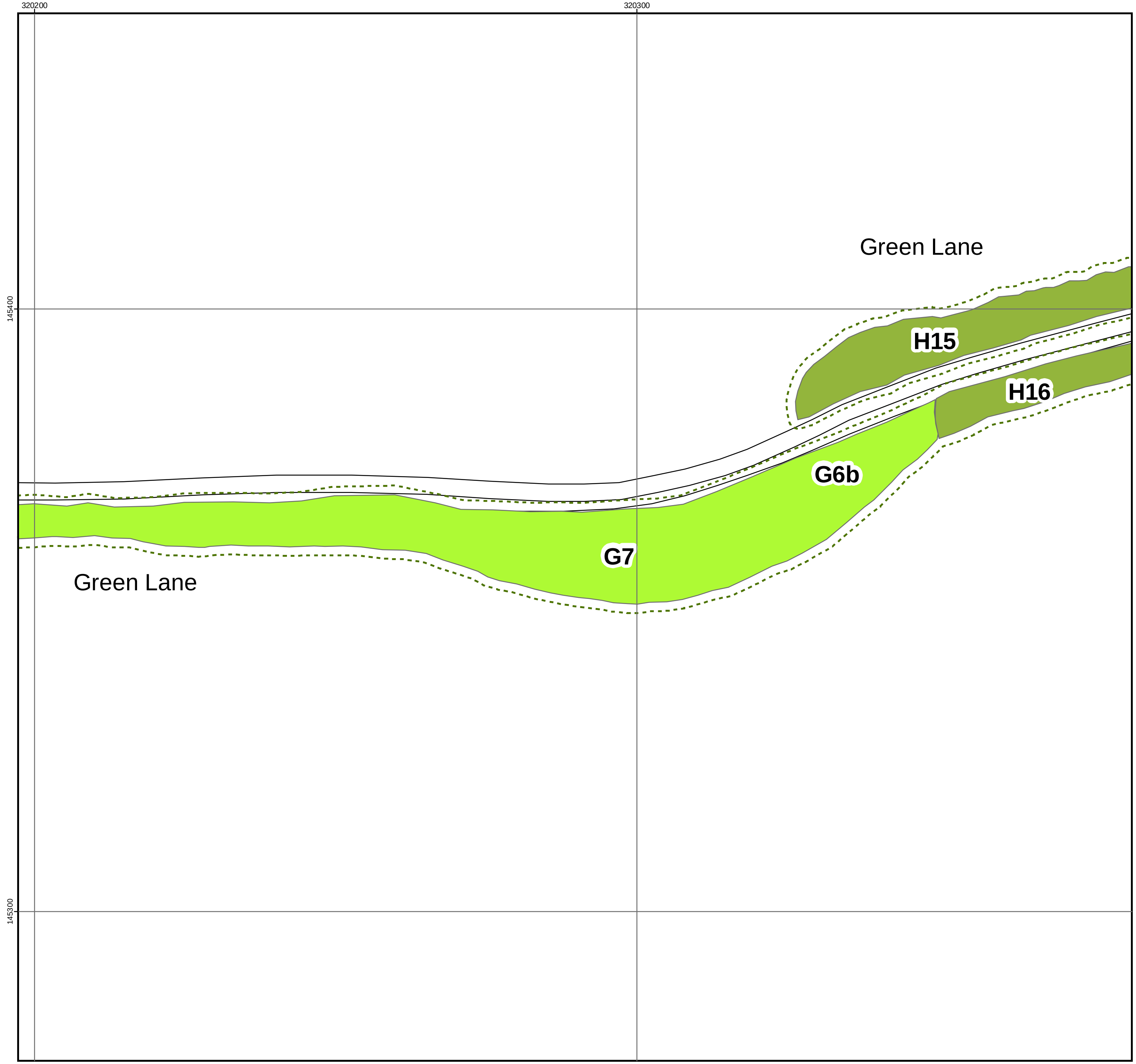

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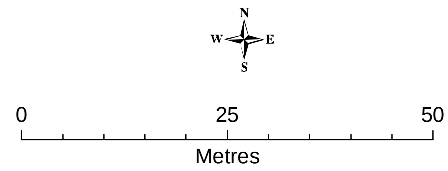

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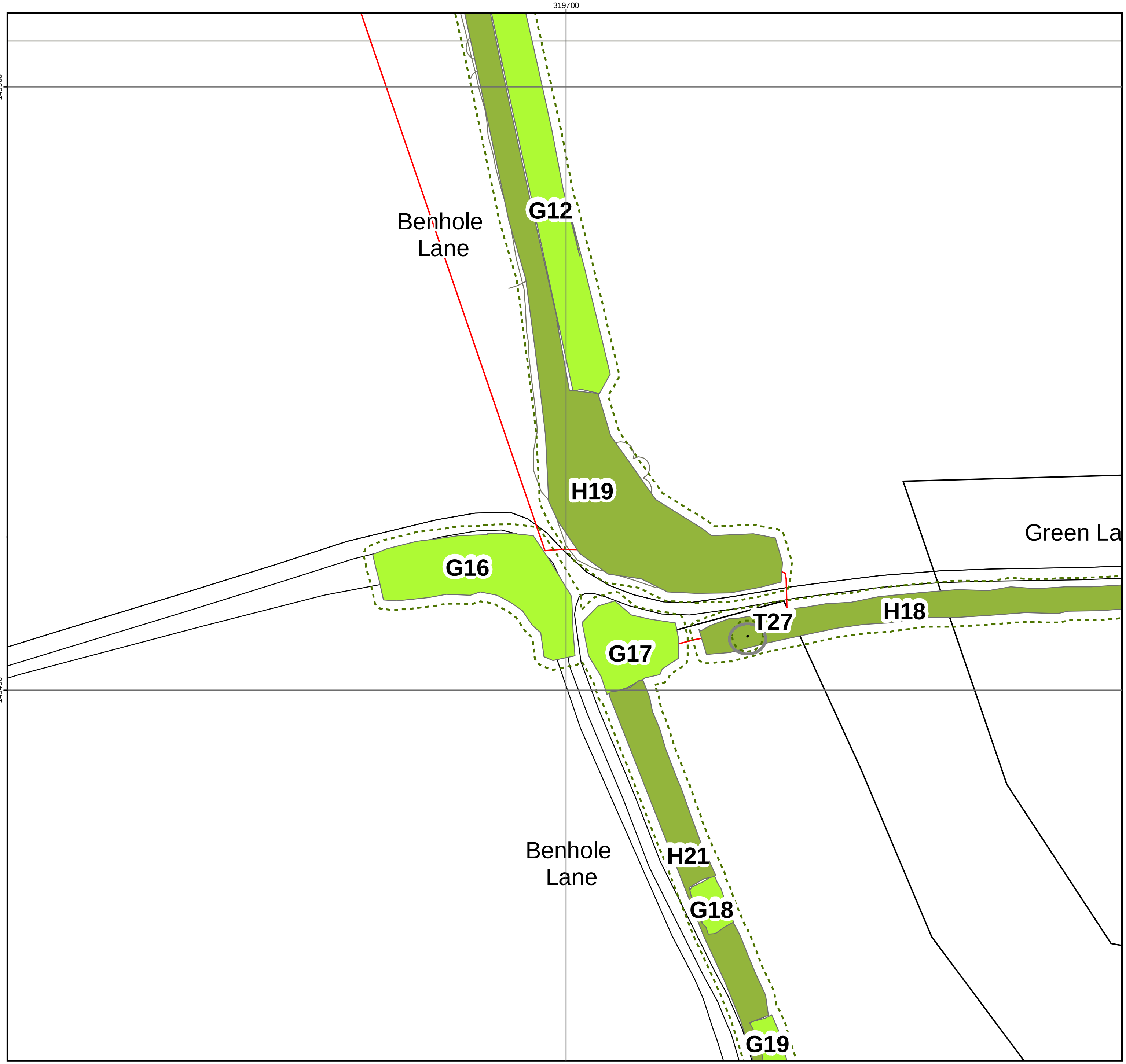

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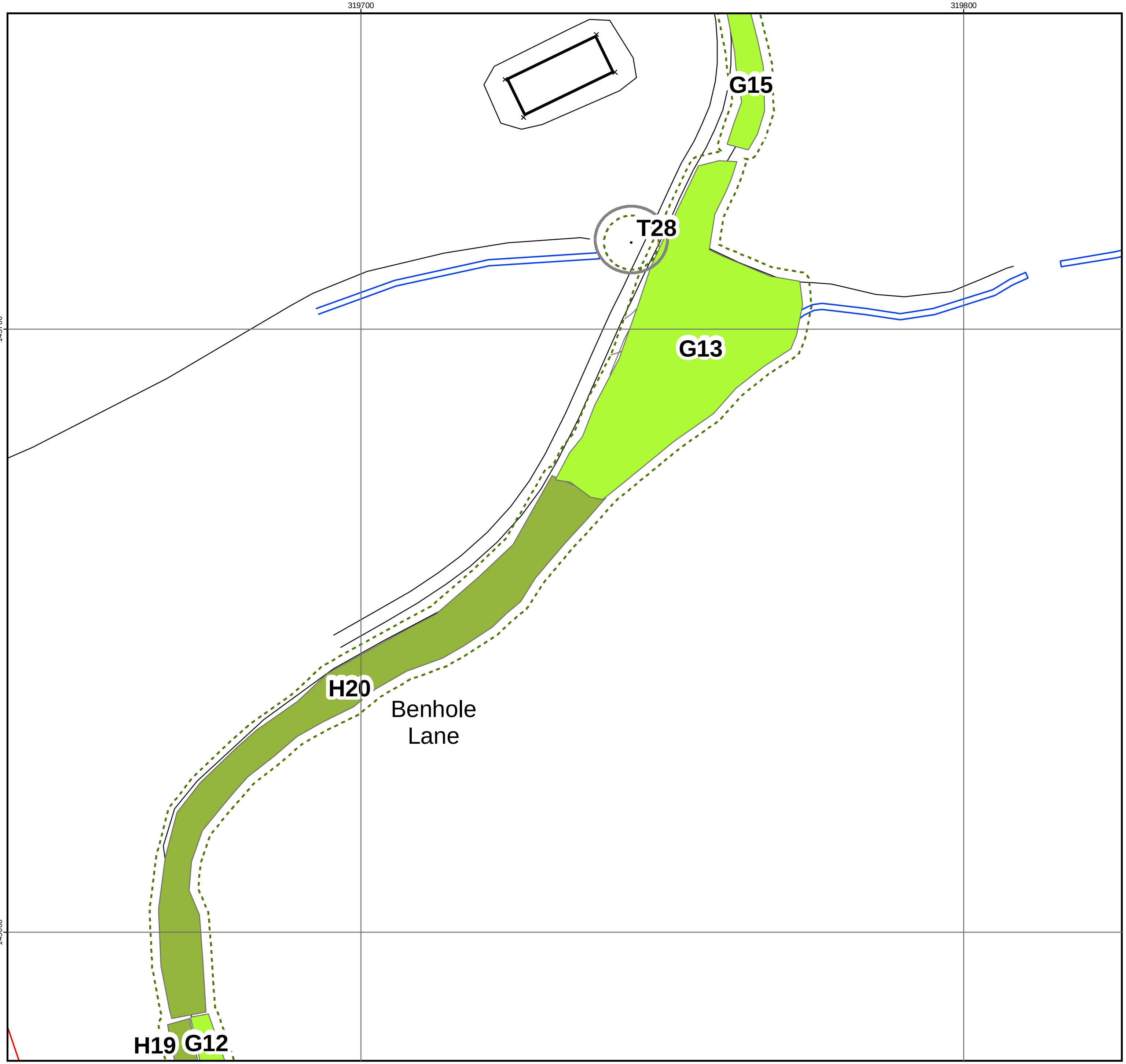

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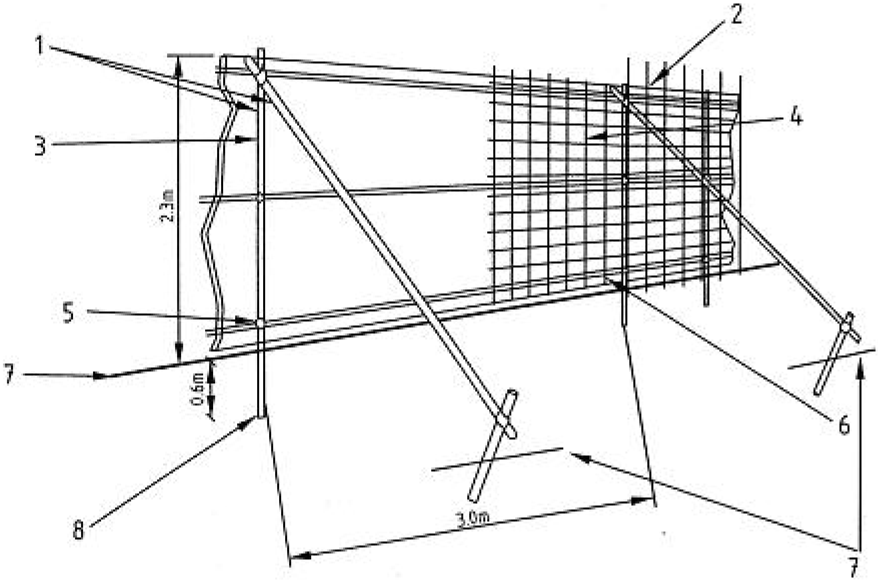
APPENDIX 2 – PROTECTIVE BARRIER ILLUSTRATION

See following page.



1 Standard scaffold poles

2 Uprights to be driven into the ground

3 Panels secured to uprights with wire ties and where necessary standard scaffold clamps

4 Weldmesh wired to the uprights and horizontals

5 Standard clamps

6 Wire twisted and secured on inside face of fencing to avoid easy dismantling

7 Ground level

8 Approx. 0.6 m driven into the ground

APPENDIX 23A: HERITAGE GAZETTEER

APPENDIX 23A: HERITAGE GAZETTEER

Table 23A.1: Hinkley Point C Heritage Gazetteer

ID Number	National Grid Reference	Description	Period	Monument Type	Record Type
1	ST 200 456	Mesolithic artefact scatter found during 1992 field walking, W of Hinkley Point, Stogursey	Mesolithic	Artefact scatter	Find spot
2	ST 2090 4557	Wick Barrow, North Moor, Stogursey	Neolithic/ Bronze Age	Bowl Barrow Cremation	Scheduled Monument
3	ST 2083 4556	St Sidwell's Well, W of Wick Barrow, North Moor, Stogursey	Iron Age? Medieval/Post-medieval	Well	Monument
4	ST 199 456	Roman settlement, SW of Hinkley Point, Stogursey	Roman	Farmstead	Monument
5	ST 209 456	Roman settlement, Hinkley Point, Stogursey	Roman	Settlement	Monument
6	ST 2081 4547	4th Century rubbish pit, SW of Wick Barrow, North Moor, Stogursey	Roman	Pit	Monument
7	ST 200 456	Sedtammtone, Domesday settlement, Hinkley Point	medieval	Settlement	Monument
8	ST 191 455	Strip fields, SW of Hinckley point, Stogursey	Post-medieval	Strip field	Monument
9	ST 193 455	Water meadows and drainage features, SW of Hinkley Point, Stogursey	Post-medieval	Water meadow	Monument
10	ST 1981 4578	Benhole Farm (site of), N of Knighton, Stogursey	Post-medieval	Farmstead	Monument
11	ST 198 449	Water meadow system, N Shurton, Stogursey identified from aerial photographs. Walkover of site identified that this interpretation is unlikely. See 60.	Post-medieval	Water meadow	Monument
12	ST 197 451	Water meadow system, N Shurton, Stogursey	Post-medieval	Water meadow	Monument
13	ST 194 446	Water meadow system, N of Bullen Farm, Stogursey	Post-medieval	Water meadow	Monument
14	ST 1961 4612	Possible limekiln, N of Knighton, Stogursey	?Post-medieval	lime kiln	Monument
15	ST 19140 45830	Lime kiln, on coast N of Knighton, Stogursey	Post-medieval	Lime kiln	Monument

ID Number	National Grid Reference	Description	Period	Monument Type	Record Type
16	ST 19550 45390	Lime kiln, SE of Benhole Farm, Stogursey	Post-medieval	Lime kiln	Monument
17	ST 1923 4602	Wharf or quay, N of Burton, Stogursey	Post-medieval	Wharf	Monument
18	ST 193 459	Deserted farm site, N of Knighton, Stogursey	Post-medieval	Farmstead	Monument
19	ST 1944 4610	Observation post or pillbox, N of Knighton, Stogursey	WWII	Pillbox	Monument
20	ST 202 447	Crop mark enclosures and boundaries, N of Shurton, Stogursey	Undated	Enclosure	Monument
21	ST 207 455	Undated features detected during watching brief	undated	Pit ditch layer	Monument
22	ST 202 456	Farm complex of two buildings, one of which is a substantial barn, within a courtyard.	Post-medieval	Barn	Monument
23	ST 208 455	Extant barn and related features	Post-medieval	Barn	Monument
24	ST 197 452	Single storey barn within courtyard	Post-medieval	Barn	Monument
25	ST 203 454	East-west track way	Undated	Track way	Monument
26	ST 1995 4595	Hollow in field 2	Undated	Unknown	Monument
27	ST 2005 4605	Linear earthwork in field 2	Undated	Unknown	Monument
28	ST 197 459	Pond in field 4	Undated	Pond/quarry	Monument
29	ST 2000 4590	Hollow in field 6	Undated	Pond/quarry	Monument
30	ST 2025 4595	Uneven ground/differential plant growth in field 6	Undated	Unknown	Monument
31	ST 202 458	Small stone bridge between fields over drainage ditch between fields 6 and 10	Undated	Bridge	Monument
32	ST 2025 4570	Field boundary in field 10	Undated	Field boundary	Monument
33	ST 2030 4570	Field boundary in field 10	Undated	Field boundary	Monument
34	ST 208 454	Penannular differential crop growth c.15m radius with slight mound in field 16.	Undated	Unknown	Monument
35	ST 204 456	Linear and curvilinear features, possible enclosure	Undated	Unknown	Monument
36	ST 199 455	Building in field shown on 1614 map	Medieval/ Post-Medieval	Building	Monument

ID Number	National Grid Reference	Description	Period	Monument Type	Record Type
37	ST 225 465 ST 234 470 ST 238 461	Submarine forest and peat deposits, Stolford shore, Stogursey	Mesolithic to Bronze Age	Forest	Monument
38	ST 1985 4485	Scatter of possible tesserae in field 26	Roman?	Mosaic?	Find Spot
39	ST 219 458	Ridge and furrow, Wick Moor, Stolford	medieval	Ridge and Furrow	Monument
40	ST 21250 44620	Shrunken village, Wick	medieval	Settlement	Monument
41	ST 2045 4500	Remains of North Lane. Very wide ditch (c 4 m wide) at northern section of field boundary in Field 29 with Field 28. A dip in field 25 probably rerpresents a continuation of the lane northwards.	medieval?/Post-medieval	Road?	Monument
42	ST 2015 4428	Thatch End with bridge over stream at entrance to South East Wing (Thatch End prevously listed), Shurton, Grade II Listed	Post-medieval	Listed Building	Listed Building
43	ST 2014 4427	Foot bridge, 5 metres south west of Thatch End, Shurton, Stogursey, Grade II Listed	Post-medieval	Listed Building	Listed Building
44	ST 2009 4417	Fishers and Brookside, Shurton, Stogursey, Grade II Listed	Post-medieval	Listed Building	Listed Building
45	ST 2004 4410	Shurton Lodge and outbuilding attached at South East corner, Shurton, Stogursey, Grade II Listed	Post-medieval	Listed Building	Listed Building
46	ST 2003 4412	Cottage, 15 metres North of Shurton Lodge, Shurton, Grade II Listed	Post-medieval	Listed Building	Listed Building
47	ST 1997 4420	Shurton Court and No.2 Shurton Court (Shurton Court previously listed), Shurton, Grade II Listed	Post-medieval	Listed Building	Listed Building
48	ST 1996 4402	Ash Cottage and Little Ash, Shurton, Grade II Listed	Post-medieval	Listed Building	Listed Building
49	ST 2063 4404	Shurton Mills, Shurton, Grade II Listed	Post-medieval	Listed Building	Listed Building
50	ST 20410 44610	Deserted farm, Corner, N of Shurton. Differential crop growth in southern part of field 28 with adjacent pile of rubble are almost certainly remains of this site and its associated enclosures.	Post-medieval	Farmstead	Monument
51	ST 2209 4596	Groynes, E of Hinkley Point	Post-medieval	Groyne	Monument
52	ST 193 444	Knighton Farmhouse, Burton	Post-medieval	Farmhouse	Monument

ID Number	National Grid Reference	Description	Period	Monument Type	Record Type
53	ST 20401 44569	Short stretch of stone wall built along north stream bank to prevent undercutting at southern boundary of Field 28.	Post-medieval	Wall	Monument
54	ST 20644 45709	Indistinct earthworks in centre of field 34. Possibly remains of accomodation block/camp from construction of power station in 1970s	Post-medieval	Settlement?	Monument
55	ST 20594 45064	Dip in Field 25 probably represents a lost field boundary	Post-medieval	Earthwork	Monument
56	ST 20194 45158	Canalised stream running through Fields 17-20 and between Fields 21 and 22.	Post-medieval	Drainage Channel	Monument
57	ST 20764 45813	Two banks in area of woodland (Field 36) running north-south and east-west each approximately 0.7 m high.	Post-medieval	Field boundary?	Monument
58	ST 2170 4594	Enclosure, Wick Moor, Stogursey	Undated	Enclosure	Monument
59	ST 20032 44898	Hollow, possible pond, between fields 18 and 27	Undated	Pond?	Monument
60	ST 19891 44960	Earthworks in northern half of Field 18. Some of these are historical field boundaries recorded on the 1841 tithe map, and others may be earlier field boundaries.	Undated	Field boundary?	Monument
61	ST 20204 45219	Low bank running east-west along southern side of field boundary between fields 13 to 15 and Fields 17 to 21.	Undated	Unknown	Monument

APPENDIX 23B: SETTINGS GAZETTEER

APPENDIX 23B: SETTINGS GAZETTEER

Table 23B.1: Hinkley Point C Settings Gazetteer

ID Number	Name	Designation	Easting	Northing
D1	Cynwit Castle	Scheduled Monument	324673	140476
D2	Settlement south-east of Cannington Park	Scheduled Monument	324598	140282
D3	Church of All Saints, Otterhampton	Grade II*	324635	143197
D4	Steyning Manor	Grade II*	321960	142772
D5	Beere Manor Farmhouse and attached Barn	Grade II*	324062	141425
D6	Farm Estate Farmhouse, Fiddington	Grade II*	322306	141774
D7	Court House Farmhouse, Splatt Lane, Spaxton	Grade II*	322517	137084
D8	Church Of St Margaret, Spaxton	Grade I	322528	137033
D9	Churchyard Cross in St Margaret's Churchyard	Scheduled Monument	322531	137018
D10	Spaxton and Four Forks	Conservation Area	322500	137100
D11	Clerks Cottage, Barford Road, Spaxton	Grade II*	323108	136104
D12	Church of St Mary, Spaxton	Grade I	323845	137806
D13	Stogursey Castle	Scheduled Monument Grade II*	320303	142589
D14	Causeway Bridge at East Entrance to Stogursey Castle	Grade II*	320313	142589
D15	Remains of Village Cross, Stogursey	Scheduled Monument Grade II*	320244	142891
D16	Church of St Andrew, Stogursey	Grade I	320477	142877
D17	Stogursey	Conservation Area	320200	143000
D18	Fairfield House	Grade II*	318755	142980
D19	Fairfield	Registered Park/garden	318717	142959
D20	Remains of Keep to Stowey Castle, Nether Stowey	Scheduled Monument Grade II*	318687	139574
D21	Coleridge's Cottage, Nether Stowey	Grade II*	319107	139857

ID Number	Name	Designation	Easting	Northing
D22	Gazebo and attached walling bounding grounds of Stowey Court, Nether Stowey	Grade II*	319545	139607
D23	Nether Stowey	Conservation Area	319000	139700
D24	Chapel east of Adscombe Farm	Scheduled Monument	318414	137782
D25	Church of All Saints, Spaxton	Grade II*	319371	135632
D26	Churchyard Cross, 5 metres south of porch, Church Of St Mary, Stringston	Scheduled Monument Grade II*	317645	142390
D27	Govett family chest tomb, in churchyard one metre west of porch, Church of St Mary, Stringston	Grade II*	317639	142396
D28	Prior family chest tomb and encircling wrought iron railings, in churchyard, 10 metres south of south chapel, Church of St Mary, Stringston	Grade II*	317644	142387
D29	Priors Farmhouse Including farm buildings adjoining east, Stringston	Grade II*	317751	142594
D30	Remains of chantry, abutting east side of Chantry Cottage, Sea Lane, Kilve	Scheduled Monument Grade II*	314635	144012
D31	Priory Cottage, Chantry cottage and dairy, abutting south west corner of Priory Cottage, Sea Lane, Kilve	Grade II*	314628	144008
D32	Church of Saint Mary, Kilve	Grade II*	314671	143942
D33	Pollard chest tomb, in churchyard about 24 metres south of porch, Church of St Mary, Kilve	Grade II*	314670	143922
D34	Remains of churchyard cross, in churchyard 2 metres north east of porch, Church Of All Saints, Holford	Grade II*	317201	140566
D35	All Saints Church, Holford	Grade I	317199	140559
D36	Dodington Hall, Holford	Grade II*	317230	140525
D37	Churchyard cross, 7 metres north of nave, Church of St Mary, Holford	Grade II*	315657	141102
D38	Holford	Conservation Area	315600	141200
D39	Court House, East Quantoxhead	Grade I	313642	143687
D40	Church of St Mary, East Quantoxhead	Grade II*	313641	143656
D41	Churchyard cross, 10 metres south of porch, Church of Saint Mary, East Quantoxhead	Grade II*	313640	143644

ID Number	Name	Designation	Easting	Northing
D42	St Audries (House)	Registered Park/garden	310680	142401
D43	Four cairns on Hurley Beacon	Scheduled Monument	314220	138084
D44	Cairn on Thorncombe Hill	Scheduled Monument	312679	139310
D45	Bowl Barrow on Thorncombe Hill known as `Thorncombe Barrow'	Scheduled Monument	312733	139418
D46	Cairn 500m north west of Quantock Farm	Scheduled Monument	315423	137164
D47	Barrows on Longstone Hill	Scheduled Monument	313590	141289
D48	Bowl barrow 100m north-west of Halsway Post	Scheduled Monument	313962	138618
D49	Bowl barrow 80m north of Halsway Post	Scheduled Monument	314012	138612
D50	Bowl barrow 122m north-north-west of Halsway Post	Scheduled Monument	313968	138643
D51	Bowl barrow on Thorncombe Hill 500 m north-west of Halsway Post	Scheduled Monument	313668	138892
D52	Bowl barrow 225m north west of Halsway Post	Scheduled Monument	313860	138706
D53	Bowl barrow on Longstone Hill, 270 m north-north-east of Bicknoller Post	Scheduled Monument	313033	140562
D54	Bowl barrow on Longstone Hill, 270m north east of Bicknoller Post	Scheduled Monument	313100	140485
D55	Cairn 150 m south-south-east of the Ordnance Survey triangulation point on Beacon Hill	Scheduled Monument	312543	140858
D56	Two bowl barrows on Beacon Hill	Scheduled Monument	312444	140997
D57	Cairn 90m south-south-east of the Ordnance Survey triangulation point on Beacon Hill	Scheduled Monument	312493	140909
D58	Cairn 250m south-south-east of the Ordnance Survey triangulation point on Beacon Hill	Scheduled Monument	312575	140764
D59	Ring cairn on West Hill	Scheduled Monument	312327	141573
D60	Cairn on Thorncombe Hill, 990 m north-west of Halsway Post	Scheduled Monument	313212	139105
D61	Bowl barrow on Thorncombe Hill	Scheduled Monument	313162	139214
D62	Barrow and cairn cemetery on Black Hill, 490 m north-west of Crowcombe Park Gate	Scheduled Monument	314539	138227
D63	Three bowl barrows on Black Hill, 590 m north-west of Crowcombe Park Gate	Scheduled Monument	314738	138364

ID Number	Name	Designation	Easting	Northing
D64	Dead Woman's Ditch cross-dyke, Robin Upright's Hill	Scheduled Monument	316081	138308
D65	Bowl barrow on Thorncombe Hill, 1.03 km north-east of Paradise Farm	Scheduled Monument	313018	139461
D66	Bowl barrow on Thorncombe Hill, 1.07 km north-east of Paradise Farm	Scheduled Monument	313030	139495
D67	Ruined cairn on Higher Hare Knap	Scheduled Monument	314844	139516
D68	Dowsborough Hillfort and associated round barrow	Scheduled Monument	316011	139116
D69	Plainsfield Camp slight univallate hillfort	Scheduled Monument	318430	136208
D70	Wick Barrow/ Pixies Mound	Scheduled Monument	320908	145575
D71	The Old Rectory	Grade II	324494	143145
D72	The Poplars	Grade II	324071	143637
D73	Church of St Mary Magdalene	Grade II	324013	143620
D74	Rogers Farmhouse	Grade II	324387	143691
D75	Stockland Manor	Grade II	323932	143320
D76	Gate and gate piers at driveway entrance to Stockland Manor	Grade II	323832	143192
D77	Sea View	Grade II	323169	145830
D78	Stolford Farmhouse	Grade II	323258	145815
D79	D`Arches	Grade II	323214	145859
D80	Chalcot Farmhouse	Grade II	323423	144808
D81	Zine Farmhouse	Grade II	321951	144584
D82	Wick Pound House	Grade II	321611	144498
D83	Gate and piers, about 20 metres west of Steyning Manor	Grade II	321938	142779
D84	Stable, about 20 m north-west of Steyning Manor	Grade II	321924	142785
D85	Threshing Barn to rear of Roobies Farmhouse	Grade II	321193	140606
D86	Roobies Farmhouse	Grade II	321190	140575
D87	South boundary wall churchyard running west from east entrance, Church of St Andrew	Grade II	320482	142842

ID Number	Name	Designation	Easting	Northing
D88	2 piers, railings, dwarf wall, gatepiers, gates and lamp carrier fronting Church of St Andrew	Grade II	320448	142886
D89	Gate and gate piers at east entrance to churchyard, Church of St Andrew	Grade II	320529	142855
D90	Pair of chest tombs to John and Mary Rawlins in churchyard, 23 metres north of nave, Church of St Andrew	Grade II	320468	142902
D91	Rowe family chest tomb, in churchyard 15 metres south of nave, Church of St Andrew	Grade II	320465	142856
D92	Unidentified chest tomb in churchyard, 7 metres north of north transept-choir, Church of St Andrew	Grade II	320493	142892
D93	Buffet chest tomb, in churchyard 3 metres north of north transept-choir, Church of St Andrew	Grade II	320488	142888
D94	2 High Street, Stogursey	Grade II	320364	142893
D95	6 High Street, Stogursey	Grade II	320352	142896
D96	8 and 10 High Street, Stogursey	Grade II	320339	142898
D97	12 and 14 High Street, Stogursey	Grade II	320310	142902
D98	30 High Street, Stogursey	Grade II	320224	142914
D99	Railings, gate and dwarf wall fronting Old Cross House onto High Street	Grade II	320247	142889
D100	Old Cross House	Grade II	320254	142881
D101	Gatepiers and entrance to Chippings, abutting west side of St Andrews Well, and adjoining wall running north to St Andrews Road	Grade II	320228	142841
D102	No 5 and boundary wall on west side abutting St Andrews Well	Grade II	320238	142848
D103	6 St Andrew's Road, Stogursey	Grade II	320244	142846
D104	St Andrews Well	Grade II	320224	142818
D105	Dovecote, about 28 metres north west of Priory Farmhouse	Grade II	320514	142813
D106	Cross Cottages	Grade II	320227	142880
D107	Gates and gatepiers to Ivy House	Grade II	320194	142914
D108	Stogursey School and attached Schoolmaster's House	Grade II	319953	142936

ID Number	Name	Designation	Easting	Northing
D109	Harford House	Grade II	320371	142889
D110	The Old Mill	Grade II	320376	142689
D111	Pear Tree	Grade II	320252	142846
D112	Darch House, railings, gates and dwarf wall fronting road	Grade II	320328	142830
D113	Stoke House	Grade II	320246	142909
D114	Corner Cottage	Grade II	320230	142891
D115	The Old Vicarage	Grade II	320397	142892
D116	Bakehouse, 5 metres north of No 8	Grade II	320344	142910
D117	Grisley's Farmhouse	Grade II	319394	143513
D118	Colepool Cottage	Grade II	319256	143666
D119	Little Water Farmhouse	Grade II	319407	143401
D120	Malthouse and malt drying kiln, 10 metres south of Little Water Farmhouse	Grade II	319400	143382
D121	Water Farmhouse	Grade II	319478	143195
D122	Ash Cottage	Grade II	319978	144035
D123	Fishers	Grade II	320094	144179
D124	Shurton Lodge and outbuilding attached at south east corner	Grade II	320052	144107
D125	Footbridge, 5 metres south west of Thatch End	Grade II	320148	144275
D126	Shurton Court	Grade II	319972	144030
D127	Shurton Mills	Grade II	320635	144054
D128	Thatch End with bridge over stream at entrance to south east wing	Grade II	320160	144279
D129	Cottage, 15 metres north of Shurton Lodge	Grade II	320036	144119
D130	Baptist Chapel	Grade II	319303	144171
D131	The Manse	Grade II	319298	144180
D132	Walls enclosing gardens, about 20 metres west of Fairfield House	Grade II	318622	142941
D133	Granary, about 50 metres north of Fairfield House	Grade II	318713	143034

ID Number	Name	Designation	Easting	Northing
D134	Barn, about 60 metres north of Fairfield House	Grade II	318719	143065
D135	Mounting block about 40 metres north of Fairfield House	Grade II	318734	143024
D136	Stable and dovecot, about 20 metres north west of Fairfield House	Grade II	318736	143004
D137	Durborough Farmhouse	Grade II	319209	141463
D138	Church of St Mary	Grade II	317646	142402
D139	Wall enclosing orchard immediately north-west of Stringston	Grade II	317594	142457
D140	Plud Farmhouse	Grade II	318181	142452
D141	Church of St Andrew	Grade II	316702	144888
D142	West Kilton Farmhouse	Grade II	316360	143824
D143	Gates, railings and dwarf wall fronting West Kilton Farmhouse	Grade II	316373	143827
D144	Church of St Nicholas	Grade II	316582	144133
D145	Limekiln complex at NGR ST 1730 4530	Grade II	317300	145300

APPENDIX 23C: HIGHWAYS IMPROVEMENTS GAZETTEER

APPENDIX 23C: HIGHWAYS IMPROVEMENTS GAZETTEER

Table 23C.1: Hinkley Point C Highways Improvements Gazetteer

ID Number	Eastings	Northings	Description	Record type	Monument	Period
H1	304600	145000	Cleeve Abbey, Cistercian, 12th Century	Scheduled Monument & Grade I Listed	Abbey	Medieval
H2	305200	141000	Deserted settlement	Monument	earthworks	Medieval - Post-medieval
H3	305510	140280	Bardon, Washford	Listed Building, Grade II	building	Medieval - Post-medieval
H4	305670	140910	Milestone at NGR ST 0567 4091, Washford Cross	Listed Building, Grade II	Monument	Post-medieval
H5	305870	140780	Milestone, Washford Cross	monument	milestone	Post-medieval
H6	305800	140700	Turnpike Road, Minehead to Nether Stowey	Monument	Road	Post-medieval
H7	305800	140700	Turnpike Road, Watchet to Skilgate	Monument	Road	Post-medieval
H8	305100	141060	Stables and granary on West side of foldyard at Washford Farm, Washford	Listed Building, Grade II	Building	Post-medieval
H9	305130	141030	Range of farmbuildings, on South side of foldyard at Washford Farm, Washford	Listed Building, Grade II	Building	Post-medieval
H10	305140	141050	Barn over shelter shed on East side of foldyard at Washford Farm, Washford	Listed Building, Grade II	Building	Post-medieval
H11	304920	141060	Methodist Chapel, Washford	Listed Building, Grade II	Building	Post-medieval
H12	305030	141180	Linhay about 50 metres North East of Nos 1 and 2 Knapp Cottages, Washford	Listed Building, Grade II	Building	Post-medieval
H13	305800	140960	Washford Transmitting Station, Washford Cross, Williton	Listed Building, Grade II	Building	Modern
H14	305800	140900	1930's BBC radio station	Monument	radio station	Modern
H15	306400	140500	Cropmark enclosure, Porch Elm, Williton	monument	cropmark	undated

ID Number	Eastings	Northings	Description	Record type	Monument	Period
H16	306300	139900	Cropmark enclosure, N of Higher Stream, Williton	Monument	cropmark	Undated
H17	305150	140400	Cropmark enclosures, Bardon, SE of WashfordU	Monument	cropmark	Undated
H18	326670	138830	Mesolithic flint core (residual)	Findspot	Settlement	Mesolithic
H19	326670	138830	Middle Bronze Age Ditch	ditch	Settlement	Bronze Age
H20	326670	138830	Iron-Age to Roman ditch, post-hole	ditch	Settlement	Iron Age and Roman
H21	327900	137800	Early medieval cemetery, Wembdon Hill, Wembdon	Monument	Inhumation cemetery	Early medieval
H22	327000	137700	Medieval settlement 160m south and 240m south west of Sandford Farm	Scheduled Monument	Deserted village	medieval
H23	326960	138210	Toll house, Sandford Waters	Monument	Toll house	Post-medieval
H24	319280	139620	Turnpike Road, Nether Stowey to Ashcott	Monument	Turnpike road	Post-medieval
H25	327760	137770	Cokerhurst Farmhouse, Wembdon Hill (South side), Wembdon. 15th/16th century	Grade II Listed Building	Farmhouse	Post-medieval
H26	327020	137920	Sandford Manor (formerly listed as Sandford Farm House), Wembdon Hill (South side), Wembdon	Grade II Listed Building	Farmhouse	Post-medieval
H27	326900	138500	Chilton Trivett Park, Cannington	Monument	Park	Post-medieval?
H28	327320	138700	Cropmark enclosure, SW of Perry Green, Wembdon	Monument	Enclosure	undated
H29	327500	138800	Cropmark enclosures, W of Perry Green, Wembdon	Monument	Enclosure/field boundaries	undated
H30	327400	138100	Cropmark enclosure, Sandford Hill, Wembdon	Monument	Enclosure	undated
H31	326700	139100	Cropmark enclosures, E of The Grange, Cannington	Monument	Enclosure	undated

APPENDIX 25A: HINKLEY POINT RECREATIONAL ACCESS SURVEY

Hinkley Point
Recreational Access Survey

EDF DEVCO

November 2010
Final Report
9S4862

A COMPANY OF

ROYAL HASKONING

HASKONING UK LTD.
ENVIRONMENT

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Document title	Hinkley Point Recreational Access Survey
Document short title	Hinkley Recreational Access Survey
Status	Final Report
Date	November 2010
Project name	Hinkley Point New Nuclear Development
Project number	9S4862
Client	EDF DEVCO
Reference	9S4862/Hinkley Recreation Final/Exet

Drafted by	Peter Thornton	
Checked by	Richard Cottle	
Date/initials check	………………….	………………….
Approved by	Richard Cottle	
Date/initials approval	………………….	………………….

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 Background

1.1.1 EDF Energy, in its assessment of the requirements for Nuclear New Build at Hinkley Point, requires quantitative baseline data with regard to the recreational access and use of Public Rights of Way (PRoW) around the Hinkley area, in order to adequately identify the baseline and assess the scale and significance of the impacts of the proposed development.

1.1.2 Royal Haskoning have been commissioned to undertake a recreational access survey around the Hinkley area, to provide quantitative baseline data to inform the Environmental Impact Assessment (EIA) for the proposed new nuclear development at Hinkley Point. The data in the final recreational access report will be incorporated into the Hinkley C Environmental Statement (ES).

1.1.3 The aim of the survey is to collect survey data on recreational use, including frequency and type of activity, along the footpath / track network around Hinkley Point, as well as to gain an understanding of the condition of the footpath network around the study area.

1.1.4 This report presents the full survey results and analysis of recreational access as well as condition of the footpath network.

1.2 Methodology

1.2.1 The recreational access survey method is based on the following survey tasks and breakdown:

1. 1 hour counts at a number of discrete access points and locations across the path network (focusing on footpath intersections).
2. Survey of 12 locations (see **Figure 1.1**). The spread of counts at each survey location for different survey days are presented in **Table 1.1**.
3. Surveying during daylight hours between the times of 07:00 and 19:00.
4. Surveying carried out at all points during and after the school holidays, and at all sites on a weekday as well as on a weekend. Each survey location to be counted at least 4 times over the overall survey.
5. Surveys to be staggered so that survey days do not take place in consecutive days, but all survey locations to be counted on each day when survey takes place.
6. A questionnaire aimed at identifying the recreational use (both of the footpaths in the area and around the larger area) to be undertaken of any footpath users during the counts.

Table 1.1 Proposed Count Locations and Times

Time \ Date	Holiday Weekday	Holiday Weekend	Term Weekday	Term Weekend
07:00 – 08:00	Site 1	Site 8	Site 12	Site 4
08:00 – 09:00	Site 2	Site 9	Site 1	Site 5
09:00 – 10:00	Site 3	Site 10	Site 2	Site 6
10:00 – 11:00	Site 4	Site 11	Site 3	Site 7
11:00 – 12:00	Site 5	Site 12	Site 4	Site 8
12:00 – 13:00	Site 6	Site 1	Site 5	Site 9
13:00 – 14:00	Site 7	Site 2	Site 6	Site 10
14:00 – 15:00	Site 8	Site 3	Site 7	Site 11
15:00 – 16:00	Site 9	Site 4	Site 8	Site 12
16:00 – 17:00	Site 10	Site 5	Site 9	Site 1
17:00 – 18:00	Site 11	Site 6	Site 10	Site 2
18:00 – 19:00	Site 12	Site 7	Site 11	Site 3

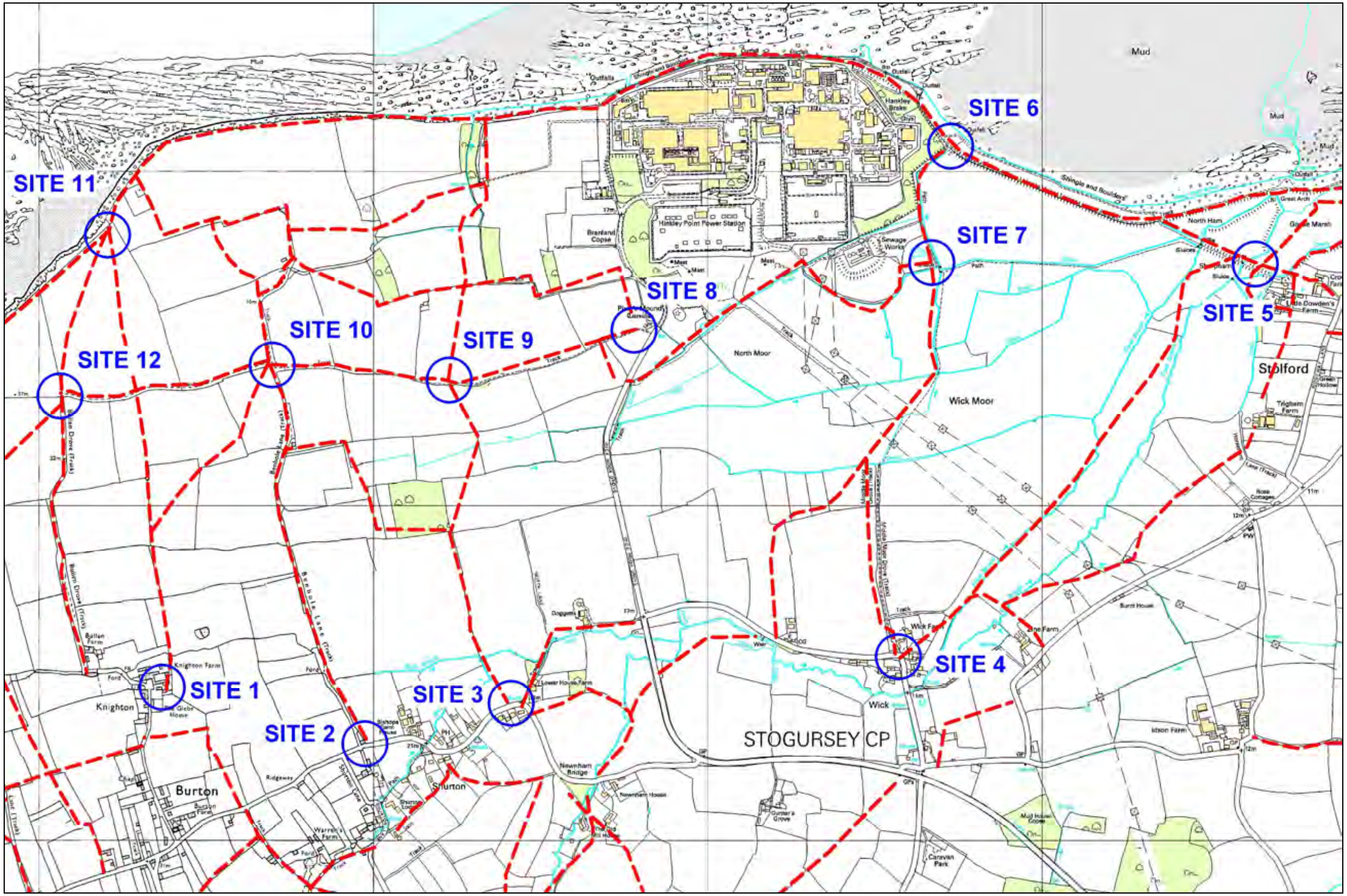
1.2.2 A wide variety of information was recorded during the surveys, including:

1. At access points, surveyors noted whether people arrived by vehicle or on foot, as well as numbers and typical age range.
2. Surveyors recorded if any of the people left the paths.
3. Recreational activity type (i.e. walking, dog-walking, cycling, horse-riding, going fishing, etc).
4. Surveyors recorded whether the same users pass the opposite way at each survey location (in order to determine whether people use differing routes during access and egress).
5. Description and photographs of the survey points, as well as the footpath/track to each survey point, noting condition (overgrown, well maintained, muddy, etc), type of route (mud, gravel, paved, tarmac, concrete).
6. For each survey the weather conditions were recorded.
7. The questionnaire was directed at recreational participants only, and focussed on gaining an understanding of the frequency and extent of use of the footpath network.

1.3 Structure of this Report

1.3.1 The first section of this report introduces the reason for the survey, whilst **Section 2** presents the questionnaire and survey recording. **Section 3** presents the details of the surveys undertaken, and **Section 4** presents the results, with a discussion of the results presented in **Section 5**. **Section 6** presents the results of the footpath condition survey.

Figure 1.1 Survey Locations



2 SURVEY RECORDING AND QUESTIONNAIRE

2.1 Introduction

2.1.1 This section sets out the approach and methodology for the footpath survey, counts of footpath users and the use of the survey questionnaire.

2.2 Questionnaire

2.2.1 A questionnaire was devised in order to gain information about the use of the footpaths, particularly information on where people originated from, how often they use the footpaths in the study area, what they use the footpaths for, their ideas of what makes a good footpath, and additional social data to put the study area and the footpath uses into context. The questionnaire devised was submitted to Somerset County Council for comment, though no changes were identified. The questionnaire is presented in **Appendix A**.

2.3 Footpath Counts

2.3.1 In order to count the number of users of the footpaths and survey locations, a referencing system was devised which comprised a site number and footpath reference number, as shown in **Figure 2.1**.

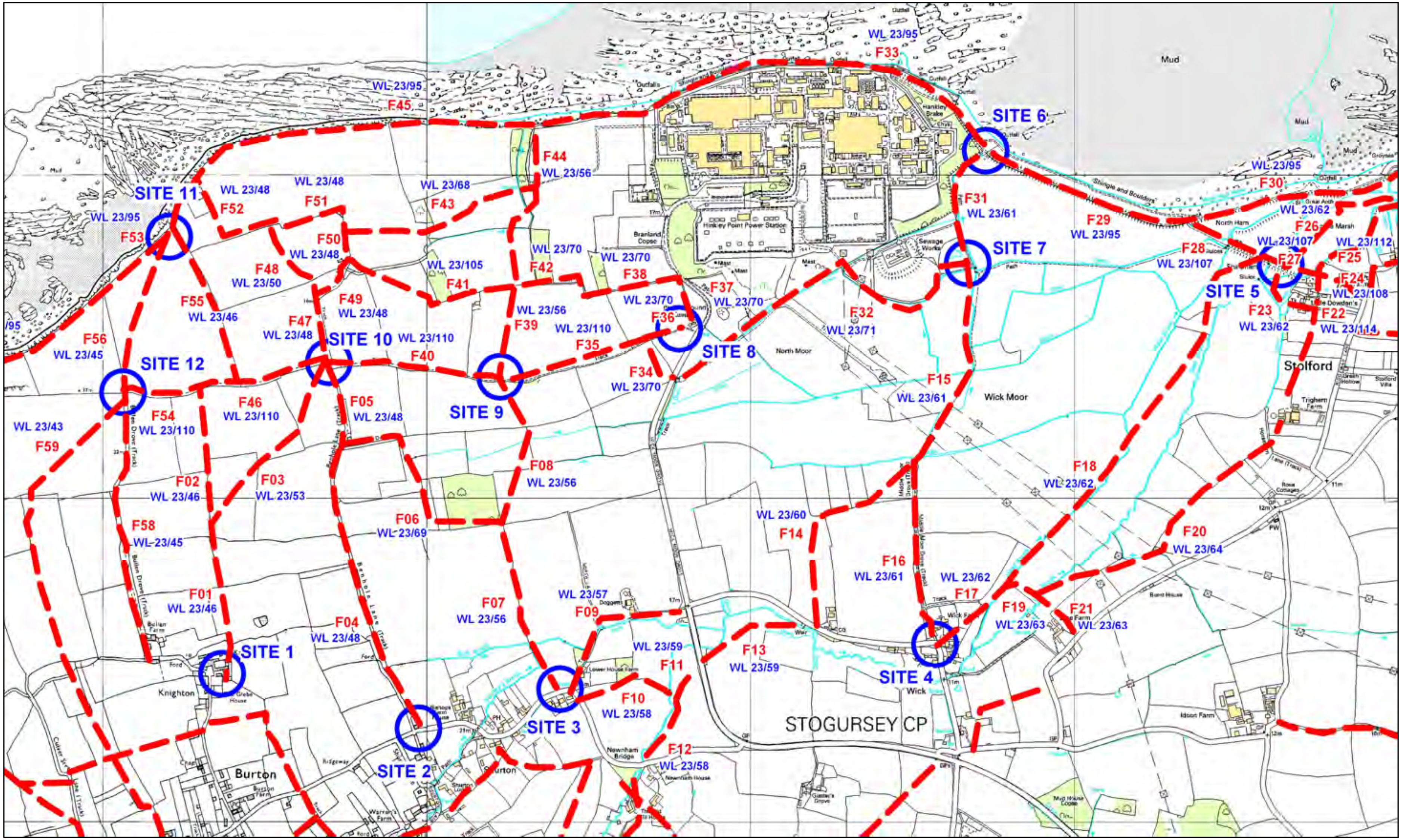
2.3.2 Recording sheets were created to ensure that the counts were structured and the results formally recorded (a copy of the sheet is provided at **Appendix B**). The sheets were used to record the number of users along each footpath length where visible on the ground, so that an indication of the overall use of each length of footpath could be determined.

2.4 Footpath Survey

2.4.1 As well as counting users, the footpaths within the study area are also assessed to gain an understanding of their condition and 'value' in the wider sense. In order to ensure a formal and standardised recording of the various features associated with each length of footpath, a proforma was generated and used (see example at **Appendix C**).

ROYAL HASKONING

Figure 2.1 Site and Footpath References



3 RECREATIONAL ACCESS SURVEY

3.1 Introduction

3.1.1 This section presents the details of the surveys undertaken in relation to recreational access use and quantification for the Hinkley Point study area.

3.2 Survey Details

3.2.1 Surveys were carried out in term time and during the summer holiday period, on the following dates:

- Wednesday 15th July 2009;
- Saturday 18th July 2009;
- Wednesday 26th August 2009; and
- Sunday 30th August 2009.

3.2.2 All surveys started at 07:00 and continued until 19:00.

3.2.3 The survey on the 15th July 2009 was carried out by A Chalmers (Lead Surveyor) and K Hillyer (Surveyor). The survey started at Site 1, and then on each hour, the survey moved on to the subsequent site (i.e. Site 2, then Site 3, then Site 4, and on to Site 12). Starting at Site 1 does not link with the commencement site (12) identified in **Table 1.1**, however, this does not affect the survey findings in any way.

3.2.4 The survey on the 18th July 2009 was carried out by P Thornton (Lead Surveyor) and A Chalmers (Surveyor). The survey started at Site 4, and then on each hour, the survey moved on to the subsequent site (i.e. Site 5, then Site 6, then Site 7, and on to Site 12, after which the next site was Site 1).

3.2.5 The survey on the 26th August 2009 was carried out by A Chalmers (Lead Surveyor) and K Hillyer (Surveyor). The survey started at Site 8, after which on each hour the survey moved on the subsequent site (i.e. Site 9, then Site 10, then Site 11, then Site 12, then Site 1, etc.).

3.2.6 The survey on the 30th August 2009 was carried out by P Thornton (Lead Surveyor) and A Chalmers (Surveyor). The survey started at Site 12, and then on each hour, the survey moved on to the subsequent site (i.e. Site 5, then Site 6, then Site 7, and on to Site 12, after which the next site was be Site 1).

3.2.7 A circular route for the survey locations was undertaken so that the distance to the survey vehicle was not excessive at the end of the day.

3.2.8 In order for the counts to commence at each site on the hour, one of the surveyors would depart to the next site with sufficient time to reach it by the start of the survey period. The remaining surveyor stayed at the former survey site until the hour was reached, at which point they would then depart to the next site to meet up with the other surveyor.

3.3 Survey on the 15th July 2009

3.3.1 The weather on the 15th July 2009 consisted generally of broken cloud, with some sunny spells. The temperature was initially cool becoming warmer as the day progressed, and as cloud cleared in the afternoon. Generally the ground was dry, but puddles from rainfall the day before were evident at some locations. During the survey it was dry, with the exception of some light showers around lunchtime. Wind was calm in the morning but generally breezy throughout the day, though it was windier on the coastal sites to the west of Hinkley Point.

3.3.2 All sites were visited, and all survey counts were undertaken as planned. However, visitor and user numbers were generally low. The footpath count record sheets for this survey are presented in **Appendix D**, whilst the questionnaires that were undertaken are presented in **Appendix E**.

3.4 Survey on the 18th July 2009

3.4.1 The weather on the 18th July 2009 was overcast for most of the day until late afternoon/early evening when the cloud rapidly cleared and temperatures rose. The ground was dry or damp, with puddles from rainfall the day before present at some locations. During the survey it was dry, with the exception of some very light and short showers scattered through the day. Wind was breezy throughout the day, until late afternoon when the wind dropped.

3.4.2 All sites were visited and all survey counts were undertaken as planned, with the exception of Site 2. During the footpath survey it was identified that access along footpath F07 was closed to pedestrians due to an extremely large body of standing water across the path. Consequently, after 20 minutes, the surveyors moved to Site 3, and continued for 90 minutes at Site 3. Visitor and user numbers were generally low. The footpath count record sheets for this survey are presented in **Appendix F**, whilst the questionnaires that were undertaken are presented in **Appendix G**.

3.5 Survey on the 26th August 2009

3.5.1 The weather on the 26th August 2009 was damp and overcast, though dry early in the morning. Showers and persistent rain continued from mid morning and throughout most of the day. The temperature was cool throughout the day with little if any warming during the day. The ground was damp, with puddles present at many locations. During the survey it was predominantly wet and showery, with a strong breeze throughout the day.

3.5.2 All sites were visited with the exception of Site 2. Access along footpath F07 was closed to pedestrians due to localised flooding in the field and across the path. Consequently, an additional 1 hour of survey was undertaken at Site 1, and the survey then leapfrogged Site 2 to commence at Site 3. Visitor and user numbers were low, most likely due to the poor weather. The footpath count record sheets for this survey are presented in **Appendix H**, whilst the questionnaires that were undertaken are presented in **Appendix I**.

3.6 Survey on the 30th August 2009

3.6.1 The weather on the 30th August 2009 was overcast but dry in the morning. Though there were some short showers in the mid morning the rest of the day was dry but remained overcast. The temperature was cool throughout the day warming up slightly by early afternoon, but remaining cool in the wind. The ground was dry with only scattered puddles in damp locations. During the survey it was generally breezy, being windy at the exposed sites on the coastline.

3.6.2 All sites were visited with the exception of Site 2, due to the localised flooding (see previous comments). Consequently, an additional 1 hour of survey was undertaken at Site 12, and the survey then leapfrogged Site 2 to commence at Site 3. Visitor and user numbers were low, most likely due to the poor weather. The footpath count record sheets for this survey are presented in **Appendix J**, whilst the questionnaires that were undertaken are presented in **Appendix K**.

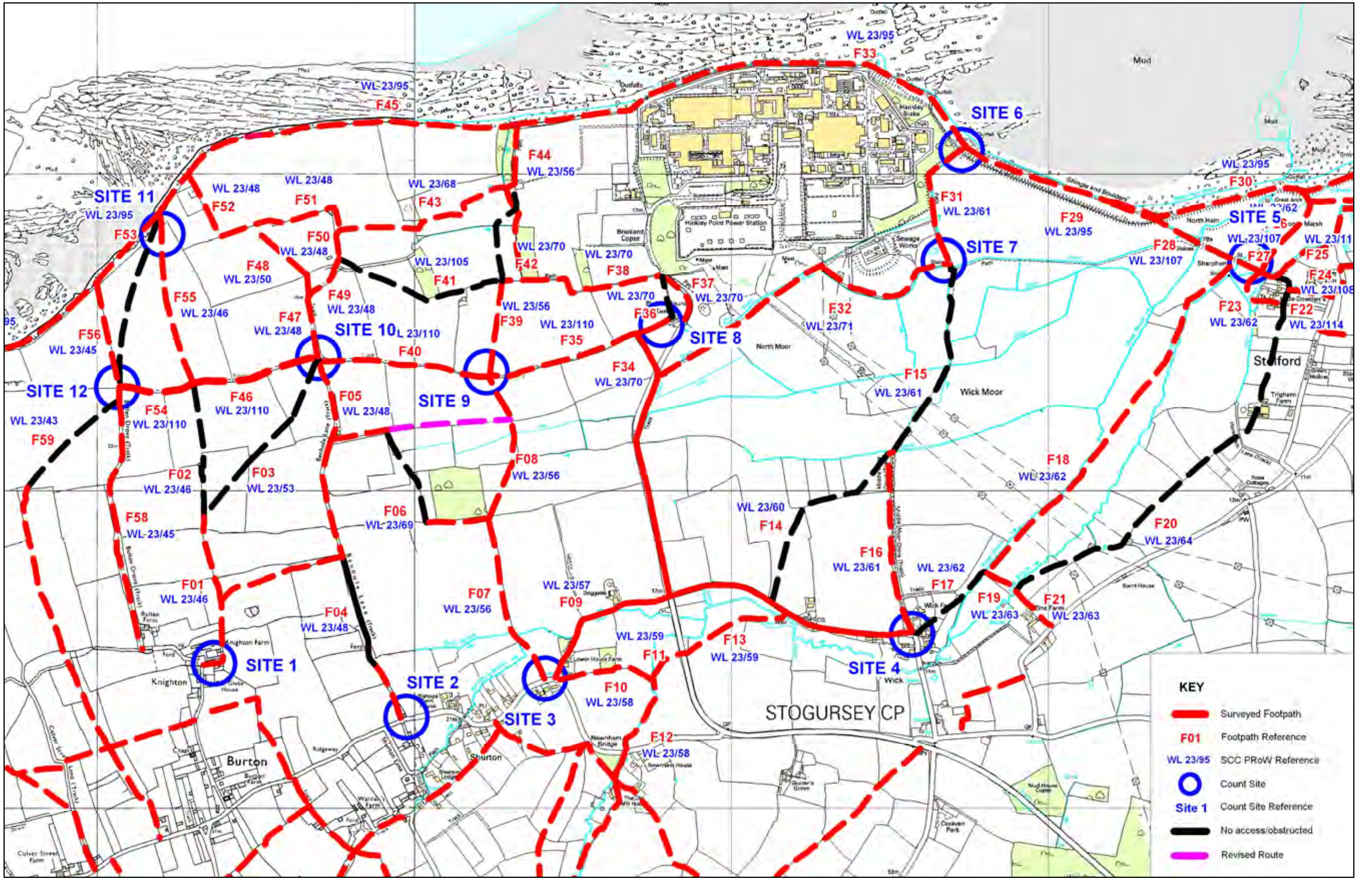
3.7 Footpath Condition Survey

3.7.1 The survey of footpath condition was undertaken on the 18th July 2009 and completed on the 30th August 2009. The completed record sheets are presented in **Appendix L**, whilst the photographs taken are presented in **Appendix M**.

3.7.2 During the survey on the 18th July, a number of footpath lengths were not surveyed, namely: F22 (WL 23/114), F24 (WL 23/108), F25 (WL 23/112), F30 (WL 23/95 partial), F34 (WL 23/70 partial), and F36 (WL 23/70 partial). These were surveyed on the 30th August 2009.

3.7.3 A number of footpaths had no visible access, or access was partially or completely obstructed. These footpaths were: F02 (WL 23/46 partial), F03 (WL 23/53 appears to divert east to join WL 23/48), F06 (partial), F14 (WL 23/60), F15 (WL 23/61 partial), F17 (WL 23/62 partial), F20 (WL 23/64 partial), F22 (WL 23/114), F41 (WL 23/105 partial), and F59 (WL 23/43 access/route not visible). **Figure 3.1** presents the footpaths surveyed, along with those that were obstructed or had been re-directed.

Figure 3.1 Footpaths Surveyed, and Footpaths Obstructed/Altered



4 RECREATIONAL ACCESS SURVEY RESULTS

4.1 Footpath Counts

4.1.1 On the survey date of the 15th July 2009, a total of 6 people were counted using the footpath network, shown on the results collated in **Appendix N**. Of these people, 2 were returning from fishing and the remaining 4 were dog walkers.

4.1.2 On the survey date of the 18th July 2009, a total of 7 people were counted using the footpath network, shown on the results collated in **Appendix O**. Of these people, 5 were dog walkers, one was visiting her cattle, and the remainder was a horse-rider.

4.1.3 On the survey date of the 26th August 2009, a total of 7 people were counted using the footpath network, shown on the results collated in **Appendix P**. Of these people, 6 were dog walkers, and one was walking alone.

4.1.4 On the survey date of the 30th August 2009, a total of 6 people were counted using the footpath network, shown on the results collated in **Appendix Q**. Of these people, 4 were dog walkers, and the remaining two were fishing along the coastal path.

4.2 Questionnaire Results

4.2.1 Of the total of 26 people counted using the footpath network, 20 completed the questionnaire individually or as a group, with a total of 15 completed questionnaire forms. The tabulated results of the questionnaires are presented in **Appendix R**.

4.3 Footpath Condition Survey Results

4.3.1 A number of footpaths had obstructed or no visible access, or access was partial due to obstructions. These footpaths were: F02 (WL 23/46), F03 (WL 23/53), F06 (WL 23/69), F14 (WL 23/60), F15 (WL 23/61), F17 (WL 23/62), F41 (WL 23/105), and F59 (WL 23/43). The detailed finding for each footpath is presented in **Appendix L** with photographs presented in **Appendix M**. The general findings are:

- No footpath was surfaced with tarmac, and the majority were not surfaced.
- Signposting was erratic, with the majority of footpath access not signposted.
- Where not obstructed, access was generally clear, with moderate to good conditions for the majority of gates, stiles, and watercourse crossings.
- Only one footpath was inaccessible due to cattle.
- The majority of footpaths were level, though a small number of relatively steep paths occur between the settlements of Burton, Shurton, and Stogursey, and the ridge to the north. These steep or sloping footpaths were often the most used.
- None of the footpaths surveyed had any lighting.
- The majority of footpaths were relatively tidy and accessible, with only a small number inaccessible due to vegetation growth.
- The majority of views (particularly to the west of the C182 Wick Moor Drove) were generally open and of distant landscape features such as Exmoor, the Quantocks, Brean Down/Bleadon Hills, the Severn Estuary, and Wales. More localised constrained views were predominantly found to the east of the C182 Wick Moor Drove, mainly due to the low-lying topography of the land.

5 DISCUSSION OF SURVEY RESULTS

5.1 Footpath Counts

5.1.1 **Table 5.1** summarises the total usage of the footpaths in the Hinkley Point area. The use of footpaths appears to be relatively low level, with use currently identified on footpath lengths F04 (WL 23/48), F05 (WL 23/48), F07 (WL 23/56), F08 (WL 23/56), F27 (WL 23/107), F28 (WL 23/107), F29 (WL 23/95), F33 (WL 23/95), F35 (WL 23/110), F39 (WL 23/56), F46 (WL 23/110), F53 (WL 23/95), F54 (WL 23/110), F55 (WL 23/46), F56 (WL 23/45), and F58 (WL 23/45). The origin of the footpath users appears to be Knighton, Shurton, Burton, Stogursey, and Stolford, based on the access points and likely destinations of the users. Furthermore, associated adjoining footpaths are also likely to be used as access to some of the paths presented in **Table 5.1** as they are linked by other footpaths. **Figure 5.1** shows the footpaths and includes coloured lines related to the number of counts on these lengths.

Table 5.1 Total Counts for each Footpath Length

Time	Site	1	2	3	5	5	6	6	9	9	9	10	10	11	11	12	12
	Footpath	58	04	07	27	28	29	33	08	35	39	05	46	53	55	54	56
	SCC PRoW Reference	WL 23/ 45	WL 23/ 48	WL 23/ 56	WL 23/ 107	WL 23/ 107	WL 23/ 95	WL 23/ 95	WL 23/ 56	WL 23/ 110	WL 23/ 56	WL 23/ 48	WL 23/ 110	WL 23/ 95	WL 23/ 46	WL 23/ 110	WL 23/ 45
0700 - 0800	**4**	2															2
0800 - 0900	**3**		1		1	1											
0900 - 1000	**2**	1										1					
1000 - 1100	**2**														2		
1100 - 1200	**2**															2	
1200 - 1300	**13**	1					2	2	4	2	2						
1300 - 1400	**4**						2					1	1				
1400 - 1500	0																
1500 - 1600	0																
1600 - 1700	**2**				2												
1700 - 1800	**1**			1													
1800 - 1900	**8**	3						1						1		3	
	Total	**7**	**1**	**1**	**3**	**1**	**4**	**3**	**4**	**2**	**2**	**2**	**1**	**1**	**2**	**5**	**2**

5.1.2 Use appears to occur in 3 periods, early morning (around 07:00 to 09:00), lunchtime (around 12:00 to 14:00), and late afternoon to early evening (around 18:00 to 19:00). A graph showing the total counts over time is presented in **Figure 5.2**.

5.1.3 Ten out of the 20 people counted were individuals, whilst the remainder were in pairs.

Figure 5.1 Total Counts for Each Length of Footpath

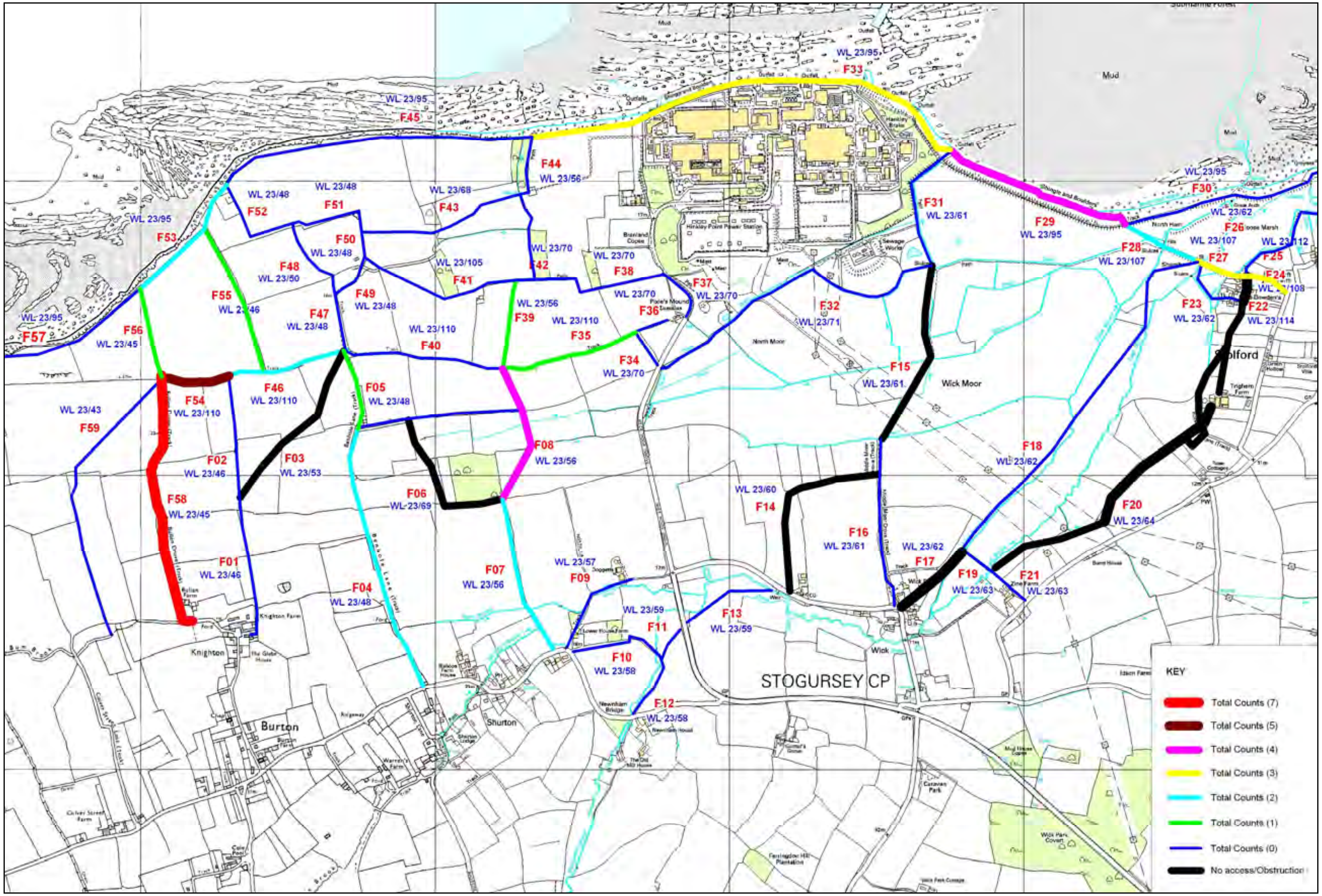
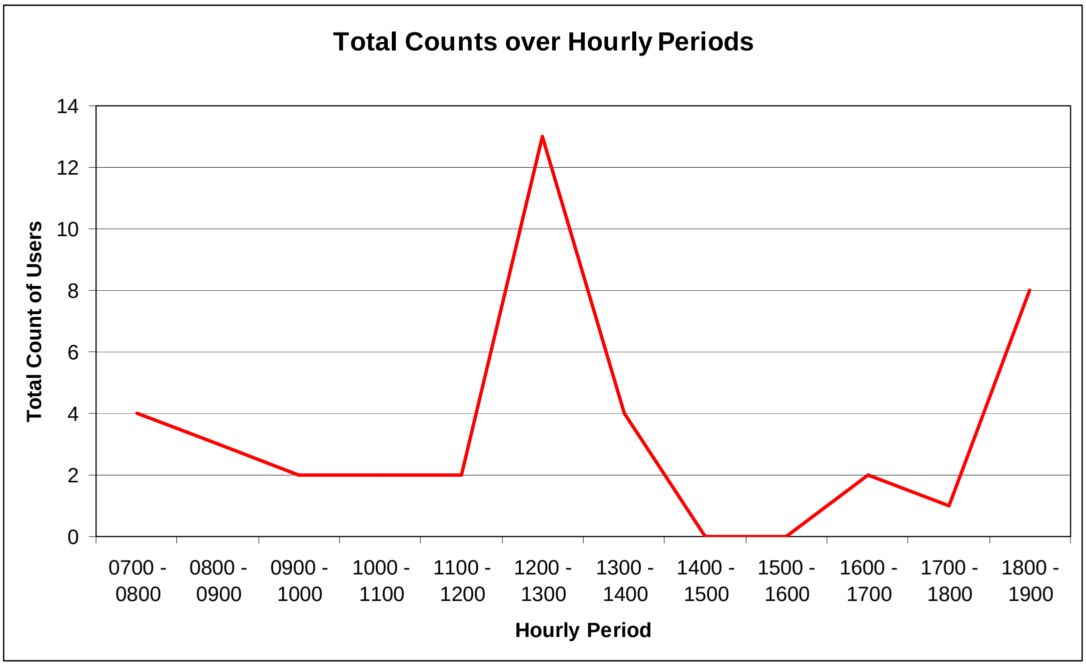


Figure 5.2 Total Counts Over Hourly Periods

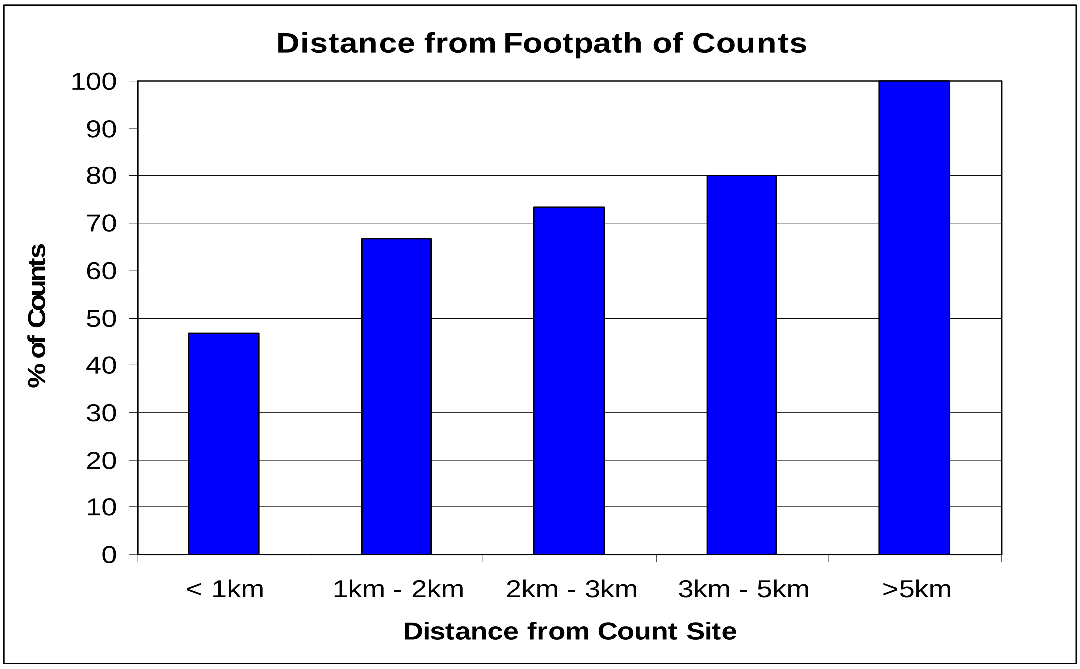


5.2 Questionnaire Findings

5.2.1 Initial findings of the questionnaire surveys are:

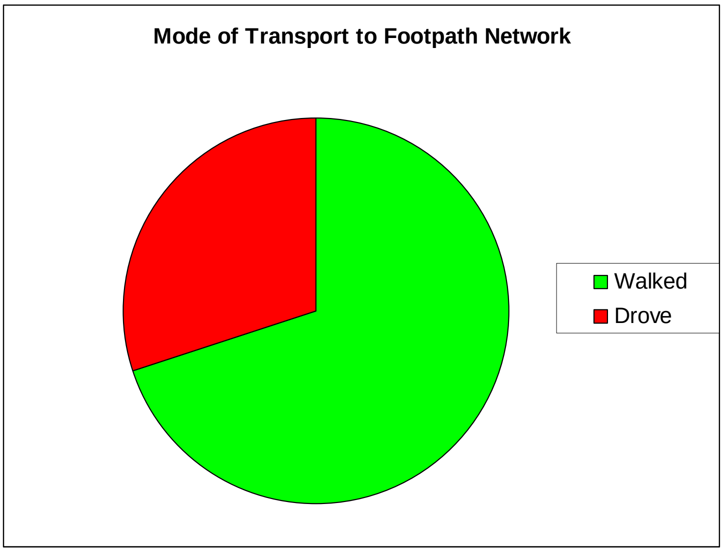
- The majority (70%) of users live in the Hinkley area, within less than 1 ½ miles from the footpath network, though this figure would be much less than a mile due to 2 visitors living outside the immediate study area. **Figure 5.3** is a graphical representation of residence distance from footpath;

Figure 5.3 Residence Distance from Footpath



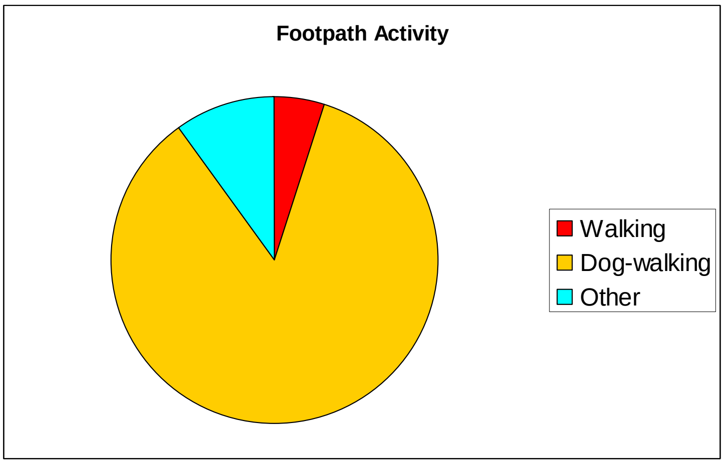
- A small number (30%) of users were from Bridgwater, Minehead or elsewhere;
- The majority (70%) of people walked to the footpath network from their place of residence, whilst the remainder drove and parked near a gate or within a farm, as presented in **Figure 5.4**;

Figure 5.4 Mode of Transport to Footpath Network



- 35% of users resided less than 5 minutes walking from the footpath network, and 75% within 30 minutes walking distance;
- Dog walkers were the most prolific users of the footpath network, with 85% of the surveyed people, with fishermen constituting 5%, and horse-riding and cattle owner comprising the remainder, as presented in **Figure 5.5**;

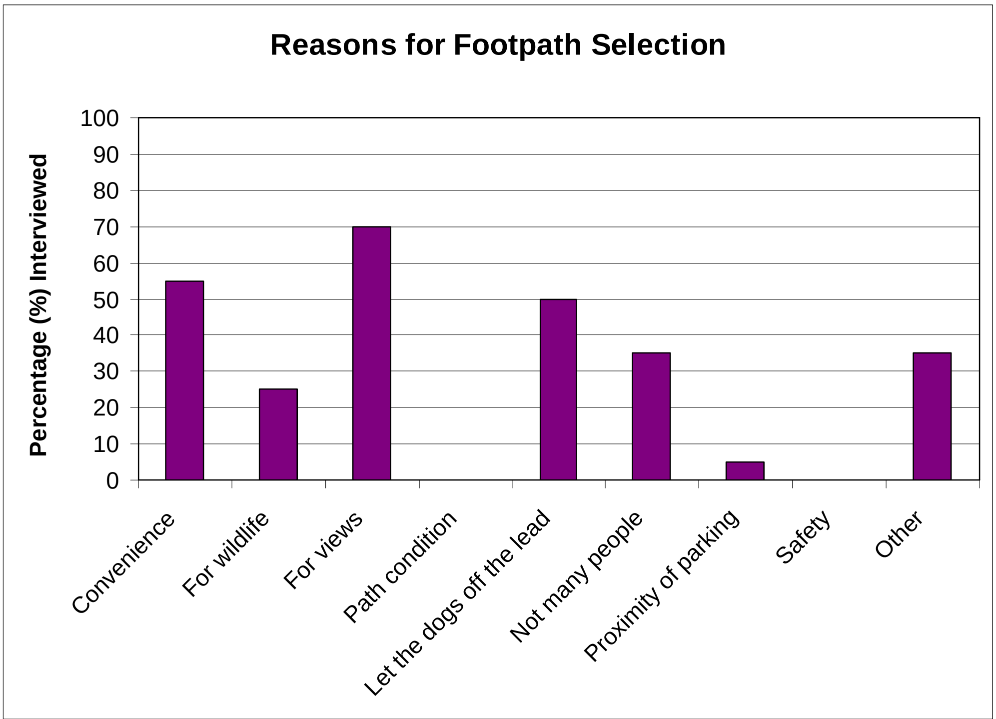
Figure 5.5 Activity Undertaken on Footpaths



- Most used the footpath network frequently, between once a week to twice a day for residents, but for a lesser frequency by non-residents;
- Users were loyal to the routes they took, though other routes within and outside the study area were also used;

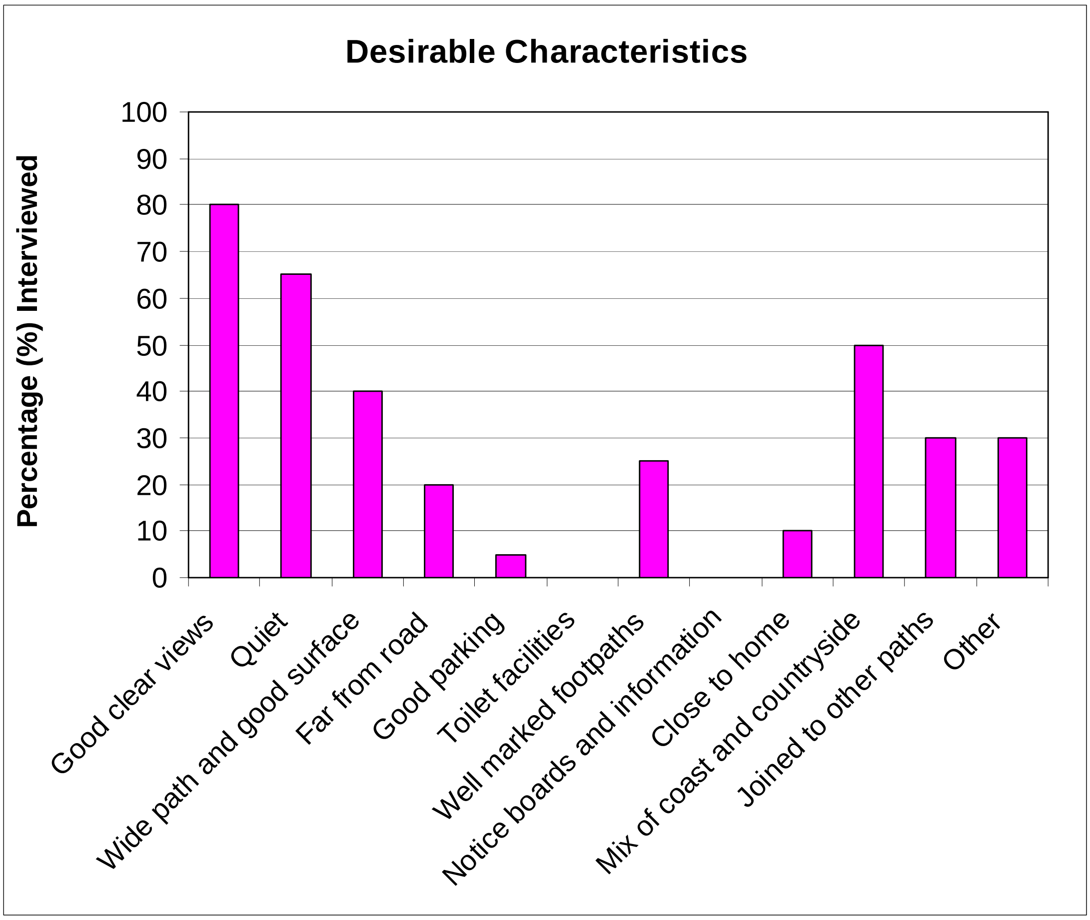
- Users were expecting to spend an average of 1 hours and 55 minutes outdoors, with duration outdoors ranging from 20 minutes to over 7 hours;
- The majority (65%) intended to follow a circular route, whilst the remainder returned the same way;
- The reasons for choosing the route were: the views (70%), convenience (55%), they could let dogs of the lead (50%), there were not many people (35%), the wildlife (25%), and other recreational reasons (35%), as presented in **Figure 5.6**;

Figure 5.6 Reasons for Footpath Selection



- The users identified the most desirable characteristics of a footpath as good views (80%), peace and quiet (65%), a mix of countryside and coast (50%), good condition of the footpaths (40%), connections to other footpaths (30%), well marked footpaths (25%), and far from the road (20%). Graphical representation is shown in **Figure 5.7**;
- The vast majority (90%) of users were over 45 years of age, and none were under 25 years of age;
- Just under half (45%) of those surveyed were in full time employment, with 30% in part time employment, and the remaining 25% were retired;
- The average number in a household was 1.9, with few or no dependents; and
- The majority of users were female (65%), though in general females were as likely to be on their own as males.

__Figure 5.7 Desirable Characteristics for Footpaths__



6 CONCLUSIONS

6.1 Footpath Network

6.1.1 The footpath network across the study area provides access to a unique blend of coastal and inland environments, with long distance views to the west and along the coastal path, whereas views are enclosed with occasional distant glimpses of Exmoor, the Quantocks, or the Brean Down/Bleadon Hills and Mendips. The footpath network is extensive in terms of the variability of routes available, particularly to the west of Wick Moor Drove (the C182) and north of the villages of Knighton, Burton, and Shurton. Footpaths are generally unsurfaced (i.e. no tarmac/concrete) or follow the route of farm tracks often comprising compressed earth with occasional buried stones. Particularly fine views are found along the east to west running ridge to the north of the small settlements and to the south west of Hinkley Point A Power Station. Views along the footpaths to the east of Wick Moor Drove are generally constrained by the low lying topography and numerous field boundaries.

6.2 Footpath Use

6.2.1 The majority of use of footpaths is by local residents, though on occasion visitors resident significant distances from the area (e.g. in excess of 15 miles) visit and use the footpaths for their value as a rather unique resource. Use is predominantly favoured for walking dogs, though for some footpath lengths use is specific to the interest along that footpath (such as fishing along the coastal footpath, and access to cattle near to Stolford). Fishing and horse-riding were the only formal activities undertaken on or near to the footpath network, and in relatively restricted areas, and in low numbers.

6.2.2 The numbers of visitors and users of the footpath network were lower than anticipated, particularly along the coastal path. The surveys were staggered through the day, all sites were surveyed around the expected and unexpected peak times (the lunchtime and afternoon peak) on weekdays and weekends. There was little difference in visitor/user numbers between weekdays and weekends, which may be indicative of the fact that mostly residents use the footpath network and mainly for the regular exercise of walking their dogs.

6.2.3 In order to generate yearly use numbers for the footpath network as a whole, the methodology presented in the Foundation for Water Research's Manual on Assessing the Benefits of Surface Water Quality Improvements (FWR, 1996) have been used to calculate a range of user numbers for the footpath network surveyed. The calculations are based on the visitor numbers for 'river' based sites, and those for coastal based sites. The river-based site numbers are calculated based on the number of residential properties in the surrounding area, with a low medium and high range provided by three ranges (500m, 800m, and 3km). The coastal based calculations are based on the counts made during the surveys undertaken, which are then multiplied using factors identified in the Manual (FWR, 1996) relating to informal recreation (which based on the summer counts is likely to be an overestimate of the number of trips). **Table 6.1** presents the ranges of values for total visitor numbers for the footpath network surveyed. The numbers for a honeypot (river) site and the average based on the coastal site calculations are in the same area, and based on the average distances of those interviewed from the area, the interest features in the area, the use of the footpath network though moderate, is of a high local value.

Table 6.1 Calculated Total Use of Network Surrounding the Site

Calculation Basis	Users per year
River-based calculations	
500m	4,500
800m	9,250
3km Honeypot	21,100
Coastal site calculations	
15/07 Survey	36,000***
18/07 Survey	16,800
26/08 Survey	29,600
30/08 Survey	8,900*
Average	22,825**

6.2.4 Based on the calculated user numbers in **Table 6.1**, an indication of the expected density of use for the individual footpaths based on the counted users from the surveys presented in this report, is provided in **Table 6.2**. These counts and the density of use shown on **Figure 5.1** point to a greater intensity of use of the footpaths along and adjacent to Bullen Drove at the far western end of the study area, but moderate to low levels of use within the remainder of the network in the study area. The point based multiplier estimates are around 75% higher than those based on residential population.

Table 6.2 Density of Footpath Use for each Footpath Length

Footpath (SCC PRoW Ref)	Users per year				
	Counted	Count Based Multiplier	Low*	Medium**	High***
F04 (WL23/48)	1	1,438	220	560	880
F05 (WL23/48)	2	2,876	440	1,120	1,760
F07 (WL23/56)	1	1,438	220	560	880
F08 (WL23/56)	4	5,752	870	2,230	3,520
F27 (WL23/108)	3	4,314	650	1,670	2,640
F28 (WL23/107)	1	1,438	220	560	880
F29 (WL23/95)	4	5,752	870	2,230	3,520
F33 (WL23/95)	3	4,314	650	1,670	2,640
F35 (WL23/110)	2	2,876	440	1,120	1,760
F39 (WL23/56)	2	2,876	440	1,120	1,760
F46 (WL23/110)	1	1,438	220	560	880
F53 (WL23/95)	1	1,438	220	560	880
F54 (WL23/110)	5	7,190	1,100	2,790	4,400
F55 (WL23/46)	2	2,876	440	1,120	1,760
F56 (WL23/43)	2	2,876	440	1,120	1,760
F58 (WL23/45)	7	10,067	1,520	3,900	6,150

7 REFERENCES

FWR (1996). Assessing the Benefits of Surface Water Quality Improvements Manual. Foundation for Water Research.

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APPENDIX A

QUESTIONNAIRE

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP_________

Interviewer	

Interview Site	Site Number -

Interview Date	

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Condition**		
	Dry		7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy		11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…		13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards		15	
3	**How did you travel to the footpath today?**			
	Walked all the way…		16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking		37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…		43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…		45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…		47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…		48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…		54	
	For the views…		55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…		62	
	Quiet and peaceful…		63	
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…		81	
	Working part time…		82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…		88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?		91	
18	How many in the group?		92	
19	How many dogs?		93	

APPENDIX B

FOOTPATH COUNT SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S_________

Footpath Link Reference	F__________

Surveyor Signature	

Survey Date	

Survey Time	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

ROYAL HASKONING

APPENDIX C

FOOTPATH SURVEY SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset

Footpath Reference Number	F_________

Surveyor Signature	

Survey Date	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	
Width	
Boundary	
Watercourse crossings	
Gates	
Stiles	
Steepness/Slopes	
Adjacent watercourses	
Adjacent cliffs/slopes	
Signposting/locating	
Ease of access	
Obstructions	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	
Lighting present	
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	
Open views description	
Views of…	
Photographs	

APPENDIX D

15/07 FOOTPATH COUNT SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 01
Footpath Link Reference	F 01
Surveyor Signature	[signature]
Survey Date	15/07/09
Survey Time	0700

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description	RESIDENTS LEAVING HOUSES BY CAR		24
Others 1 Count	~~IIII~~ III		25
Others 2 Description	CYCLIST ON ROAD		26
Others 2 Count	I		27
Others 3 Description	~~POSTMAN ON ROAD~~ Corner shop delivery		28
Others 3 Count	I		29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 2

Footpath Link Reference	F 04

Surveyor Signature	[signature]

Survey Date	15/07/09

Survey Time	0800

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	1 (RESIDENT OF ADJACENT HOUSE – CONCERN OVER SPOIL FEILD – PASSED ON BUSININCSS CARD)		17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description	RESIDENT – WALK TO CAR		24
Others 1 Count	1		25
Others 2 Description	FARRIER LEAVING FARM		26
Others 2 Count	1		27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 3
Footpath Link Reference	F 07
Surveyor Signature	[signature]
Survey Date	15/07/2009
Survey Time	9:00am

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 3
Footpath Link Reference	F 09
Surveyor Signature	
Survey Date	15/07/2009
Survey Time	9:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 3
Footpath Link Reference	F 10
Surveyor Signature	D Chalmers
Survey Date	15/07/2009
Survey Time	9:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S_04
Footpath Link Reference	F_17
Surveyor Signature	[signature]
Survey Date	15/07/09
Survey Time	1000

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S_04

Footpath Link Reference	F_16

Surveyor Signature	[signature]

Survey Date	15/07/09

Survey Time	1000

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 18
Surveyor Signature	[signature]
Survey Date	15/07/2009
Survey Time	11:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 27
Surveyor Signature	
Survey Date	15/07/2009
Survey Time	11:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**	✓	
	Dry		10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 23
Surveyor Signature	
Survey Date	15/07/05
Survey Time	1100

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	~~✓~~	13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 28
Surveyor Signature	[signature]
Survey Date	15/07/05
Survey Time	1100

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 6
Footpath Link Reference	F 31
Surveyor Signature	
Survey Date	15/07/2009
Survey Time	12:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 6
Footpath Link Reference	F 29
Surveyor Signature	
Survey Date	15/07/09.
Survey Time	12:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**	✓	
	Dry		10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description	Fishing		24
Others 1 Count	11	2	25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 6

Footpath Link Reference	F 33

Surveyor Signature	[signature]

Survey Date	15/7/09

Survey Time	12:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description	Fishing		24
Others 1 Count	II	2	25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S CA
Footpath Link Reference	F 32
Surveyor Signature	
Survey Date	
Survey Time	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 07
Footpath Link Reference	F 15
Surveyor Signature	[signature]
Survey Date	15/07/09
Survey Time	1300

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 07
Footpath Link Reference	F 31
Surveyor Signature	
Survey Date	15/07/09
Survey Time	1300

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 8
Footpath Link Reference	F 36
Surveyor Signature	[signature]
Survey Date	15/07/09
Survey Time	1400

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 8

Footpath Link Reference	F 37 (WARNING – BUZZARDS NESTING)

Surveyor Signature	[signature]

Survey Date	15/07/09

Survey Time	1400

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 9
Footpath Link Reference	F ~~[illegible]~~ 08
Surveyor Signature	[illegible]
Survey Date	15/07/2009.
Survey Time	3:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 9
Footpath Link Reference	F 39
Surveyor Signature	
Survey Date	15/07/2009.
Survey Time	3.00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 9
Footpath Link Reference	F 40
Surveyor Signature	[signature]
Survey Date	15/07/2009
Survey Time	3:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 09
Footpath Link Reference	F 35
Surveyor Signature	[illegible]
Survey Date	15/07/2009
Survey Time	3:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 05
Surveyor Signature	
Survey Date	15/07/09
Survey Time	1600

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 03
Surveyor Signature	[signature]
Survey Date	15/07/09
Survey Time	1600

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 10

Footpath Link Reference	F 46

Surveyor Signature	[signature]

Survey Date	15/07/09

Survey Time	1600

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 40
Surveyor Signature	
Survey Date	15/07/09
Survey Time	1600

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 47
Surveyor Signature	[signature]
Survey Date	15/07/09
Survey Time	1600

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 11
Footpath Link Reference	F 55
Surveyor Signature	S Chalmers
Survey Date	15/07/2009.
Survey Time	5:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 11
Footpath Link Reference	F 56
Surveyor Signature	A Chalmers
Survey Date	15/07/2009
Survey Time	5:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 11
Footpath Link Reference	F 57
Surveyor Signature	
Survey Date	15/07/2009
Survey Time	5:00 pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 11
Footpath Link Reference	F 53
Surveyor Signature	A Chalmers
Survey Date	15/07/2009.
Survey Time	5:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 12
Footpath Link Reference	F 54
Surveyor Signature	AChalmer
Survey Date	15/07/2009.
Survey Time	6:00 pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)	✓	4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count	111 7 dogs - 1 dog	3 8 Dogs	19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 12

Footpath Link Reference	F 59

Surveyor Signature	S Chalmers

Survey Date	15/07/2009.

Survey Time	6:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)	✓	4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 12
Footpath Link Reference	F 58
Surveyor Signature	AChalmers
Survey Date	15/07/2009
Survey Time	6:00 pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)	✓	4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count	III 1 dog, 7 dogs	3 8 Dogs.	19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 12
Footpath Link Reference	F 56
Surveyor Signature	[signature]
Survey Date	15/07/2009
Survey Time	6:00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)	✓	4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

APPENDIX E

15/07 COMPLETED QUESTIONNAIRES

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F04

Interviewer	Alex Chalmers

Interview Site	Site Number - 2

Interview Date	15/07/2009.

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	[signature]

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm	✓	10
	Breezy		11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	lives next to pathway
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	5 meters	15	with 5m
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…	✓	30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	365	43	Every Day
8	**Do you usually walk the same route or a different one every time?**			
	The same route…	✓	44	
	Different routes nearby…		45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	365	47	Every day

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	Half a day	48	7 hours
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…	✓	50	✓
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…		54	
	For the views…		55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…		62	
	Quiet and peaceful…	✓	63	location.
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…	✓	78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…		81	
	Working part time…	✓	82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	Female	91	
18	How many in the group?	1	92	
19	How many dogs?	2	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F29
Interviewer	Alex Chalmers
Interview Site	Site Number - 6
Interview Date	15/07/09.

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	AChalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy		11
	Windy	✓	12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes...		13	
	No... (state location of residence)	✓	14	looking after Parents house.
2	**How close is your home or starting point to this footpath?**			
	Distance...meters/kilometres/miles/yards	1mile.	15	
3	**How did you travel to the footpath today?**			
	Walked all the way...	✓	16	
	Bicycle...		17	
	Horse...		18	
	Motorcycle...		19	
	Car...		20	
	Bus/train....		21	
	Other...(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park...		23	
	Lay-by...		24	
	Gateway...		25	
	Wide verge...		26	
	Nearby housing area...		27	
	On the road...		28	
	Other...(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…	✓	31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking		37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)	✓	42	Fishing.
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	2.	43	Every 6 Months
8	**Do you usually walk the same route or a different one every time?**			
	The same route…	✓	44	
	Different routes nearby…		45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	2	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	2 hours	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…	✓	50	
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…		54	
	For the views…		55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)	Fishing	61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…	✓	76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time…	✓✓	81	
	Working part time…		82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	1 male 1 female	91	
18	How many in the group?	2	92	
19	How many dogs?	No	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F58

Interviewer	LGH

Interview Site	Site Number - 12

Interview Date	15/07/09

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	[signature]

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy		11
	Windy	✓	12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	1 MILE	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…		31	
	16 to 30 minutes…	✓	32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	2/DAY	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…	✓ ✗	44	
	Different routes nearby…	✓	45	
	Different routes >2 miles away…	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	2/365	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	1/2 HRS	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…	✓	54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)	✓	61	

COASTLINE.

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…	✓	71	
	Joined to other paths….		72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…	✓	79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…		81	
	Working part time…		82	
	Retired…	✓	83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2	88	
	Adults over 65…	✓	89	
	NOTES		90	
17	Male or female?	F	91	
18	How many in the group?	1	92	
19	How many dogs?	1	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F54 to F58

Interviewer	Alex Chalmers.

Interview Site	Site Number - 12

Interview Date	15/07/2009.

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	AChalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy		11
	Windy	✓	12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	1 ½	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…		16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…	✓	20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…	✓	25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…	✓	30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…		43	1 per week.
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…		45	
	Different routes >2 miles away…	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	52.	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	1 hour.	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…		54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views...	✓	62	
	Quiet and peaceful...		63	
	Wide path and good surface...		64	
	Far from the main roads...		65	
	Good available parking nearby...		66	
	Toilet facilities available...		67	
	Well marked footpaths...		68	
	Notice boards and information about the surroundings/wildlife/routes...		69	
	Close to home...		70	
	Mix of coast and countryside...	✓	71	
	Joined to other paths....		72	
	Others....		73	Beach.
14	**What age group are you in?**			
	Less than 18...		74	
	18 to 24...		75	
	25 to 29...		76	
	30 to 44...		77	
	45 to 59...	✓	78	
	60 to 74...		79	
	Over 75...		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…	✓✓	81	
	Working part time…		82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2.	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	2x female	91	
18	How many in the group?	2	92	
19	How many dogs?	7.	93	

APPENDIX F

18/07 FOOTPATH COUNT SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 1
Footpath Link Reference	F 01 + 58
Surveyor Signature	[signature] [signature]
Survey Date	18/7/09
Survey Time	16:00 – 17:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		0	16
Individual Walkers with Dogs Count		0	17
Group of Walkers Count		0	18
Group of Walkers with Dogs Count		0	19
Individual Cyclists Count		0	20
Group of Cyclists Count		0	21
Individual Horse-riders Count		0	22
Individual Horse-riders Count		0	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 02
Footpath Link Reference	F 04
Surveyor Signature	[signatures]
Survey Date	18/7/09
Survey Time	17:00 – 17:30

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)	✓	4
	Warm (15-20 C)		5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		0	16
Individual Walkers with Dogs Count		0	17
Group of Walkers Count		0	18
Group of Walkers with Dogs Count		0	19
Individual Cyclists Count		0	20
Group of Cyclists Count		0	21
Individual Horse-riders Count		0	22
Individual Horse-riders Count		0	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users, access blocked.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 3

Footpath Link Reference	F 07

Surveyor Signature	[signature]

Survey Date	18/07/2009

Survey Time	5:30 - 7

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	\	|	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 03
Footpath Link Reference	F 09
Surveyor Signature	
Survey Date	18/7/09
Survey Time	17:30 – 19:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		0	16
Individual Walkers with Dogs Count		0	17
Group of Walkers Count		0	18
Group of Walkers with Dogs Count		0	19
Individual Cyclists Count		0	20
Group of Cyclists Count		0	21
Individual Horse-riders Count		0	22
Individual Horse-riders Count		0	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	None seen.	0	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 03

Footpath Link Reference	F 10

Surveyor Signature	[signature]

Survey Date	18/7/09

Survey Time	17:30 – 19:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

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HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 4
Footpath Link Reference	F 167
Surveyor Signature	Slhalmers Roberts
Survey Date	18/07/09
Survey Time	07:00 – 08:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No access - access not clear.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S ~~F6~~ 4
Footpath Link Reference	F 16
Surveyor Signature	[illegible]
Survey Date	18/07/09
Survey Time	0700 – 08:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 28 + 27 + 26
Surveyor Signature	S Chalmers [signature]
Survey Date	18/07/2009.
Survey Time	08:00 – 09:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description	WALKER ATENDING OWN LIVE STOCK.	1	24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 18
Surveyor Signature	AChalmers [illegible]
Survey Date	18/07/2009
Survey Time	08:00 - 09:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 06

Footpath Link Reference	F 29 + 31 + 33

Surveyor Signature	[signature]

Survey Date	18/7/09

Survey Time	09:00 – 10:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		–	16
Individual Walkers with Dogs Count		–	17
Group of Walkers Count		–	18
Group of Walkers with Dogs Count		–	19
Individual Cyclists Count		–	20
Group of Cyclists Count		–	21
Individual Horse-riders Count		–	22
Individual Horse-riders Count		–	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users –		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 07
Footpath Link Reference	F 15 + 31 + 32
Surveyor Signature	[signature]
Survey Date	18/7/09
Survey Time	10:00 – 11:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 08
Footpath Link Reference	F 36 + 37
Surveyor Signature	[signature]
Survey Date	18/7/09
Survey Time	11:00 - 12:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No men.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 9
Footpath Link Reference	F F35
Surveyor Signature	[signature]
Survey Date	18/07/2009.
Survey Time	12:00pm – 13:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	II (walkers) I Dogs	2 1	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 9
Footpath Link Reference	F 39
Surveyor Signature	S Dhatom – P...
Survey Date	18/07/2009
Survey Time	12:00pm – 13:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	11 WALKERS 1 DOGS	2 1	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 9
Footpath Link Reference	F 08
Surveyor Signature	[signature]
Survey Date	18/07/2009
Survey Time	12.00 pm – 13:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count	II		16
Individual Walkers with Dogs Count	IIII WALKERS II DOGS	4 2	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 09
Footpath Link Reference	F 40
Surveyor Signature	[illegible]
Survey Date	18/7/09
Survey Time	12:00 – 13:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 05
Surveyor Signature	[illegible]
Survey Date	18/07/2009
Survey Time	1:00pm – 14:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**	✓	
	Dry		10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count	1 Horse Rider 1 Horse	1 1	22
Individual Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 46
Surveyor Signature	
Survey Date	18/07/2009
Survey Time	1:00pm – 14:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Individual Horse-riders Count	1 Horse Rider 1 Horse F05 to F46	1 1	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 10

Footpath Link Reference	F 47 + 40.

Surveyor Signature	[signature]

Survey Date	18/7/09

Survey Time	13:00 – 14:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users No route F03.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 11
Footpath Link Reference	F 53 + 55 + 56 + 57
Surveyor Signature	[signature]
Survey Date	18/7/09.
Survey Time	14:00 – 15:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No users.		

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 12
Footpath Link Reference	F 54 + 56 + 59 + 58
Surveyor Signature	[signatures]
Survey Date	18/7/09
Survey Time	15:00 – 16:00.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count		—	16
Individual Walkers with Dogs Count		—	17
Group of Walkers Count		—	18
Group of Walkers with Dogs Count		—	19
Individual Cyclists Count		—	20
Group of Cyclists Count		—	21
Individual Horse-riders Count		—	22
Individual Horse-riders Count		—	23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes	No men -		

APPENDIX G

18/07 COMPLETED QUESTIONNAIRES

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F07

Interviewer	ALEX CHALMERS

Interview Site	Site Number - 3/F07

Interview Date	18/07/09

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	A Chalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm	✓	10
	Breezy		11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	100 yards	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…	2 mins.	30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	2 per day	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…		45	
	Different routes >2 miles away…	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	1 per Day	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	2 hours	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…		54	
	For the views…		55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…	✓	64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…	✓	79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time...		81	
	Working part time...	✓	82	
	Retired...		83	
	Unemployed/not working...		84	
	Housewife/househusband, not working outside the home...		85	
	In full time education...		86	
16	**How many others are there in your household?**			
	Dependents...		87	
	Adults...	2.	88	
	Adults over 65...		89	
	NOTES		90	
17	Male or female?	Male.	91	
18	How many in the group?	1	92	
19	How many dogs?	1	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F35 to F08

Interviewer	ALEX CHALMERS

Interview Site	Site Number - 9

Interview Date	18/07/2009

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes...	✓	13	
	No... (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance...meters/kilometres/miles/yards	4 miles	15	
3	**How did you travel to the footpath today?**			
	Walked all the way...	✓	16	
	Bicycle...		17	
	Horse...		18	
	Motorcycle...		19	
	Car...		20	
	Bus/train....		21	
	Other...(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park...		23	
	Lay-by...		24	
	Gateway...		25	
	Wide verge...		26	
	Nearby housing area...		27	
	On the road...		28	
	Other...(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…	✓	33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	3/4. Per Month	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…		45	
	Different routes >2 miles away…	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	1 per week	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	2 hours	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…		54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)	✓	58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…	✓	64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…	✓	68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…	✓	78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time…		81	
	Working part time…	✓	82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	4	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	1 Male & 1 female.	91	
18	How many in the group?	2	92	
19	How many dogs?	1	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F39 to F08

Interviewer	ALEX CHALMERS

Interview Site	Site Number - 9

Interview Date	18/07/2009

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	

Weather conditions

ID	Condition	Tick	Reference
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…		13	
	No… (state location of residence)	✓	14	Bridgwater.
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	3 miles	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…	✓	33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	3/4 Per year	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…	✓	45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	3/4 Per year	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	2 hours.	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…		54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)	✓	58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views...	✓	62	
	Quiet and peaceful...	✓	63	
	Wide path and good surface...	✓	64	
	Far from the main roads...		65	
	Good available parking nearby...		66	
	Toilet facilities available...		67	
	Well marked footpaths...		68	
	Notice boards and information about the surroundings/wildlife/routes...		69	
	Close to home...		70	
	Mix of coast and countryside...	✓	71	
	Joined to other paths....	✓	72	
	Others....		73	Dog GATES
14	**What age group are you in?**			
	Less than 18...		74	
	18 to 24...		75	
	25 to 29...		76	
	30 to 44...		77	
	45 to 59...	✓✓	78	
	60 to 74...		79	
	Over 75...		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…	✓✓	81	
	Working part time…		82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	1 MALE 1 FEMALE	91	
18	How many in the group?	2	92	
19	How many dogs?	1	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F18

Interviewer	ALEX CHALMERS

Interview Site	Site Number -

Interview Date	18/07/2009.

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	20m	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…	✓	30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	365	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…	✓	44	
	Different routes nearby…		45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	365	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	1½	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…	✓	50	
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…		54	
	For the views…		55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…		63	
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others….	Access	73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…	✓	78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…		81	
	Working part time…	✓	82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	Male	91	
18	How many in the group?	1	92	
19	How many dogs?	1	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP F28

Interviewer	ALEX CHALMERS

Interview Site	Site Number - 5

Interview Date	18/07/2009

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	A Chalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	1/4 - 1/2 mile	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…	✓	31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking	✓	35	To check on Farm Animals.
	Jogging/Running		36	
	Dog-walking		37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	10 months. of the year	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…	✓	44	
	Different routes nearby…		45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	10 months of the year	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	20 minutes	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…	✓	50	
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	To attend livestock.
	For its wildlife…		54	
	For the views…		55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…		62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…	✓	64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…	✓	68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…	✓	70	
	Mix of coast and countryside…	✓	71	
	Joined to other paths….		72	
	Others….		73	Useful to Attend Animals & land access
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…		79	
	Over 75…	✓	80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time…		81	
	Working part time…		82	
	Retired…	✓	83	Works on own Farm
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	3	88	
	Adults over 65…	1	89	
	NOTES		90	
17	Male or female?	female.	91	
18	How many in the group?	1	92	
19	How many dogs?	0	93	

APPENDIX H

26/08 FOOTPATH COUNT SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 01
Footpath Link Reference	F 58
Surveyor Signature	
Survey Date	26/08/09
Survey Time	1200

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	/	1	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 5
Footpath Link Reference	F 27
Surveyor Signature	
Survey Date	26/08/09
Survey Time	1600

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description	x2 SURVEYORS		24
Others 1 Count	2.	2	25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 6
Footpath Link Reference	F 33
Surveyor Signature	[signature]
Survey Date	26/08/09
Survey Time	1800

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry		10
	Drizzling/showers		11
	Persistent rain	✓	12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count	I	1	16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 10
Footpath Link Reference	F 05
Surveyor Signature	[signature]
Survey Date	26/08/09
Survey Time	0900

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	1	1	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 11
Footpath Link Reference	F 54
Surveyor Signature	
Survey Date	26/08/09
Survey Time	1000

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy		14
	Windy	✓	15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count	\ (54 → 58)	2	19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 12
Footpath Link Reference	F 55
Surveyor Signature	[signature]
Survey Date	26/08/09
Survey Time	11:12

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	II WALKERS II DOGS	2	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

APPENDIX I

26/08 COMPLETED QUESTIONNAIRES

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP Site 1 / FS8

Interviewer	Alex Chalmers

Interview Site	Site Number -

Interview Date	26/08/2009

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	[signature]

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry		7
	Drizzling/showers	✓	8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	200 m	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes...		30	
	6 to 15 minutes...		31	
	16 to 30 minutes...		32	
	31 to 60 minutes...	✓	33	
	Over an hour...		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other...(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year...	365 per	Year 43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route...		44	
	Different routes nearby...		45	
	Different routes >2 miles away...	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year...		47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…		48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…	✓	54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…		57	
	There are not many people around (it is peaceful)	✓	58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state) Exercise		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…		62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…	✓	64	
	Far from the main roads…	✓	65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others…. Natural / Easy access for Dogs	✓	73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…	✓	78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…		81	
	Working part time…		82	
	Retired…	✓	83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…	1	87	
	Adults…		88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	1	91	
18	How many in the group?	1	92	
19	How many dogs?	2	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP (F05)

Interviewer	Alex Chalmers

Interview Site	Site Number - 10 (f05)

Interview Date	26/08/09

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	AChalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy		11
	Windy	✓	12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	1/4 Mile	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…	✓	31	5
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	2x Per day	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…		45	
	Different routes >2 miles away…	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	Most Days	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	1°3 hrs	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…	✓	53	
	For its wildlife…	✓	54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)	Quiet	61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…		62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…		64	
	Far from the main roads…	✓	65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…	✓	71	
	Joined to other paths….	✓	72	
	Others….	wildlife/	73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…	✓	79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…		81	
	Working part time…		82	
	Retired…	✓	83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…		88	
	Adults over 65…	1	89	
	NOTES		90	
17	Male or female?	female	91	
18	How many in the group?	1	92	
19	How many dogs?	1	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP 12

Interviewer	KH

Interview Site	Site Number - F55

Interview Date	26/08/09

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry		7
	Drizzling/showers	✓	8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy		11
	Windy	✓	12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	MINEHEAD
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	5 MILES.	15	MINEHEAD
3	**How did you travel to the footpath today?**			
	Walked all the way…		16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…	✓	20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)	FARM	29	NEARBY

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…		31	
	16 to 30 minutes…	✓	32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	IRREG.	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…	✓	45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	1	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	1HR.	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…		54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)	FLAT.	61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…		63	
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…		71	
	Joined to other paths….		72	
	Others…. OPEN / CLEAR VIEWS		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…	✓	78	
	60 to 74…	✓	79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time...		81	
	Working part time...	✓	82	
	Retired...	✓	83	
	Unemployed/not working...		84	
	Housewife/househusband, not working outside the home...		85	
	In full time education...		86	
16	**How many others are there in your household?**			
	Dependents...	2	87	
	Adults...	1	88	
	Adults over 65...		89	
	NOTES		90	
17	Male or female?	F	91	x 2
18	How many in the group?	2	92	
19	How many dogs?	2	93	

ROYAL HASKONING

APPENDIX J

30/08 FOOTPATH COUNT SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 01
Footpath Link Reference	F 58
Surveyor Signature	R. Waters
Survey Date	30/8/09
Survey Time	09:00 – 10:00

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	1 with 2 dogs	1	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 6
Footpath Link Reference	F 29 to 30
Surveyor Signature	S Chalmers
Survey Date	30th August 2009
Survey Time	1.00 – 2.00pm

Weather conditions

ID	Condition	Tick	Reference
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count			17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description	Fishing on Rock Wall.		24
Others 1 Count	II	2	25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset

Site Location Reference Number	S 11

Footpath Link Reference	F 45 to F53

Surveyor Signature	[signature]

Survey Date	30th August 2009

Survey Time	6·00pm – 7·00pm

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	1 2 x Dogs	1	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Survey Site	Hinkley, Somerset
Site Location Reference Number	S 12
Footpath Link Reference	F 56 & 58
Surveyor Signature	[illegible]
Survey Date	30th August 2009
Survey Time	7.00am – 9.00AM

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH COUNT

Type	Counts	Number	Reference
Individual Walkers Count			16
Individual Walkers with Dogs Count	11 2 x Dogs. +2 x Dogs	2	17
Group of Walkers Count			18
Group of Walkers with Dogs Count			19
Individual Cyclists Count			20
Group of Cyclists Count			21
Individual Horse-riders Count			22
Group of Horse-riders Count			23
Others 1 Description			24
Others 1 Count			25
Others 2 Description			26
Others 2 Count			27
Others 3 Description			28
Others 3 Count			29
Notes			

APPENDIX K

30/08 COMPLETED QUESTIONNAIRES

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP 58

Interviewer	P. THORNTON.

Interview Site	Site Number - 01

Interview Date	30/08/09.

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	[signature]

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry		7
	Drizzling/showers	✓	8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	250	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…	✓	16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…		20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…		25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…	✓	30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	365	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…	✓	45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	365	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	2hrs	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…	✓	54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)	✓	58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…	✓	63	
	Wide path and good surface…		64	
	Far from the main roads…	✓	65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…	✓	68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…	✓	70	
	Mix of coast and countryside…	✓	71	
	Joined to other paths….	✓	72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…	✓	79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you….**			
	Working full time…	✓	81	
	Working part time…		82	
	Retired…		83	
	Unemployed/not working…		84	
	Housewife/househusband, not working outside the home…		85	
	In full time education…		86	
16	**How many others are there in your household?**			
	Dependents…		87	
	Adults…	2	88	
	Adults over 65…		89	
	NOTES		90	
17	Male or female?	M	91	
18	How many in the group?	1	92	
19	How many dogs?	2	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP Site 11 F45 to F53
Interviewer	Alex Chalmers.
Interview Site	Site Number - 11
Interview Date	30th August 2009

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	A Chalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	3½ Miles	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…		16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…	✓	20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…	✓	25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…		30	
	6 to 15 minutes…		31	
	16 to 30 minutes…	✓	32	25 Mins.
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	300.	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…		44	
	Different routes nearby…		45	
	Different routes >2 miles away…	✓	46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	300	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	2½.	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…	✓	50	
	Circular route…		51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…	✓	54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)	✓	58	
	Proximity of car-parking…	✓	59	
	For safety…		60	
	Other…(please state)		61	

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…		63	
	Wide path and good surface…	✓	64	
	Far from the main roads…	✓	65	
	Good available parking nearby…	✓	66	
	Toilet facilities available…		67	
	Well marked footpaths…		68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…	✓	71	
	Joined to other paths….	✓	72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…		78	
	60 to 74…	✓	79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time...	✓	81	
	Working part time...		82	
	Retired...		83	
	Unemployed/not working...		84	
	Housewife/househusband, not working outside the home...		85	
	In full time education...		86	
16	**How many others are there in your household?**			
	Dependents...		87	
	Adults...	1	88	
	Adults over 65...		89	
	NOTES		90	
17	Male or female?	F.	91	
18	How many in the group?	1	92	
19	How many dogs?	2	93	

HINKLEY – RECREATIONAL ACCESS QUESTIONNAIRE

Questionnaire Reference Number	HP 12 (F) 58 to (F) 56

Interviewer	Alex Chalmers

Interview Site	Site Number - 12

Interview Date	30th August 2009.

I confirm that I have conducted this interview face-to-face with the interviewee and that I asked all the relevant questions and recorded the answers, conforming to the survey specifications and within the MRS Code of Conduct.

Interviewer's Signature	AChalmers

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Condition**		
	Dry	✓	7
	Drizzling/showers		8
	Persistent rain		9
4	**Wind conditions**		
	Calm		10
	Breezy	✓	11
	Windy		12

ID	Question	Answer	Ref	Notes
1	**Are you a resident of the area?**			
	Yes…	✓	13	
	No… (state location of residence)		14	
2	**How close is your home or starting point to this footpath?**			
	Distance…meters/kilometres/miles/yards	1 mile	15	
3	**How did you travel to the footpath today?**			
	Walked all the way…		16	
	Bicycle…		17	
	Horse…		18	
	Motorcycle…		19	
	Car…	✓	20	
	Bus/train….		21	
	Other…(state type)		22	
4	If they drove> **Where did you park your vehicle?**			
	Car park…		23	
	Lay-by…		24	
	Gateway…	✓	25	
	Wide verge…		26	
	Nearby housing area…		27	
	On the road…		28	
	Other…(state type)		29	

ID	Question	Answer	Ref	Notes
5	**How long did it take to get to this site from home or from where you are staying?**			
	0 to 5 minutes…	✓	30	
	6 to 15 minutes…		31	
	16 to 30 minutes…		32	
	31 to 60 minutes…		33	
	Over an hour…		34	
6	**What is the purpose of your visit to or along the footpath today?**			
	Walking		35	
	Jogging/Running		36	
	Dog-walking	✓	37	
	Cycling		38	
	Horse-riding		39	
	Bird watching / wildlife watching		40	
	Picnic		41	
	Other…(state type)		42	
7	**How often do you go walking/cycling/horse riding in the Hinkley area?**			
	Number of times a year…	10/12 per year.	43	
8	**Do you usually walk the same route or a different one every time?**			
	The same route…	✓	44	
	Different routes nearby…		45	
	Different routes >2 miles away…		46	
9	**How often, on average, do you use this footpath?**			
	Number of times a year…	10/12 per year.	47	

ID	Question	Answer	Ref	Notes
10	**How long do you think you will spend on your <outdoor activity> here today?**			
	Time in hours and minutes…	30 mins → 1 hour.	48	
11	**How would you best describe the route you are taking today – is it a circular walk or will you be coming back the same way?**			
	Return the same way…		50	
	Circular route…	✓	51	
	Don't know…		52	
12	**Of the following, which is the reason why you choose this particular place/route/path today?**			
	Convenience – close to residence…		53	
	For its wildlife…		54	
	For the views…	✓	55	
	Because of the condition of the path…(wide, smooth – enter in notes)		56	
	I can let the dogs off the lead…	✓	57	
	There are not many people around (it is peaceful)		58	
	Proximity of car-parking…		59	
	For safety…		60	
	Other…(please state)		61	

Dog walking.

ID	Question	Answer	Ref	Notes
13	**In your opinion what are the desirable characteristics for a footpath?**			
	Good clear views…	✓	62	
	Quiet and peaceful…		63	
	Wide path and good surface…		64	
	Far from the main roads…		65	
	Good available parking nearby…		66	
	Toilet facilities available…		67	
	Well marked footpaths…	✓	68	
	Notice boards and information about the surroundings/wildlife/routes…		69	
	Close to home…		70	
	Mix of coast and countryside…	✓	71	
	Joined to other paths….	✓	72	
	Others….		73	
14	**What age group are you in?**			
	Less than 18…		74	
	18 to 24…		75	
	25 to 29…		76	
	30 to 44…		77	
	45 to 59…	✓	78	
	60 to 74…		79	
	Over 75…		80	

ID	Question	Answer	Ref	Notes
15	**Are you....**			
	Working full time...	✓	81	
	Working part time...		82	
	Retired...		83	
	Unemployed/not working...		84	
	Housewife/househusband, not working outside the home...		85	
	In full time education...		86	
16	**How many others are there in your household?**			
	Dependents...		87	
	Adults...	1	88	
	Adults over 65...		89	
	NOTES		90	
17	Male or female?	F	91	
18	How many in the group?	1	92	
19	How many dogs?	2	93	

APPENDIX L

COMPLETED FOOTPATH SURVEY SHEETS

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 01
Surveyor Signature	[signature]
Survey Date	16th December 2009.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Concrete - then gravel / mud track, then grass.
Width	5m +
Boundary	Bounded at southern end by farm buildings and walls, then open field boundaries.
Watercourse crossings	None.
Gates	Open gate access to southern end, and open gate into field (halfway).
Stiles	None.
Steepness/Slopes	Level.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at southern end at farm entrance.
Ease of access	Easy / clear access at southern end and to start of FR 02.
Obstructions	None, ~~[illegible]~~

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Muddy access track, but grass in field is short.
Open views description	Contained views to north and south, due to topo and ~~two~~ field boundary hedges. Slightly extend views to the east with distant view of Power Station but interim views obstructed by nearby field boundaries. Views to West and South West obstructed by farm buildings.
Views of…	Farm buildings Agricultural land. Field boundary hedges and trees. Distant power station. Low hills.
Photographs	
01 02	Southern access and signpost. Farm access.
03 04	Access track looking West. Access track looking North.
05 06	" " " " " " " NE.
07 08	" " " East. " " " SE.
09 10	" " " South. " " " South W.
11 12	Halfway access gate. From halfway gate looking North to FP02.
13 14	" " " " South. View North from near northern end.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 02
Surveyor Signature	[signature]
Survey Date	16th December 2009

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Low ~~arable~~/vegetable crop.
Width	NA. Not demarcated.
Boundary	Field boundary.
Watercourse crossings	None at southern end.
Gates	Gate at southern end.
Stiles	None at southern end.
Steepness/Slopes	Gentle slope up to 1 in 8 at southern end.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	None.
Ease of access	Open access beside southern gate, but no path through crop, hence access is inhibited.
Obstructions	Crop obstructs passage.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Crop growing in field.
Open views description	View from southern end looking north obstructed by topography. View south as FR 01.
Views of…	Agricultural land.
Photographs	
01 02	Southern access point. Southern access looking North.
03 04	" " " NE. " " " East.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 03
Surveyor Signature	[illegible]
Survey Date	16th December 2009.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Grass.
Width	Not demarcated.
Boundary	Field boundaries.
Watercourse crossings	None.
Gates	Possible open gate at halfway.
Stiles	
Steepness/Slopes	Level ground.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	None.
Ease of access	Clear and unobstructed access.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Low grassland.
Open views description	Views are mainly obstructed by nearby field boundaries and topography with some features visible in far distant background including the existing Power Station, and Quantocks to the South.
Views of…	Agricultural land Hedgerow field boundaries. Quantocks to the South. Power Station to the NE.
Photographs	
01 02	West end looking East along RoW. " " " " " " to halfway gate.
03 04	Halfway gate entrance. Adjacent gate entrance (no access).
05 06	View from halfway looking West. " " " " South West.
07 08	" " " " South. " " " " South East.
09 10	" " " " East. View at East end looking East.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 04
Surveyor Signature	[illegible]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass trackway.
Width	1.5 – 3m.
Boundary	Hedgerows either side.
Watercourse crossings	1 watercourse / pond preventing access.
Gates	None.
Stiles	None.
Steepness/Slopes	Level.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Sign at southern end.
Ease of access	Open access until the pond / watercourse is reached which ~~[illegible]~~ cannot be passed by pedestrians.
Obstructions	Pond.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	Signs of horse riding. Halfway, inaccessible to foot pedestrian due to large pond. At southern entrance to lane, trees on left hand side obscure views from properties on the right hand side, and hide the sun in the evenings. They were apparently planted as screening for the old Hinkley C. Can they be trimmed down?

Target	Description	
Qualitative Conditions		
Tidiness	Part overgrown with thistles and nettles. Also damp in places with a large pond halfway.	
Open views description	Views contained by hedgerows bounding and corner of path.	
Views of…	Hedgerows Trees.	
Photographs		
1	Mid point looking at pond (N wards).	095
~~2~~	~~South end looking up path~~	

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 05
Surveyor Signature	[illegible]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Stony track with central grass strip –
Width	3 – 4m.
Boundary	Embanked hedgerows.
Watercourse crossings	None.
Gates	None
Stiles	None.
Steepness/Slopes	Moderate 1 in 10.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	~~Sign~~ No signposting but clear access path
Ease of access	Open access.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward, and fairly even track.
Open views description	Views are curtailed E, W and N by topography and for a large part the hedgerows. Some views to the south but only on the western slopes, showing Quantocks in the background.
Views of…	Farmland Quantocks.
Photographs	
1	Looking South. 090

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 06
Surveyor Signature	[illegible]
Survey Date	16th December 2009.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	Grass.
Width	4m +
Boundary	Northern end of field, and field hedgerow.
Watercourse crossings	None.
Gates	1 gate halfway, gate in open.
Stiles	
Steepness/Slopes	Northern half slopes approx 1 in 5.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at south east end.
Ease of access	Could not pass through gate adjacent to Bishops Wood due to extensive depth and extent of deep mud (cattle disturbed ground). Access otherwise clear.
Obstructions	Mud area prevented passing through halfway gate adjacent to Bishops Wood.

Target	Description
Animals (agricultural)	None present at time of survey, but northern field is grazed by cattle.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass. Muddy and sodden in places.
Open views description	Views to north restricted by hedgerow. Views to the south only of far distant hills due to topography and hedgerow boundaries to the east and west. View of power station over the northern boundary hedgerow.
Views of…	Hedgerow field boundaries. Quantocks to the south. Power Station over the top of the northern hedgerow.
Photographs	
01 02 03	Gate connecting F07 & F08 Sign at South East end of F06. SE end looking West.
04 05 06	Looking E to SE corner/end. Southern end looking SE. " " " South.
07 08 09	" " " SW. " " looking West. " " looking NW.
10 11 12	" " looking North. " " looking NE. " " " East.
13 14 15	SW end looking East. Halfway gate. " " looking NW.
16 17 18	" " " North. " " looking NE " " " East.
19 20 21	" " " North (far distant). " " " NE (" "). " " " NW (" ").

Survey Site	Hinkley, Somerset
Footpath Reference Number	F ~~[illegible]~~ 07308
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Arable crop. Northern 1/3 Central 1/3 – grassland. F07 Southern 1/3 – field margin (arable) grass strip from concrete beside ditch / stream. with concrete slab bridge. no railings
Width	c. 3ft. or less.
Boundary	Open arable field / grassland / arable field margin
Watercourse crossings	None.
Gates	None.
Stiles	North end? Stile in the middle, hedge partially obstructing. 2nd stile in central 1/3, good condition. 3rd stile at 1/3 southern (N) end. Good condition F07 - stile good condition.
Steepness/Slopes	Steep slope c. 1 in 5 at north end. Otherwise general gentle to flat.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at stile. Route slightly different in the middle compared to OS map route, but signposted. Stile with signpost at junction with F07. F07 - southern end - gate accessible with small sign.
Ease of access	Relatively easy access.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Arable crop in northern 1/3 but clear path. Short sward grassland in central 1/3. Arable field grassy margin, relatively short FO7.
Open views description	Northern 1/3 contained views to N, E, S, due to topo and hedgerows. Slightly more extended views to W of farmland but contained by ridge and topo in the mid-distance. Central third in 'valley' contained by topo for N & S views, and topo + hedgerow for E & W views. FO7 Southern 1/3; views open to [redacted] Quantocks in the far distance. Southernmost views also include views over the settlement of Shurton
Views of…	Farmland. Hedgerows. [redacted] Quantocks in Southern 1/3 FO7
Photographs	
	~~Northern 1/3 looking West.~~
FO7 1	Southern 1/3 looking SW to [redacted] Quantocks.
" 2	Southern end start of footpath looking NE.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 09
Surveyor Signature	[signature]
Survey Date	18/07/2009

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	EARTH, SHOWING EXTENSIVE USE FROM HORSE RIDERS.
Width	VARIES AT START 3FT → LEADING TO TARMAC TRACK 2mt+
Boundary	AT START! WALL ON RIGHT SIDE, WITH WATERCOURSE ON LEFT LEADING TO FORD (— to —)
Watercourse crossings	1 FOOT BRIDGE TIMBER, GOOD CONDITION
Gates	NONE
Stiles	NONE
Steepness/Slopes	FLAT/ REASONABLY LEVEL
Adjacent watercourses	YES - ON LEFT HAND SIDE OF FOOTPATH WHEN TRAVEL FROM — to —.
Adjacent cliffs/slopes	NONE
Signposting/locating	NONE
Ease of access	EASY TO ACCESS, VIA LANE/ TRACKS EITHER END.
Obstructions	FORD - But Footbridge over watercourse to divert for 30 meters on oposite BANK

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	NONE – USED BY HORSE RIDERS
Lighting present	NONE
Other 1	
Other 2	
Other 3	
Other 4	
Notes	FORD ALONG FOOTPATH, BUT FOOTBRIDGE TO CROSS WATERCOURSE.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	MUDDY / WET (NARROW AT POINTS) BUT NO DOG FOUL OR LITTER.
Open views description	Views limited as wall on Right hand Side, & Watercourse / hedge on left. when past wall views to open countryside for brief length 30 meter & Powerstation.
Views of…	Powerstation Watercourse Wall along Path, Ford, Track
Photographs	
1	Western Entrance
2	Ditch Alongside.
3	Junction where Ford is inaccessible
4	Inaccessible Ford.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 10 + F12
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Grass margin of arable field.
Width	1 – 2.5 m narrowing to overgrown as it reaches the F12
Boundary	
Watercourse crossings	Hedgerow to the north, open field to the south. One small metal footbridge crossing.
Gates	Gate at west entrance – open.
Stiles	~~None~~. Two stiles fair condition.
Steepness/Slopes	Level.
Adjacent watercourses	~~None~~. At eastern edge along F12 length.
Adjacent cliffs/slopes	None
Signposting/locating	Signpost at West entrance.
Ease of access	Open access until reaching the F12 stretch which becomes impassable due to crops and thistles.
Obstructions	Thistles and crop along F12 reach.

Target	Description
Animals (agricultural)	None.
Lighting present	None
Other 1	
Other 2	
Other 3	
Other 4	
Notes	Becomes impassable as it continues along route F12.

Target	Description	
Qualitative Conditions		
Tidiness	Grass long 1 – 2ft, and ground uneven. Overgrown after the first stile and 2nd field.	
Open views description	View contained by surrounding hedgerows around the field, with only occasional view of top of Mendips in the far distance. Eastern edges has closed views to the S and W, due to hedgerow and tall crop. View of field and hedge to the east but nothing else.	
Views of...	Arable field Hedgerows. Trees Quantocks.	
Photographs		
1	Quantocks to the SW.	096
2	Overgrowth along F12 stretch looking south.	097

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 11
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Arable crop with trampled route.
Width	1-2 ft.
Boundary	Open field.
Watercourse crossings	None.
Gates	None.
Stiles	Stile in fair condition at E entrance.
Steepness/Slopes	Level, except for 5 steps at Eastern entrance.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signpost at W end. Signpost at Eastern entrance.
Ease of access	Relatively open access.
Obstructions	None.

Target	Description
Animals (agricultural)	None
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Narrow trampled path.	
Open views description	All views contained by field boundary hedgerows, trees and to the south, topography.	
Views of…	Arable crop. Hedgerows. Trees. Glimpses of Hinkley A + B.	
Photographs		
1	Looking North	098
2	" South	099

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 13
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Arable field.
Width	Trampled path c. 2ft wide.
Boundary	Open field
Watercourse crossings	~~None~~ One wooden footbridge over running water (stream) with handrails both sides.
Gates	None.
Stiles	Stile at W entrance, fair condition. Two stiles at each end of footbridge.
Steepness/Slopes	Level.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at Wenton entrance. " at Eastern entrance.
Ease of access	Easy access from W via a stile, and also from the East.
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Relatively clean trampled path through corn.	
Open views description	Contained views to E and N due to hedgerows + trees. Views to the West are mostly contained with glimpse of [redacted] Exmoor. Views to the south are contained by the southern ridge – and show some farmland in the near distance.	
Views of…	Farmland Hedgerows Trees. Tiny views of [redacted] Exmoor.	
Photographs		
1	View W to Mendips	100
2	View south	101
3	View North W along path.	102

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 14
Surveyor Signature	[signature]
Survey Date	16th December 2009.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny	✓	1
	Broken cloud		2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	Grass.
Width	Not defined
Boundary	Field hedges at ~~bottom~~ southern. half.
Watercourse crossings	None in southern half.
Gates	Gate at southern entrance/access.
Stiles	None.
Steepness/Slopes	Level.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	None.
Ease of access	Gate access is easy.
Obstructions	Obstructed in southern field by electric and roped field boundary.

Target	Description
Animals (agricultural)	Horses in area of field closed off by electric fencing.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass, some horse jumps lying around.
Open views description	Open view north to the Power Station and rising land to the NE, but some enclosed views to the north due to field boundaries. View south inhibited/obstructed by field boundary and trees beyond.
Views of…	Power Station. Agricultural land. Hills (low) to the north east.
Photographs	
01 02	View from road to southern access gate. Close up of southern access gate.
03 04	View NW from Southern end. View N to NE from southern end.
05 06	View East from Southern end. View NW - N from obstruction.
07	Close up of RoW route north from obstruction.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 15
Surveyor Signature	[signature]
Survey Date	18/07/09

ID	Condition	Tick	Reference
Weather conditions			
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Short Open grass fields,
Width	wide, as no clear useage,
Boundary	N/A
Watercourse crossings	
Gates	GATE AT START OF F15 (site 7)
Stiles	
Steepness/Slopes	Reasonably level.
Adjacent watercourses	watercourse on left hand side of footpath
Adjacent cliffs/slopes	N/A
Signposting/locating	
Ease of access	Over gate at site 7 to access F15
Obstructions	GATE as above

Target	Description
Animals (agricultural)	DAIRY CALVES,
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	N/A. Access over water-Course not possible as Sluice has railing to Prevent Crossing. Used other side of watercourse as Sluice crossing was a Risk.

Target	Description
Qualitative Conditions	
Tidiness	OPEN PASTURE LAND, WITH CATTLE, (DAIRY CALVES)
Open views description	To Hills, Powerstation, Powerlines, Powerstation and Reed filled watercourse to left of footpath, from F31 site 7. Open Pasture Land, with Cattle. (views of surrounding Countryside/fields.)
Views of…	
Photographs	
1	Time 10.51 Looking South from Northern End.
2	From southern end (F16) looking North.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 16
Surveyor Signature	[illegible]
Survey Date	18/07/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Mud and gravel, occassional puddles and slightly uneven, central grass strip.
Width	c. 3m.
Boundary	Hedge row with gaps for entry into fields.
Watercourse crossings	None.
Gates	Metal gate access into F15. Good condition, easy gate opening.
Stiles	None.
Steepness/Slopes	Generally flat except at the northern end where it drops about 1 in 10 slope.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposts, but clear route.
Ease of access	No hindrance or obstruction.
Obstructions	None.

Target	Description
Animals (agricultural)	Sheep in fields.
Lighting present	No lighting.
Other 1	Occassional dog feces.
Other 2	Background noise from the power station.
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Vegetation growing in central grass strips but not impassable. Hedgerow generally well kept.	
Open views description	Open views through field access at the southern end, but generally obscured by hedgerow until the northern end with views opening onto the power station at Hinkley and the sea defence wall in the distance.	
Views of…		
Photographs		
1	Southern end looking north.	001
2	Northern end looking onto F15 entry.	002
3	Mid looking NW to closed entrance of F01.	003.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 17
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass at northern end.
Width	Not seen at either end (obstructed).
Boundary	Hedgerows.
Watercourse crossings	Not seen at either end.
Gates	At southern end - residential obstructing access.
Stiles	Not seen from either end.
Steepness/Slopes	Flat (1 in 100).
Adjacent watercourses	Not seen at either end.
Adjacent cliffs/slopes	None.
Signposting/locating	Sign post at southern end. Not signposted at northern end.
Ease of access	No visible access except for residential gate at southern end. At northern end electric fence obstructs access.
Obstructions	Residential gate - unsure of access. Electric fence obstructing access at northern end.

Target	Description
Animals (agricultural)	Sheep in field at northern end.
Lighting present	None
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Short grass at northern end.	
Open views description	At northern end, views to north east east of gently undulating agricultural land with views obstructed by hedgerows. Also coastal ridge to north.	
Views of…	Agricultural fields. Coastal ridge.	
Photographs		
1	Southern end signpost and "entrance"?	004
2	Northern end looking north.	007

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 18
Surveyor Signature	[illegible]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass. At north end pass through reed and thistle.
Width	route (narrow) through grass – trampled.
Boundary	Ditch and hedgerows.
Watercourse crossings	None.
Gates	Metal gate toward north end – have to climb as closed with twine.
Stiles	None.
Steepness/Slopes	Flat.
Adjacent watercourses	Ditch to the west side (c. 5m away). Watercourse on eastern boundary.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost from F17. Signpost halfway up.
Ease of access	No gate from F19.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Long grass (2ft).
Open views description	Open views generally. to NW is coastal ridge with Hinkley A+B in background. To NE is ridge and agricultural. Pylons run over the field.
Views of…	Hinkley ~~A+B~~ (top). Coastal ridge. Agricultural land. Pylons.
Photographs	
1	NW to Hinkley A+B.
2	NE to Stolford.
3	Section and looking North to Coastal Bank.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 19
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass – main.
Width	Field.
Boundary	Hedge.
Watercourse crossings	1 culverted ditch.
Gates	From F21. At western end – metal, no opening, closed with twine.
Stiles	None.
Steepness/Slopes	Flat.
Adjacent watercourses	At start by F21.
Adjacent cliffs/slopes	None.
Signposting/locating	Easy route from F21. Signpost at connection with F17.
Ease of access	Gate of bridge at F21.
Obstructions	Gate at western end has to be climbed.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	Signs of use by bench halfway along.

Target	Description
Qualitative Conditions	
Tidiness	Short (½ ft) mown grass. No nettles.
Open views description	Open view of ridge in the NW, with agricultural buildings. and Hinkley A &B in the background.
Views of…	Agricultural views. Ridge line. Hinkley A + B.
Photographs	
1	NW to Hinkley A+B with ridgeline to south.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 20
Surveyor Signature	[signature]
Survey Date	30/8/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Path seen - grass.
Width	Between 2m + depending. At south end no boundary.
Boundary	No boundary (field) at southern end. Northern end by track is bounded by fence and hedge.
Watercourse crossings	Unknown.
Gates	Kissing gate by track near north end.
Stiles	Unknown.
Steepness/Slopes	Level - flat.
Adjacent watercourses	Watercourse adjacent to southern end.
Adjacent cliffs/slopes	None.
Signposting/locating	Poor signposting - none. At northern end, difficult to identify when track is reached.
Ease of access	Access at southern end risky due to bullocks in field. Access undiscernible near north end.
Obstructions	Lack of visible route and signage.

Target	Description
Animals (agricultural)	Bullocks in southern field.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	Access blocked at southern end due to risk from bullocks.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Relatively short mown grass – where seen.
Open views description	Power station to NW with view of coast to the N where not obstructed.
Views of…	Power station. Power lines. Severn Estuary (distant) Wales coastline (distant).
Photographs	
2-001	From bench looking NW to PS. – used Photo 1 from F21.
2-002	" " " N to coastline. used Photo 3 from F18.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 21
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp		8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Grass.
Width	Field. 1½ ft wide trampled grass route, with stone slabs per 10m.
Boundary	Hedge and wall at southern side.
Watercourse crossings	Cross a shallow ditch but dry. ~~None~~. Cross a water filled ditch using ~~stile~~ pedestrian gate and fenced bridge (1.2m wide).
Gates	Entry gate at eastern end. Crossing ditch.
Stiles	None.
Steepness/Slopes	Within 1-2m across whole length.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at eastern end.
Ease of access	Eastern gate easy to open.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward, no rubbish.
Open views description	Open view to the north west showing Hinkley B station and slight ridge to the east. The rest is agricultural vegetation.
Views of…	Agricultural fields Hinkley B Station. Low ridge east of Hinkley A.
Photographs	
1	Eastern end looking NW to Hinkley B. 005

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 22
Surveyor Signature	[illegible]
Survey Date	30/8/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)	~~✓~~	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass.
Width	Field boundaries
Boundary	Field hedgerows.
Watercourse crossings	Not identified.
Gates	At north end. – needs to be climbed. South end not surveyed.
Stiles	Unknown.
Steepness/Slopes	Level.
Adjacent watercourses	Not identified but likely along southern edge.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at north end.
Ease of access	Relatively clear at north end.
Obstructions	Not identified.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	Not identified.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	Access through 20 is difficult therefore southern access to 22 not surveyed.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Clean to north end.
Open views description	Some views NW to Quantocks. Occasional views of PS and coastal embankment, with agricultural land in foreground.
Views of…	Quantocks. PS. Coastal Embankment. Agricultural Land.
Photographs	
2 - 03	North end looking W at gate.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 23
Surveyor Signature	[illegible]
Survey Date	30/8/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	Grass track, then gravelled.
Width	Track is 3m wide. Grass is bounded by field hedges.
Boundary	Track bounded by wall + fence. Grass is field boundary.
Watercourse crossings	1 dry ditch, over culvert.
Gates	Field gate, metal opens.
Stiles	North end to connect to F27.
Steepness/Slopes	Level.
Adjacent watercourses	[illegible] at north end.
Adjacent cliffs/slopes	None.
Signposting/locating	None.
Ease of access	Clear from East end North end connection to F26 open.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward. Well tended and short track.
Open views description	Quantocks to the W. PS to NW. with agricultural land W of this. Coastal embankments to N and NE with views in background of <u>Brent Knoll.</u> and Brean down.
Views of…	PS. Electric pylons (SW) + W. Mendips / Brent Knoll. Coastal embankment Agricultural land. Quantocks. (W).
Photographs	
2006	Access track to W end.
2007	W to Exmoor & Quantocks.
2008	NW to Hinkley Point PS.
2009.	NE + N to embankment + BD.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset

Footpath Reference Number	F 24

Surveyor Signature	[illegible]

Survey Date	30/8/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Track at southern end turning to grass.
Width	Track in 3m. Grass in field bordered.
Boundary	Track in bordered by hedge. Else field boundary.
Watercourse crossings	Unidentified.
Gates	A kissing gate but path blocked by barbed wire and electric fencing
Stiles	—
Steepness/Slopes	Level.
Adjacent watercourses	Not identified
Adjacent cliffs/slopes	None
Signposting/locating	Signpost obscured.
Ease of access	No access beyond gate due to barbed wire and electric fencing.
Obstructions	See access.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Relatively clean, some broken dressing southern entrance.
Open views description	Views North to embankment (coastal) with Brean down in the background.
Views of...	Brean down. Coastal floodplain embankment.
Photographs	
2-004	Obscured access gate.
2-005	View to N to embankment + Brean Down.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 26
Surveyor Signature	[illegible]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass
Width	2 - 3m.
Boundary	On embankment.
Watercourse crossings	~~[illegible]~~. Bridge over drain
Gates	
Stiles	
Steepness/Slopes	Flat
Adjacent watercourses	At culvert end – crossed.
Adjacent cliffs/slopes	1 in 1 slope on each side of the embankment.
Signposting/locating	Signposted near F27.
Ease of access	Connected to F27 and F25.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward with thicket either side.
Open views description	As F27.
Views of…	As F27.
Photographs	
1	As F27
2	"
3	"

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 27
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass – short sward.
Width	2 – 3m.
Boundary	None.
Watercourse crossings	Bridge with stiles either end. + gate
Gates	2 gates adjoining /access to / from bridge. New gates.
Stiles	2 stiles either end of the bridge. New.
Steepness/Slopes	Flat.
Adjacent watercourses	Crossing.
Adjacent cliffs/slopes	On embankment with 1 in 1 slopes either side.
Signposting/locating	Signposting on bridge crossing stream/ditch.
Ease of access	Connected to F18, F28, F26
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward with longer thistles at the sides.
Open views description	Open views except to east. North is coastal ridge. West is Hinkley A + B. South and SW are [redacted] Quantocks. East is Stolford.
Views of...	Agricultural fields. Hedgerows and houses. Coastal embankment. Hinkley A + B. [redacted] Quantocks.
Photographs	
1	[redacted] looking South to Quantocks.
2	Hinkley A + B. looking West.
3	Coast embankment looking North
4	Stolford + gate crossing looking east.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 28
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass embankment
Width	2-3 m on embankment.
Boundary	Embankment.
Watercourse crossings	Ditch crossing using narrow footbridge.
Gates	Kissing gate ( ) good condition at western end junction with F29 + F30.
Stiles	Stile by bridge crossing. Medium condition.
Steepness/Slopes	~~Flat slope on embanked section~~ Flat ~~est~~.
Adjacent watercourses	Crossed.
Adjacent cliffs/slopes	1 in 1 slope on embanked stretch.
Signposting/locating	Adjoining F27. Join F29 + F30 and gate is signposted.
Ease of access	Adjoining F27 and. F29. + F30.
Obstructions	None.

Target	Description
Animals (agricultural)	None. – though cowpats in western stretch.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward. Thistles on sides of embankment.
Open views description	As F27
Views of…	As F27.
Photographs	
1	Bridge crossing. + Stolford.
2	Quantocks.
3	Hinkley A + B
4	Coastal Embankment.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F F29
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Stony track
Width	2 - 3m.
Boundary	Fence (wire) to the south and grass leading down to coastal path, which is concrete.
Watercourse crossings	None.
Gates	Gate at Western end. Good condition.
Stiles	None.
Steepness/Slopes	Flat.
Adjacent watercourses	Sea to the north over rock boulders.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at the western end on the gate access.
Ease of access	Easy clear access.
Obstructions	None.

Target	Description
Animals (agricultural)	None
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Clean and open in short.
Open views description	Views to the north of the Severn Estuary and Wales in the background. East views show the Brent Knoll & Mendip hills and Burnham on Coach. Southerly views are agricultural fields with trees and hedgerows, more open in the SW than SE, with [redacted] Quantocks in the background. + Pylons. Hinkley A + B to the west.
Views of...	Coastline and estuary. Wales Low hills to the east / Brent Knoll / Mendips Agriculture Pylons [redacted] Quantocks (W & SW). Hinkley A + B.
Photographs	
1	North to Wales.
2	NE to Bleadon Hill / Brean Down / W-S-M.
3	East to Stolford.
4	SE
5	SW to [redacted] Quantocks.
6	W to Hinkley A + B.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 30
Surveyor Signature	[illegible]
Survey Date	30/8/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

As F 29.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	
Width	
Boundary	
Watercourse crossings	
Gates	
Stiles	
Steepness/Slopes	
Adjacent watercourses	
Adjacent cliffs/slopes	
Signposting/locating	
Ease of access	
Obstructions	

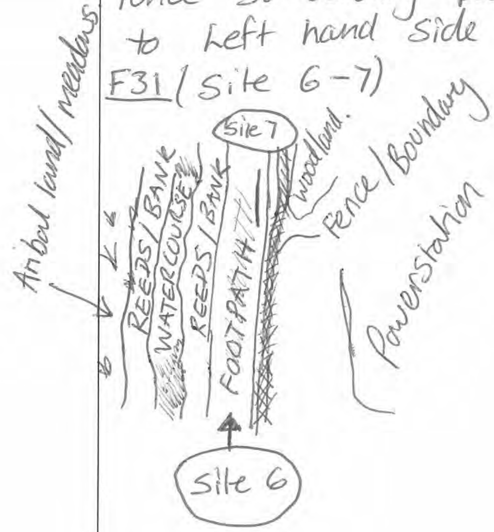
Target	Description
Animals (agricultural)	
Lighting present	
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	
Open views description	
Views of…	
Photographs	

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 31 site 6 to site 7.
Surveyor Signature	[signature]
Survey Date	18/07/2009

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

Target	**Description**
Physical Conditions	
Length	( )
Surface	VARIES ALONG PATH GRASS / Short / Long (with Reeds from Watercourse) a weeds along Path)
Width	VARIES, 1 ft to 1.5 meters,
Boundary	N/A
Watercourse crossings	N/A.
Gates	AT END OF FOOTPATH F31 leading to footpath F15
Stiles	AT END OF FOOTPATH F31 starting at Footpath F32
Steepness/Slopes	Embankment at Start of
Adjacent watercourses	Watercourse to left of footpath traveling towards site 7,
Adjacent cliffs/slopes	N/A
Signposting/locating	(NO UNAUTHORISED ACCESS ON FENCE, ADJACENT TO FOOTPATH) (RIGHT SIDE)
Ease of access	Easy to Access from site F29 ~~[illegible]~~ (Site 6)
Obstructions	None

Target	Description
Animals (agricultural)	CATTLE TO LEFT HAND SIDE OF FOOTPATH, ON LEFT SIDE OF WATERCOURSE.
Lighting present	NONE
Other 1	Buzzard's Flying overhead from woodland on ~~xxx~~ Right side of footpath. (Traveling 6 to 7)
Other 2	
Other 3	
Other 4	
Notes	Fence Surrounding Power Station to left hand side of footPath F31 / Site 6-7) 

Target	Description
Qualitative Conditions	
Tidiness	Clean, Grass length varies, No Rubbish, No Dog Foul. (Long Grass along both sides of footpath)
Open views description	Fields, Woodland (open), (Surrounding) open watercourse, Powerstation, pile-ons & cables.
Views of...	
Photographs	
1	TAKEN AT MID POINT. Time : 10:20

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 32
Surveyor Signature	[signature]
Survey Date	18/07/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm	✓	13
	Breezy		14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Short Grass/Earth
Width	Varies 2ft to 1.5meters
Boundary	Fields within Gates.
Watercourse crossings	None.
Gates	1/1 X3 Good Condition
Stiles	11 x2 with Footpath Arrows.
Steepness/Slopes	Reasonably Level.
Adjacent watercourses	Yes to left of Footpath, Toped with Algea & filled with Reeds.
Adjacent cliffs/slopes	N/A
Signposting/locating	Small Arrows on Stiles.
Ease of access	Ease of Access from Site 7 F31 to F32 using Stiles etc.
Obstructions	None. Note Overhead Cables from Power Station.

Target	Description
Animals (agricultural)	Yes in fields (GATED) (CATTLE)
Lighting present	None -
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Clean, Short Grass, Well kept, No Dog foul or Litter.
Open views description	Views to Powerstation on Right for Some Sections of footpath. (Views to fields/ Hills All Around) Power Cables in Middle of field, (Left of footpath) Small watercourse to left of (fp)
Views of…	Power lines, fields/ Hills/ Countryside, Road, Powerstation, Watercourse,
Photographs	
1	11:07 Looking n/s F15 (North End).
2	11:12 To south of STW looking South.
3	Along North Moor looking SW (Quantocks in Background).

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 33
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Grass for first ___ m. Then onto concrete and gravel on sea defence. Then recommences as grass after W end of PS.
Width	2 - 8m on grass. 3m on sea wall. 1 - 2m at W end grass section.
Boundary	Sea wall on north side. Fence and embankment on south side. Cliff at W end.
Watercourse crossings	None
Gates	None.
Stiles	None.
Steepness/Slopes	Mainly flat with 2 steep short sections.
Adjacent watercourses	None.
Adjacent cliffs/slopes	At W end, coastal cliff from 1m - 10m high.
Signposting/locating	Not clear, route through grass and then along. Then clear for the remainder. Signposting at W end.
Ease of access	Access by gate linking to F29 at east end.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	Some from adjacent power station.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Grass relatively short with occasional thistles. Concrete slightly uneven but flat. At W end cliff path is quite grown but with narrow trampled path.	
Open views description	Open view to east of estuary, Burnham, and Brean Down, extending north east to Weston-S-M, and then north across the estuary to Wales. North west are view of the Severn, ~~[illegible]~~ and Quantocks. and to the west the Somerset coastal cliffs.	
Views of...	Severn Estuary. Mendip Hills, Bleadon Hill, Brean Down. Wales. ~~[illegible]~~ Quantocks. and coastal cliffs. Foreshore. HP A & B.	
Photographs		
1	Sea wall footpath.	024
2	East to ~~[illegible]~~ Mendip / Brent Knoll / Bleadon Hills.	025
3	NE to WSM / Brean Down.	026
4	N to Wales.	027
5	NW to view across Severn + BC.	028
6	W to ~~[illegible]~~ Quantocks and N. Somerset Coast.	029
7	Low lying forested cliff at W end.	030
8	W of HP looking East toward HP A & B.	033
9	" " looking South to ridgeline.	034.
~~[illegible]~~	~~" " looking toward [illegible]~~	~~[illegible]~~

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 34
Surveyor Signature	[signature]
Survey Date	30/8/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass.
Width	1.5m.
Boundary	Field (East). Hedge (W)
Watercourse crossings	None.
Gates	None.
Stiles	Southern end.
Steepness/Slopes	Slopes light.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	None.
Ease of access	Open access at north end.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Shortish sward c. 30cm.
Open views description	View of agricultural land and pylons to the NE. View of [redacted] Quantocks. to the SW and over the top of the hedge.
Views of…	Agricultural land. [redacted] Quantocks. Pylons
Photographs	
2010	View NE of pylon. Used F35 Photo 2.
2011.	View SW of [redacted]. Quantocks.) Used F35 Photo 3.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 35 836
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles	✓	9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Stony track
Width	3 – 4m on track.
Boundary	Arable field to N & Hedgerows to south. Western half bordered by hedgerows, covering all southward area + some of north.
Watercourse crossings	None.
Gates	Metal gate at east end. Cannot be opened, need to climb over.
Stiles	None.
Steepness/Slopes	Gentle to mild slopes, 1 in 20.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposting at East end. Track continues on to F40 with no break in signposting. Signposting to F08
Ease of access	Clear.
Obstructions	None.

Target	Description
Animals (agricultural)	None
Lighting present	None
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Uneven but clean.	
Open views description	At E end. Open view across farmland to the NE, E, and SE, with pylons in the distance, and the Bleadon hills + Brean Down + HPA & B in near distance to the north. At mid path - view occasionally open to the [redacted] Quantocks.	
Views of...	HPA & B. Farmland Distant hills. [redacted]. Quantocks. Mendips & Bleadon Hills.	
Photographs		
1	At eastern end - looking north to HPA	045
2	" " " - looking north east	046
3	" " " - looking east.	047
4	Mid path looking S to [redacted] Quantocks.	048

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 38 + 37
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass.
Width	2m.
Boundary	Hedgerow + Trees – West Half. Fence on N side for eastern half.
Watercourse crossings	None.
Gates	None.
Stiles	~~[illegible]~~. Stile at entrance. Fair condition.
Steepness/Slopes	Flat
Adjacent watercourses	None
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at W end. Signpost at E entrance
Ease of access	Clear access. Buzzard warning.
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	F37 is the easternmost portion that runs N-S.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Short grass sward, well trimmed hedges.	
Open views description	Views across the Severn Estuary though constrained E & W by hedges/trees, and ridge lines View of top of HPA. At far east end (F37 stretch). there are views to the east.	
Views of…	HPA Estuary. Wales.	
Photographs		
1	View to Estuary from mid point	042
2	View of HPA from mid point	043
3	View of HPA & Estuary from E end	044

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 39.
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	~~Arable fields.~~
Surface	Arable field.
Width	1/2 m.
Boundary	Route through crops. (trampled).
Watercourse crossings	None.
Gates	Gate at northern end.
Stiles	None.
Steepness/Slopes	Mild slope. 1 in 30m.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost on stile from FP 38, and on northern gate.
Ease of access	Clear.
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Trampled path through crop.	
Open views description	Constrained view to the south by Hedgerow. Constrained view W due to topography. Partial views to the north and north east of the Estuary & Wales & Brean Down/Bleadon Hill. in the distance with some obstruction by the HPBA&B.	
Views of...	Wales. Estuary. Brean Down & Bleadon. hill. Pylons. HPA&B. Ruined farmhouse.	
Photographs		
1	~~[illegible]~~ View South East from N end.	051
2	~~[illegible] along the footpath.~~ View South along F39.	052
3	View SW from North end.	053

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 40
Surveyor Signature	[illegible]
Survey Date	18/07/2009

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	Cobbles, slatestone; soil, grass.
Width	Track width est 2m.
Boundary	Fields
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	N/A
Ease of access	Easy to Access from Site Nine Routes — — —
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	~~[illegible]~~ None.
Lighting present	~~Distance~~ ~~[illegible]~~ None.
Other 1	~~3/4 Times~~
Other 2	~~Sheriton:~~
Other 3	
Other 4	~~Quantock St.~~
Notes	~~Dog~~ Gates. Circular Route, ~~Years~~ ~~45-55.~~ ~~1 Dog~~

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Some Dog foul, few litter Path maintained,
Open views description	left of pathway Hillside views / fields & livestock, Right views of Estuary / Wales / And Coastal Edge. & Powerstation. Small woodlands to right side.
Views of…	Woodland fields / Countryside / Hills. Sea / Estuary Power Station Powerlines. Wales / Coastline.
Photographs	
1	Time 1:04
2	F40 / F35 looking NE to HPA. 049
3	F40/F35/F39 looking North along F39. 050.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 41
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

F39 - Stile at north end.
Photo 50 - view of Mendips.
51
52

Target	Description
Physical Conditions	
Length	
Surface	Grassland Eastern Half. Arable Western half.
Width	Unconstrained E half. No path W half.
Boundary	Hedgerow to S in Eastern Half. " to N in Western Half.
Watercourse crossings	None.
Gates	Open gate halfway.
Stiles	At east end, moderate condition.
Steepness/Slopes	Gentle slope 1 in 50.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at East end. Western half cannot be seen due to obscurity by arable. No signpost at W end.
Ease of access	Eastern half in good. Western half is unmarked and cannot be seen. Overgrown and arable crop hinder use.
Obstructions	Arable on western half.

Target	Description
Animals (agricultural)	None
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	E half short grass sward. No path / overgrown by arable / thistles along W half.	
Open views description	Eastern half. Views to S constrained by hedgerow. Views N & NE of estuary and background shoreline/water and WSM. Views E of HPA & B. Western views constrained by topography of N ridge & S ridge. Some views to the W / SW of ~~[illegible]~~ Quantocks.	
Views of…	Estuary. Water. WSM HPA & B ~~[illegible]~~ Quantocks.	
Photographs		
1	View across from East End.	040
2	View of sea / estuary from East End.	041
3	Midpoint View East to HPA & B	054

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 44 + 42
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass
Width	2m bounded by hedgerow at northern half and fence + hedgerow southern half.
Boundary	Hedgerow very dense at northern half. Fence + hedge southern half
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	Some gentle slopes with steepest at 1 in 5.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at north end.
Ease of access	Clear easy access at north end. Clear signpost at southern end.
Obstructions	None.

Target	Description
Animals (agricultural)	None
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Short grass sward, hedge kept back from the path. Some small puddles in a short stretch.	
Open views description	No open views in northern half + southern 1/3. In southern half, glimpses of Hinkley A+B. Closed in by undulating fields, ridge to the south and undulating fields to the W with trees.	
Views of…	Fields. Glimpses of HP A + B. Hedgerow.	
Photographs		
1	Glimpse of HP A + B	039

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 43
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	W half crop. E half grassland.
Width	Field - no limit.
Boundary	Field boundaries.
Watercourse crossings	None.
Gates -	Middle gate - open. Eastern gate join F42 & F44 - check.
Stiles	None.
Steepness/Slopes	Gently sloping 1 in 30
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signpost at W end. - check E end!
Ease of access	Open access at W end. Open access but unclear the actual route due to crop at W half.
Obstructions	

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Crop.	
Open views description	West end views: views contained by hedgerows + topo. E views contained by trees/hedgerows in near distance + HPA & B. Northern views over Estuary + Wales. East end views contained by topo + HPA&B. North views are " " by topo & hedgerows. Western views contained by topo + & " ". Southern views " " hedgerows.	
Views of…	Wales. Estuary. HPA & B. Farmland. Trees + hedgerows.	
Photographs		
1	W end looking E.	058
2	" end " N.	059

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 45
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	**Description**
Physical Conditions	
Length	
Surface	Grass
Width	10m +
Boundary	Cliff edge or fields to the South (N)
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	Sloping 1 in 10.
Adjacent watercourses	None.
Adjacent cliffs/slopes	Cliff along north edge.
Signposting/locating	No signposts beyond those at junction with F33.
Ease of access	Open access
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Heavily grown bordering hedgerows with nettles. Well cut grass.	
Open views description	Open rolling views. Some closed views where hedgerow is on the cliff edge. Views south along some section, with agricultural fields and backdrop of the Mendips, though foreshortened by a ridgeline.	
Views of…	WSM – Brean Down – Elsheny. Wales ~~[illegible]~~. N. Somerset coast.	
Photographs		
1	Looking W along F45.	031
2	Looking E to HP.	035
3	Looking N into Elsheny + Wales	036
4 + 5	Looking S at ridge + ~~[illegible]~~ SW at Quantocks	037 +038

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 46
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Stony track with grass on edges and centre
Width	c. 6m.
Boundary	Hedge row along southern boundary, open field to the north.
Watercourse crossings	None
Gates	None.
Stiles	None.
Steepness/Slopes	Level.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposts ~~at W end~~. Signpost at E end adjoining F40, F47, and Bowlake Lane.
Ease of access	Open access.
Obstructions	None.

Target	Description
Animals (agricultural)	None
Lighting present	None
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Short grass sward and fairly even track.	
Open views description	Contained view to the South due to hedgerow. View West contained by hedgerow + topo but Quantocks [redacted] in the background. View NW, N, NE and East across the estuary showing Wales, Lundy, WSM, Bleadon Hills and to the East also HP A&B. + Brent Knoll + Brean Down.	
Views of…	Farmland [redacted] Estuary. Wales + Lundy + WSM + Bleadon Hills + Brean Down. HP A&B. Quantocks (W).	
Photographs		
1	West	085.
2	Looking North	086
3	" NE	087
4	" E.	088

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 47
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Stony track with grass on sides & centre
Width	c. 4m.
Boundary	Hedgerow to the east and open field to west + north.
Watercourse crossings	None
Gates	None.
Stiles	None.
Steepness/Slopes	c. 1 in 10 moderate slope.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposts.
Ease of access	Open access.
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Short grass sward and even track.
Open views description	Constrained views to East, North, South and West due to topo and trees / hedgerows. Located in small 'valley'.
Views of…	Farmland Hedgerows.
Photographs	
1	View North over F47. 089.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 48
Surveyor Signature	[signature]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud	✓	2
	Overcast		3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Crop.
Width	~~Flat~~ c. 1m.
Boundary	Field boundary – no path visible.
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	Slopes downward mildly at 1in 20.
Adjacent watercourses	None
Adjacent cliffs/slopes	None.
Signposting/locating	No signpost at N end.
Ease of access	Access at north end through narrow gap in hedgerow.
Obstructions	

Target	Description
Animals (agricultural)	None
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Qualitative Conditions	
Tidiness	Crop growing - ~~no path visible~~. 1m wide path
Open views description	North views contained by hedgerow + topo. Southern views contained by southern ridge. Eastern views " " by topo, hedgerow + HPA SB. Western views of rolling farmland with ~~[illegible]~~ Quantocks + Exmoor in the background.
Views of...	Farmland Hedgerow. ~~[illegible]~~ Quantocks. + Exmoor. HPA SB.
Photographs	
1	Looking East 063
2	Looking West. 064

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 49
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	As 47
Width	"
Boundary	"
Watercourse crossings	"
Gates	"
Stiles	"
Steepness/Slopes	Level.
Adjacent watercourses	As 47
Adjacent cliffs/slopes	"
Signposting/locating	"
Ease of access	"
Obstructions	"

Target	Description
Animals (agricultural)	As 47
Lighting present	"
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	As 47
Open views description	"
Views of…	"
Photographs	

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 50
Surveyor Signature	[illegible]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)	✓	5
	Cool (<15 C)		6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass with some track at Southern end.
Width	3 - 4m.
Boundary	Hedgerow on Eastern end. Field to the West.
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	Sloping at 1 in 5.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposts
Ease of access	Joins on from F49, F51, & F53.
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Medium length grass sward 1 – 2ft.	
Open views description	Eastern and Northern views constrained by hedgerow. Southern views constrained by ridge. SE and E views of near farmland with ~~[illegible]~~ in the far distant background. ~~[illegible]~~ ~~[illegible]~~ Quantocks + Exmoor.	
Views of…	~~[illegible]~~ Farmland. Hedgerow. ~~[illegible]~~. ~~[illegible]~~. Quantocks & Exmoor	
Photographs		
1	North along F50.	055
2	SE to ~~[illegible]~~ Quantocks + Exmoor. ~~[illegible]~~	056
3	E " "	057

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 57
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass.
Width	5m
Boundary	Hedgerow along southern boundary, Non field.
Watercourse crossings	None.
Gates	No
Stiles	No
Steepness/Slopes	Generally flat.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposting at Eastern end. No " " West end.
Ease of access	Open access at E end. " " " W end.
Obstructions	None.

Target	Description
Animals (agricultural)	None
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Main short grass sward.	
Open views description	View south contained by hedgerow. Only far distant views to (1) W – Quantocks/Exmoor. (2) N – Estuary and Wales. (3) E – Brent Knoll + HPA&B. + Mendips.	
Views of…	Estuary. Wales. Mendips & Brent Knoll. Quantocks + Exmoor. HPA&B. Farmland. Hedgerow.	
Photographs		
1	W to Quantocks + Exmoor.	060
2	N to Wales	061
3	E to HPA&B and beyond.	062

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 52
Surveyor Signature	[illegible]
Survey Date	18/7/09.

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Grass
Width	5m
Boundary	Hedgerow on southern side, field to the north.
Watercourse crossings	None
Gates	None.
Stiles	None.
Steepness/Slopes	Gentle slope 1 in 50
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposting at E and W ends.
Ease of access	Continued access from F51. Access of CFP + [illegible]
Obstructions	None

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Mown grass sward.	
Open views description	Contained views to the NE & E and S by hedgerows and topo. Views north & NW of estuary, and west of estuary and ~~[illegible]~~ Quantocks + Exmoor.	
Views of…	Estuary. ~~[illegible]~~ Quantocks + Exmoor.	
Photographs		
1	Looking W to Exmoor.	065
2	Looking NW.	066

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 53 + 57.
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass
Width	> 10m.
Boundary	Cliff or cliff + vegetation along the N. Field (grass) to the south.
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	Gentle to mild 1 in 20
Adjacent watercourses	None.
Adjacent cliffs/slopes	Cliff to N variable height 1m – 8+m.
Signposting/locating	No signposting.
Ease of access	Open access
Obstructions	None.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Mown short grass sward.	
Open views description	Contained to the south and east by topography with rolling grassland in the near distance and top of HPA&B in distance. Views of estuary + Wales to the north, and ~~[illegible]~~ Exmoor to the West.	
Views of…	~~[illegible]~~ Estuary Wales. WSM. Quantocks. + Exmoor.	
Photographs		
1	Looking East	067
2	Looking NE	068
3	Looking N.	069
4	Looking W.	070

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 54
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Stony track.
Width	c. 5m.
Boundary	Hedgerow to south, open field to N.
Watercourse crossings	None
Gates	None.
Stiles	None.
Steepness/Slopes	Flat.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	Signpost at West end.
Ease of access	Open access.
Obstructions	None

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Short grass < 1ft.	
Open views description	Open views to NW, N, & NE, and Eastwards, showing estuary with Wales, Lundy, WSM, & Brent Knoll and Bleadon Hills. and HP A & B in background. No views south or west due to topo and hedgerows.	
Views of…	Farmland, Estuary, Wales + Lundy. WSM Brent Knoll & Mendips. HP A &B.	
Photographs		
1	Looking NW to Wales	074
2	Looking N to Lundy + WSM	075
3	Looking NE to ~~Bleadon~~ Brean Down Hills + HP.	076.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 55
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	**Description**
Physical Conditions	
Length	
Surface	Crop.
Width	No visible or only partially visible trampling.
Boundary	Open field.
Watercourse crossings	None.
Gates	None
Stiles	None.
Steepness/Slopes	Slopes down at 1 in 8.
Adjacent watercourses	None
Adjacent cliffs/slopes	None.
Signposting/locating	No signposting.
Ease of access	Open access – but no visible route.
Obstructions	None other than crop.

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description	
Qualitative Conditions		
Tidiness	Crop up to waist height.	
Open views description	Views to the NW of estuary with some westerly views of [redacted] Exmoor. Views to the N of estuary and Wales and Lundy, with WSM further to the NE. Easterly views of Brent Knoll and HPASB, and Bream Down / Bleadon Hills.	
Views of…	Farmland Estuary [redacted] Bream Down / Bleadon Hills. Wales + Lundy WSM Brent Knoll HPASB.	
Photographs		
1	Looking West	077
2	Looking N	078
3	" " NE	079
4	" " E.	080.

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 56
Surveyor Signature	[signature]
Survey Date	18/7/09

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry		7
	Damp	✓	8
	Puddles		9
4	**Condition**		
	Dry		10
	Drizzling/showers	✓	11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Physical Conditions	
Length	
Surface	Grass.
Width	c. 5m
Boundary	Open fields.
Watercourse crossings	None.
Gates	None.
Stiles	None.
Steepness/Slopes	Mild slopes 1in 10 – 20.
Adjacent watercourses	None.
Adjacent cliffs/slopes	None.
Signposting/locating	No signposts.
Ease of access	Open access.
Obstructions	None.

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description
Animals (agricultural)	None.
Lighting present	None.
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Target	Description	
Qualitative Conditions		
Tidiness	Short grass sward.	
Open views description	Constrained views to S and W by topo and hedgerows. East views of near distance parkland with HP A & B in background. Views to N & NE of estuary, Wales, Lundy & WSM.	
Views of…	Estuary. Wales + Lundy. WSM / Brean Down / Bleadon Hills Farmland.	
Photographs		
1	N to Wales	071
2	NE to Lundy + WSM + Brean Down.	072
3	E to HP A & B.	073

HINKLEY – RECREATIONAL ACCESS – FOOTPATH SURVEY

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 58
Surveyor Signature	S Chalmers
Survey Date	18/07/2009

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Target	Description
Physical Conditions	
Length	
Surface	Stone / Cobbles
Width	2m - 2.5 meters
Boundary	Fields.
Watercourse crossings	None.
Gates	1 GATE AT END OF F58. (leading to site 1) (F__)
Stiles	None
Steepness/Slopes	Downhill walk to Site 1 F__
Adjacent watercourses	N/A
Adjacent cliffs/slopes	N/A
Signposting/locating	
Ease of access	Easy to Access from Sites __ __ __
Obstructions	None

Target	Description
Animals (agricultural)	None
Lighting present	None
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	Clean, No Dog Foul or litter
Open views description	Mendips to left of footpath. Open views of fields/countryside, Traveling up from _ to views of wales/Estuary. Powerstation Visiable from Top of __
Views of...	Mendip Hills, Powerstation Fields Track. Near by Houses.
Photographs	
1	Time : 3:19

Survey Site	Hinkley, Somerset
Footpath Reference Number	F 59
Surveyor Signature	D Chalmers
Survey Date	18/07/2009

Weather conditions			
ID	**Condition**	**Tick**	**Reference**
1	**Cloud cover**		
	Sunny		1
	Broken cloud		2
	Overcast	✓	3
2	**Temperature**		
	Hot (>20 C)		4
	Warm (15-20 C)		5
	Cool (<15 C)	✓	6
3	**Previous Weather Conditions**		
	Dry	✓	7
	Damp		8
	Puddles		9
4	**Condition**		
	Dry	✓	10
	Drizzling/showers		11
	Persistent rain		12
5	**Wind conditions**		
	Calm		13
	Breezy	✓	14
	Windy		15

Note: No Access to F59, FARMER HAS PLANTED CORN/WHEAT WHERE FOOT PATH SHOULD BE!

Target	Description
Physical Conditions	
Length	
Surface	
Width	
Boundary	
Watercourse crossings	
Gates	
Stiles	
Steepness/Slopes	
Adjacent watercourses	
Adjacent cliffs/slopes	
Signposting/locating	
Ease of access	
Obstructions	

Target	Description
Animals (agricultural)	
Lighting present	
Other 1	
Other 2	
Other 3	
Other 4	
Notes	

Target	Description
Qualitative Conditions	
Tidiness	
Open views description	
Views of…	
Photographs	

APPENDIX M

COMPLETED FOOTPATH SURVEY PHOTOGRAPHS


Site F02 – Photo 1


Site F02 – Photo 2


Site F02 – Photo 3


Site F02 Photo 4


Site F04 – Photo 1


Site F05 – Photo 1


Site F06 – Photo 1


Site F06 – Photo 2

Site F07 – Photo 1

Site F07 – Photo 2

Site F09 – Photo 1

Site F09 – Photo 2

Site F09 – Photo 3

Site F09 – Photo 4

Site F10 – Photo 1

Site F10 – Photo 2

Site F11 – Photo 1

Site F11 – Photo 2

Site F13 – Photo 1

Site F13 – Photo 2


Site F13 – Photo 3


Site F14 – Photo 1


Site F15 – Photo 1


Site F15 – Photo 2

Site F16 - Photo 1

Site F16 – Photo 2

Site F16 – Photo 3

Site F17 – Photo 1


Site F17 – Photo 2


Site F18 – Photo 1


Site F18 – Photo 2


Site F18 – Photo 3

Site F19 – Photo 1

Site F20 – Photo 1

Site F20 – Photo 2

Site F21 – Photo 1


Site F27 – Photo 1


Site F27 – Photo 2


Site F27 – Photo 3


Site F27 – Photo 4


Site F28 – Photo 1


Site F28 – Photo 2


Site F28 – Photo 3


Site F28 – Photo 4


Site F29 – Photo 1


Site F29 – Photo 2


Site F29 – Photo 3


Site F29 – Photo 4

Site F29 – Photo 5

Site F29 – Photo 6

Site F29 – Additional Photo 1

Site F29 Additional Photo 2


Site F31 – Photo 1


Site F32 – Photo 1


Site F32 – Photo 2


Site F32 – Photo 3

Site F33 – Photo 1

Site F33 – Photo 2

Site F33 – Photo 3

Site F33 – Photo 4

Site F33 – Photo 5

Site F33 – Photo 6

Site F33 – Photo 7

Site F33 – Photo 8


Site F33 – Photo 9


Site F34 – Photo 1


Site F34 – Photo 2


Site F35 & F36 – Photo 1

Site F35 & F36 – Photo 2

Site F35 & F36 – Photo 3

Site F35 & F36 – Photo 4

Site F37 & F38 – Photo 1


Site F37 & F38 – Photo 2


Site F37 & F38 – Photo 3


Site F39 - Photo051


Site F39 - Photo052


Site F39 - Photo053


Site F40 – Photo 1


Site F40 – Photo 2


Site F40 – Photo 3

Site F41 – Photo 1

Site F41 – Photo 2

Site F41 – Photo 3

Site F42 & F44 – Photo 1

Site F43 – Photo 1

Site F43 – Photo 2

Site F45 – Photo 1

Site F45 – Photo 2


Site F45 – Photo 3


Site F45 – Photo 4


Site F45 – Photo 5


Site F46 – Photo 1


Site F46 – Photo 2


Site F46 – Photo 3


Site F46 – Photo 4


Site F47 & 49 – Photo 1

Site F48 – Photo 1

Site F48 – Photo 2

Site F50 – Photo 1

Site F50 – Photo 2


Site F50 – Photo 3


Site F51 – Photo 1


Site F51 – Photo 2


Site F51 – Photo 3

Site F52 – Photo 1

Site F52 – Photo 2

Site F53 – Photo 1

Site F53 – Photo 2

Site F53 – Photo 3

Site F53 – Photo 4

Site F54 – Photo 1

Site F54 – Photo 2


Site F54 – Photo 3


Site F55 – Photo 1


Site F55 – Photo 2


Site F55 – Photo 3


Site F55 – Photo 4


Site F56 – Photo 1


Site F56 – Photo 2


Site F56 – Photo 3

Site F58 – Photo 1

ROYAL HASKONING

APPENDIX N

15/07 FOOTPATH COUNT SUMMARY

Hinkley Point Recreational Access Survey - Footpath Counts
Survey Date: 15 July 2009

Time commenced	0700	0700	0800	0900	0900	0900	1000	1000	1100	1100	1100	1100	1200	1200	1200	1300	1300	1300	1400	1400	1500	1500	1500	1500	1600	1600	1600	1600	1600	1700	1700	1700	1700	1800	1800	1800	1800
Site	**1**	**1**	**2**	**3**	**3**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**6**	**6**	**6**	**7**	**7**	**7**	**8**	**8**	**9**	**9**	**9**	**9**	**10**	**10**	**10**	**10**	**10**	**11**	**11**	**11**	**11**	**12**	**12**	**12**	**12**
Footpath	**01**	**58**	**04**	**07**	**09**	**10**	**17**	**16**	**18**	**27**	**23**	**28**	**31**	**33**	**29**	**32**	**15**	**31**	**36**	**37**	**08**	**39**	**40**	**35**	**05**	**03**	**46**	**40**	**47**	**55**	**56**	**57**	**53**	**54**	**59**	**58**	**56**
1 - Sunny									1	1				1	1															1	1	1	1	1	1	1	1
2 - Broken cloud	1	1	1	1	1	1	1	1			1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1								
3 - Overcast																																					
4 - Hot																																		1	1	1	1
5 - Warm			1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
6 - Cool	1	1		1	1	1	1	1																													
7 - Ground dry				1	1	1			1	1			1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8 - Ground damp																																					
9 - Puddles on ground	1	1	1				1	1			1	1				1	1	1	1	1																	
10 - Dry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11 - Drizzling/showers																1	1	1																			
12 - Persistent rain																																					
13 - Calm	1	1		1	1	1																															
14 - Breezy			1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										1	1	1	1
15 - Windy																									1	1	1	1	1	1	1	1	1				
16 - Walkers																																					
17 - Walkers with dogs			1																															3		3	
18 - Groups																																					
19 - Groups with dogs																																		1		1	
20 - Cyclists																																					
21 - Groups of cyclists																																					
22 - Horse riders																																					
23 - Groups of horse riders																																					
24 - other 1 description														Fishing	Fishing																						
25 - other 2 count														2	2																						
26 - other 2 description																																					
27 - other 2 count																																					
28 - other 3 description																																					
29 - other 3 count																																					

APPENDIX O

18/07 FOOTPATH COUNT SUMMARY

Hinkley Point Recreational Access Survey - Footpath Counts
Survey Date: 18 July 2009

Time commenced	1600	1600	1700	1730	1730	1730	0700	0700	0800	0800	0800	0800	0900	0900	0900	1000	1000	1000	1100	1100	1200	1200	1200	1200	1300	1300	1300	1300	1400	1400	1400	1400	1500	1500	1500	1500
Site	**1**	**1**	**2**	**3**	**3**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**6**	**6**	**6**	**7**	**7**	**7**	**8**	**8**	**9**	**9**	**9**	**9**	**10**	**10**	**10**	**10**	**11**	**11**	**11**	**11**	**12**	**12**	**12**	**12**
Footpath	**01**	**58**	**04**	**07**	**09**	**10**	**17**	**16**	**26**	**27**	**28**	**18**	**29**	**31**	**33**	**15**	**31**	**32**	**36**	**37**	**35**	**39**	**08**	**40**	**05**	**46**	**40**	**47**	**53**	**55**	**56**	**57**	**54**	**56**	**58**	**59**
1 - Sunny	1	1	1	1	1	1																														
2 - Broken cloud																																				
3 - Overcast							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4 - Hot			1																																	
5 - Warm	1	1		1	1	1																														
6 - Cool							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7 - Ground dry	1	1		1	1	1	1	1	1	1	1	1									1	1	1	1	1	1	1	1								
8 - Ground damp			1										1	1	1	1	1	1	1	1									1	1	1	1	1	1	1	1
9 - Puddles on ground																																				
10 - Dry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11 - Drizzling/showers																																				
12 - Persistent rain																																				
13 - Calm	1	1		1	1	1																														
14 - Breezy			1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15 - Windy																																				
16 - Walkers																																				
17 - Walkers with dogs				1																	2	2	4													
18 - Groups																																				
19 - Groups with dogs																					1	1	2													
20 - Cyclists																																				
21 - Groups of cyclists																																				
22 - Horse riders																									1	1										
23 - Groups of horse riders																																				
24 - other 1 description									Livestock owner	Livestock owner	Livestock owner																									
25 - other 2 count									1	1	1																									
26 - other 2 description																																				
27 - other 2 count																																				
28 - other 3 description																																				
29 - other 3 count																																				

APPENDIX P

26/08 FOOTPATH COUNT SUMMARY

Hinkley Point Recreational Access Survey - Footpath Counts
Survey Date: 26 August 2009

Time commenced	1200	1200		1400	1400	1400	1500	1500	1600	1600	1600	1600	1800	1800	1800	1700	1700	1700	0700	0700	0800	0800	0800	0800	0900	0900	0900	0900	1000	1000	1000	1000	1100	1100	1100	1100
Site	**1**	**1**	**2**	**3**	**3**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**6**	**6**	**6**	**7**	**7**	**7**	**8**	**8**	**9**	**9**	**9**	**9**	**10**	**10**	**10**	**10**	**11**	**11**	**11**	**11**	**12**	**12**	**12**	**12**
Footpath	**01**	**58**	**04**	**07**	**09**	**10**	**17**	**16**	**26**	**27**	**28**	**18**	**29**	**31**	**33**	**15**	**31**	**32**	**36**	**37**	**35**	**39**	**08**	**40**	**05**	**46**	**40**	**47**	**53**	**55**	**56**	**57**	**54**	**56**	**58**	**59**
1 - Sunny																																				
2 - Broken cloud																																				
3 - Overcast	1	1							1	1	1	1	1	1	1										1	1	1	1	1	1	1	1	1	1	1	1
4 - Hot																																				
5 - Warm																																				
6 - Cool	1	1							1	1	1	1	1	1	1										1	1	1	1	1	1	1	1	1	1	1	1
7 - Ground dry																																				
8 - Ground damp																													1	1	1	1	1	1	1	1
9 - Puddles on ground	1	1							1	1	1	1	1	1	1										1	1	1	1								
10 - Dry																									1	1	1	1					1	1	1	1
11 - Drizzling/showers	1	1							1	1	1	1																	1	1	1	1				
12 - Persistent rain													1	1	1																					
13 - Calm																																				
14 - Breezy																																	1	1	1	1
15 - Windy	1	1							1	1	1	1	1	1	1										1	1	1	1	1	1	1	1				
16 - Walkers															1																					
17 - Walkers with dogs		1																							1					2			2			
18 - Groups																																				
19 - Groups with dogs																																	1			
20 - Cyclists																																				
21 - Groups of cyclists																																				
22 - Horse riders																																				
23 - Groups of horse riders																																				
24 - other 1 description										Surveyors																										
25 - other 2 count										2																										
26 - other 2 description																																				
27 - other 2 count																																				
28 - other 3 description																																				
29 - other 3 count																																				

APPENDIX Q

30/08 FOOTPATH COUNT SUMMARY

Hinkley Point Recreational Access Survey - Footpath Counts
Survey Date: 30 August 2009

Time commenced	0900	0900		1000	1000	1000	1100	1100	1200	1200	1200	1200	1300	1300	1300	1400	1400	1400	1500	1500	1600	1600	1600	1600	1700	1700	1700	1700	1800	1800	1800	1800	0700	0700	0700	0700
Site	**1**	**1**	**2**	**3**	**3**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**6**	**6**	**6**	**7**	**7**	**7**	**8**	**8**	**9**	**9**	**9**	**9**	**10**	**10**	**10**	**10**	**11**	**11**	**11**	**11**	**12**	**12**	**12**	**12**
Footpath	**01**	**58**	**04**	**07**	**09**	**10**	**17**	**16**	**26**	**27**	**28**	**18**	**29**	**31**	**33**	**15**	**31**	**32**	**36**	**37**	**35**	**39**	**08**	**40**	**05**	**46**	**40**	**47**	**53**	**55**	**56**	**57**	**54**	**56**	**58**	**59**
1 - Sunny																																				
2 - Broken cloud																																				
3 - Overcast	1	1											1	1	1														1	1	1	1	1	1	1	1
4 - Hot																																				
5 - Warm																																				
6 - Cool	1	1											1	1	1														1	1	1	1	1	1	1	1
7 - Ground dry	1	1											1	1	1														1	1	1	1	1	1	1	1
8 - Ground damp																																				
9 - Puddles on ground																																				
10 - Dry													1	1	1														1	1	1	1	1	1	1	1
11 - Drizzling/showers	1	1																																		
12 - Persistent rain																																				
13 - Calm																																				
14 - Breezy													1	1	1														1	1	1	1	1	1	1	1
15 - Windy	1	1																																		
16 - Walkers																																				
17 - Walkers with dogs		1																											1					2	2	
18 - Groups																																				
19 - Groups with dogs																																				
20 - Cyclists																																				
21 - Groups of cyclists																																				
22 - Horse riders																																				
23 - Groups of horse riders																																				
24 - other 1 description																																				
25 - other 2 count													2																							
26 - other 2 description													Fishing																							
27 - other 2 count																																				
28 - other 3 description																																				
29 - other 3 count																																				

APPENDIX R

QUESTIONNAIRE RESULTS

Hinkley Point Recreational Access Survey - Completed Questionnaires

Reference		F04	F29	F58	F54toF58	F07	F35toF08	F39toF08	F18	F28	F58	F05	F55	F58	F53	F58toF56
Date		1507	1507	1507	1507	1807	1807	1807	1807	1807	2608	2608	2608	30/08	30/08	30/08
Site		2	6	12	12	3	9	9	5	5	1	10	12	1	11	12
Interviewer		AC	AC	KH	AC	AC	AC	AC	AC	AC	AC	AC	KH	PT	AC	AC
Weather conditions																
1	Sunny				2											
2	Broken cloud	1	2	1		1			1							
3	Overcast						2	2		1	1	1	2	1	1	1
4	Hot															
5	Warm			1	2	1										
6	Cool	1	2				2	2	1	1	1	1	2	1	1	1
7	Dry	1	2	1	2	1	2	2	1	1		1			1	1
8	Drizzling/showers										1		2	1		
9	Persistent rain															
10	Calm	1				1										
11	Breezy						2	2	1	1	1			1	1	1
12	Wndy		2	1	2							1	2			
Are you a resident in the area?																
13	Yes	1		1	2	1	2		1	1	1	1		1	1	1
14	No		2					2					2			
	If no state where resident		Looking after parents house					Bridgwater					Minehead			
How close is your home to this starting point? In m																
15		5	1500	1500	2300	100	6000	4500	20	700	200	400	23400	250	5460	1560
How did you travel to the footpath today?																
16	Walked	1	2	1		1	2	2	1	1	1	1		1		
17	Cycled															
18	Horse															
19	Motorcycle															
20	Car				2								2		1	1
21	Bus/train															
22	Other															
Where did you park your vehicle?																
23	Car park															
24	Lay-by															
25	Gateway				2										1	1
26	Wide verge															
27	Neabry housing area															
28	On the road															
29	Other												Farm			
How long did it take to get here?																
30	0 to 5 mins	1			2	1			1					1		1
31	6 to 15 mins		2							1		1				
32	16 to 30 mins			1									2		1	
33	31 to 60 mins						2	2			1					
34	Over an hour															

Hinkley Point Recreational Access Survey - Completed Questionnaires

Reference		F04	F29	F58	F54toF58	F07	F35toF08	F39toF08	F18	F28	F58	F05	F55	F58	F53	F58toF56
Date		1507	1507	1507	1507	1807	1807	1807	1807	1807	2608	2608	2608	30/08	30/08	30/08
Site		2	6	12	12	3	9	9	5	5	1	10	12	1	11	12
Interviewer		AC	AC	KH	AC	AC	AC	AC	AC	AC	AC	AC	KH	PT	AC	AC
What is the purpose of your visit to the path today?																
35	Walking									1						
36	Jogging															
37	Dog-walking	1		1	2	1	2	2	1		1	1	2	1	1	1
38	Cycling															
39	Horse-riding															
40	Bird/wildlife watching															
41	Picnic															
42	Other		Fishing							Check on cattle						
How often do you use footpaths in the Hinkley area? Times a year																
43		365	2	730	52	730	52	4	365	300	365	730	200	365	300	12
Do you usually walk the same route or a different route?																
44	Same route	1	2						1	1						1
45	Different route nearby			1				2					1	1		
46	Different route >2 miles away			1	2	1	2				1	1			1	
How often do you use this footpath? Times a year																
47		365	2	730	52	365	52	4	365	300		365	1	365	300	12
How long will you spend outdoor today? In mins																
48		430	120	30	60	120	120	120	90	20		90	60	120	150	60
How would you describe your route today?																
50	Return the same way	1	2						1	1					1	
51	Circular route			1	2	1	2	2				1	2	1		1
52	Don't know															
Why did you chose this route?																
53	Convenience	1		1		1	2	2	1	1	1	1				
54	For wildlife			1							1	1		1	1	
55	For views			1	2		2	2			1	1	2	1	1	1
56	Path condition															
57	Let the dogs off the lead				2			2				1	2	1	1	1
58	Not many people						2	2			1			1	1	
59	Proximity of parking														1	
60	Safety															
61	Other		Fishing	Coastline						Direct route to cattle	Exercise	Quiet	Flat			Dog walking

Hinkley Point Recreational Access Survey - Completed Questionnaires

Reference		F04	F29	F58	F54toF58	F07	F35toF08	F39toF08	F18	F28	F58	F05	F55	F58	F53	F58toF56
Date		1507	1507	1507	1507	1807	1807	1807	1807	1807	2608	2608	2608	30/08	30/08	30/08
Site		2	6	12	12	3	9	9	5	5	1	10	12	1	11	12
Interviewer		AC	AC	KH	AC	AC	AC	AC	AC	AC	AC	AC	KH	PT	AC	AC
What are the desirable characteristics for a footpath																
62	Good clear views		2	1	2	1	2	2	1				2	1	1	1
63	Quiet	1	2	1		1	2	2		1	1	1		1		
64	Wide path and good surface					1	2	2		1	1				1	
65	Far from road										1	1		1	1	
66	Good parking														1	
67	Toilet facilities															
68	Well marked footpaths						2			1				1		1
69	Notice boards and information															
70	Close to home									1				1		
71	Mix of coast and countryside			1	2			2		1		1		1	1	1
72	Joined to other paths							2				1		1	1	1
73	Other				Beach			Dog gates	Access	Access to cattle	Easy access for dogs	Wildlife				
What age group are you in?																
74	Less than 18															
75	18 to 24															
76	25 to 29		2													
77	30 to 44															
78	45 to 59	1			2		2	2	1		1		1			1
79	60 to 74			1		1						1	1	1	1	
80	Over 75									1						
Are you…..																
81	Full time		2		2			2						1	1	1
82	Part time	1				1	2		1				1			
83	Retired			1						1	1	1	1			
84	Unemployed/not working															
85	Houswife/husband															
86	Full time education															
How many in your household?																
87	Dependents										1		1			
88	Adults	1	1		1		2	1	1				1	1	1	1
89	Adults over 65			1		1				1		1				
Notes																
91	Male or female	F	M & F	F	F & F	M	M & F	M & F	M	F	M	F	F & F	M	F	F
92	How many in group	1	2	1	2	1	2	2	1	1	1	1	2	1	1	1
93	How many dogs	2	0	1	7	1	1	1	1	0	2	1	2	2	2	2

APPENDIX 25B: DESTINATIONS OF PROW ROUTES THROUGH THE HINKLEY POINT C DEVELOPMENT SITE

APPENDIX 25B: DESTINATIONS OF PROW ROUTES THROUGH THE HINKLEY POINT C DEVELOPMENT SITE

Destination / Route	PRoW Routing
West Somerset Coast Path to Knighton (and Burton)	1) Leave WSCP at WL23/43 and continue to Knighton. 2) Leave WSCP at WL23/46 and continue to Knighton. 3) Leave WSCP at WL23/48 and follow WL23/48 around or turn off onto WL23/50 until reconnect with WL23/48, then turn off onto WL23/110, and then turn off onto WL23/46 and continue to Knighton. 4) Leave WSCP at WL23/48 and follow WL23/48 around or turn off onto WL23/50 until reconnect with WL23/48, then turn off onto WL23/53, and then turn off onto WL23/46 and continue to Knighton. 5) Leave WSCP at WL23/48 and follow WL23/48 around or turn off onto WL23/50 until reconnect with WL23/48, then turn off onto WL23/52, and then turn off onto WL23/46 and continue to Knighton. 6) Leave WSCP at WL23/56 then turn off onto WL23/68, and then follow routes 3, 4, and 5 above to Knighton. 7) Leave WSCP at WL23/56 then turn off onto WL23/105, and then follow routes 3, 4, and 5 above to Knighton. 8) Leave WSCP at WL23/56 then turn off onto WL23/110, and then turn off onto WL23/46 (or via WL23/53 or WL23/48 and WL23/52) to Knighton.
West Somerset Coast Path to Shurton	1) Leave WSCP at WL23/43 and turn onto WL23/110, then turn off onto WL23/48 and continue to Shurton. 2) Leave WSCP at WL23/46 and turn onto WL23/110, then turn off onto WL23/48 and continue to Shurton. 3) Leave WSCP at WL23/48 and follow WL23/48 around or turn off onto WL23/50 until reconnect with WL23/48, then continue to Shurton. 4) Leave WSCP at WL23/48 and follow WL23/48 around or turn off onto WL23/50 until reconnect with WL23/48, then turn off onto WL23/69 and connect with WL23/56 and continue to Shurton. 5) Leave WSCP at WL23/48 and follow WL23/48 around or turn off onto WL23/50 until reconnect with WL23/48, then turn off onto WL23/110 and connect with WL23/56 and continue to Shurton. 6) Leave WSCP at WL23/48 and follow WL23/48 then turn onto WL23/105 and connect with WL23/56 and continue to Shurton. 7) Leave WSCP at WL23/48 and turn onto WL23/68, then turn onto WL23/56 and connect with WL23/56 and continue to Shurton. 8) Leave WSCP at WL23/56 and continue to Shurton. 9) Leave WSCP at WL23/56 and take alternative route to Shurton along the WL23/48, which can be reached by turning off onto WL23/68, WL23/105, or WL23/110. 10) Leave WSCP at WL23/56 and take alternative route to Shurton along the WL23/57, which can be reached by turning off onto WL23/70 or WL23/110.

Destination / Route	PRoW Routing
West Somerset Coast Path to Wick	1) Leave WSCP at WL23/56 and turn onto WL23/70, then continue on WL23/70 to WL23/57 and on to Wick. 2) Leave WSCP at WL23/56 and turn onto WL23/110, continuing on WL23/70 before turning onto WL23/57 and on to Wick. 3) Leave WSCP at WL23/56 and continue on to Shurton and then turning onto WL23/57 and on to Wick.

APPENDIX 25C: CIRCULAR ROUTES WITHIN THE PROW NETWORK IN THE HINKLEY POINT C STUDY AREA

APPENDIX 25C: CIRCULAR ROUTES WITHIN THE PROW NETWORK IN THE HINKLEY POINT C STUDY AREA

ID	Route Type	Distance	PRoW References
1	Circular – individual	1,400m	WL23/43 – WL23/95 – WL23/46 – WL23/110 – WL23/43
2	Circular – individual	1,900m	Wl23/46 – WL23/95 – WL23/48 – WL23/50 – WL23/48 – WL23/110 – WL23/46
3	Circular – individual	850m	WL23/50 – WL23/48 – WL23/50
4	Circular – individual	2,550m	WL23/48 – WL23/95 – WL23/56 – WL23/68 – WL23/48
5	Circular – individual	1,600m	WL23/105 – WL23/48 – WL23/68 – WL23/56 – WL23/70 – WL23/105
6	Circular – individual	4,500m	WL23/70 – WL23/56 – WL23/95 – WL23/61 – WL23/71 – WL23/70 (includes one road crossing – C182)
7	Circular – individual	1,750m	WL23/48 – WL23/105 – WL23/56 – WL23/110 – WL23/48
8	Circular – individual	1,550m	WL23/56 – WL23/70 – WL23/110 – WL23/56
9	Circular – individual	2,750m	WL23/44 – WL23/43 – WL23/45 – Track/Lane (385m) – WL23/44
10	Circular – individual	2,250m	WL23/45 – WL23/110 – WL23/46 – Track/Lane (210m) – WL23/45
11	Circular – individual	1,425m	WL23/46 – WL23/110 – WL23/53 – WL23/46
12	Circular – individual	1,950m	WL23/46 – WL23/53 – WL23/110 – WL23/48 – WL23/52 – WL23/46
13	Circular – individual	1,980m	WL23/48 – WL23/110 – WL23/56 – WL23/69 – WL23/48
14	Circular – individual	5,200m	WL23/44 – WL23/42 – WL24/21 – WL24/8 – WL24/9 – WL23/95 – WL23/43 – WL23/44
15	Circular – using road	1,290m	WL23/42 – WL23/44 – WL23/43 – Shurton Lane (230m) – WL23/42
16	Circular – using road	1,570m	WL23/43 – WL23/44 – cross Lane – WL23/47 – Shurton Lane (450m) – WL23/43
17	Circular – using road	2,230m	WL23/47 – Lane (150m) – WL23/46 – WL23/52 – WL23/48 – Shurton Lane (400m) – WL23/47
18	Circular – using road	2,660m	WL23/48 – WL23/69 – WL23/56 – Shurton Lane (510m) – WL23/48
19	Circular – using road	2,930m	WL23/56 – WL23/110 – WL23/70 – WL23/70 C182 Wick Moor Road (730m) – WL23/57 – Shurton Lane (35m) – WL23/56
20	Circular – using road	3,461m	WL23/71 – WL23/61 – WL23/57 Wick Lane (320m) – WL23/70 C182 Wick Moor Road (720m)
21	Circular – using road	1,699m	WL23/60 – WL23/61 – WL23/57 Wick Lane (465m)
22	Circular – individual	4,195m	WL23/61 – WL23/95 – WL23/107 – WL23/62 – WL23/61
23	Circular – using road	1,114m	WL23/57 – C182 Wick Moor Road (185m) – WL23/58 – WL23/57
24	Circular – using road	914m	WL23/59 – C182 Wick Moor Road (185m) – WL23/57 Wick Lane (380m) – WL23/59
25	Circular – using road	2,043m	WL23/59 – WL23/57 Wick Lane (420m) – Wick Lane (400m) – C182 Wick Moor Road (870m) – WL23/59
26	Circular – using road	1,495m	WL23/62 – WL23/63 – Stolford Lane (200m) – WL23/67 – Idson/Wick Lane (395m) – WL23/62

ID	Route Type	Distance	PRoW References
27	Circular – using road	2,376m	WL23/21 – Shurton Lane (330m) – C182 Wick Moor Road (615m) – WL23/15 – WL23/20 – WL23/21
28	Circular – using road	957m	WL23/59 – C182 Wick Moor Road (275m) – Shurton Lane (300m) – WL23/59
29	Circular – using road	901m	WL23/58 – WL23/59 – Shurton Lane (335m) – WL23/58
30	Circular – using road	333m	WL23/21 – Shurton Lane (110m) – WL23/21
31	Circular – using road	2,736m	WL23/16 – WL23/22 – WL23/20 – WL23/15 – Farringdon Hill Lane (220m) – WL23/16
32	Circular – individual	1,311m	WL23/16 – Shurton Lane (10m) – WL23/21 – WL23/20 – WL23/22 – WL23/16
33	Circular – using road	779m	WL23/55 – Shurton Lane (465m) – WL23/55
34	Circular – using road	2,008m	WL23/54 – WL23/55 – WL23/16 – WL23/22 – Shurton Lane (515m) – WL23/54
35	Circular – using road	1,214m	WL23/22 – WL23/16 – WL23/17 – Shurton Lane (415m) – WL23/22
36	Circular – using road	602m	WL23/28 – Shurton Lane (230m) – WL23/25 – WL23/28
37	Circular – using road	1,455m	WL23/28 – WL23/25 – Shurton Lane (145m) – WL23/23 – WL23/24 – WL23/28
38	Circular – using road	1,302m	WL23/25 – WL23/24 – Shurton Lane (495m) – WL23/28 – WL23/25
39	Circular – individual	1,277m	WL23/24 – WL23/25 – WL23/28 – WL23/24
40	Circular – using road	977m	WL23/54 – Shurton Lane (635m) – WL23/55 – WL23/54
41	Circular – using road	1,174m	WL23/25 – Shurton/Burton Lane (655m) – WL23/24 – WL23/25
42	Circular – using road	1,002m	WL23/41 – Tower Hill (215m) – Shurton/Burton Lane (295m) – WL23/25 – WL23/41
43	Circular – using road	1,599m	WL23/27 – Tower Hill (330m) – WL23/41 – WL23/25 – WL23/24 – WL23/29 – WL23/27
44	Circular – individual	1,150m	WL23/27 – WL23/29 – WL23/24 – WL23/28 – WL23/27
45	Circular – using road	984m	WL23/111 – Shurton/Burton Lane (295m) – Tower Hill (235m) – Track (195m) – WL23/111
46	Circular – using road	1,180m	WL23/111 – Track (195m) – Tower Hill (405m) – Track (135m) – WL23/30 – WL23/111
47	Circular – using road	634m	WL23/29 – Tower Hill (270m) – WL23/27 – WL23/29
48	Circular – using road	973m	WL23/29 – WL23/27 – Tower Hill (330m) – WL23/29
49	Circular – using road	1,354m	WL23/27 – WL23/28 – WL23/24 – WL23/23 – Tower Hill (300m) – WL23/27

APPENDIX 25D: PROW WITHIN OR ADJACENT TO OFF-SITE HIGHWAYS IMPROVEMENTS SITES

APPENDIX 25D: PROW WITHIN OR ADJACENT TO OFF-SITE HIGHWAYS IMPROVEMENTS SITES

Highways Site	PRoW Presence
A38 Bristol Road / The Drove (see **Figure 25.6**)	BW38/1 – 100m outside the works area. BW38/2 – 480m outside the works area. BW38/4 – 420m outside the works area.
A38 Bristol Road / Wylds Road Junction (see **Figure 25.6**)	BW10/12 – 100m outside the works area. BW38/2 – 30m outside the works area. BW38/3 – 380m outside the works area. BW38/5 – 300m outside the works area.
A38 Bristol Road / Northern Distributor Road (NDR) Junction (see **Figure 25.6**)	BW38/1 – 50m outside the works area. BW38/2 – 440m outside the works area. BW38/4 – 280m outside the works area.
The Drove / Wylds Road Junction (NDR) (see **Figure 25.6**)	BW10/12 – 300m outside the works area. BW38/1 – 160m outside the works area. BW38/2 – immediately outside the works area. BW38/3 – 70m outside the works area. BW38/4 – 440m outside the works area. BW38/6 – 170m outside the works area. BW38/7 – 300m outside the works area. BW38/8 – 440m outside the works area. BW38/9 – 490m outside the works area.
A38 Taunton Road / A39 Broadway Junction (see **Figure 25.6**)	BW38/3 – 420m outside the works area. BW38/9 – 170m outside the works area. BW38/21 – 310m outside the works area. BW38/25 – 190m outside the works area. BW38/26 – connects to pavement within the works area. BW38/27 – 220m outside the works area. BW38/29 – 390m outside the works area.
A39 New Road/B3339 Sandford Hill Roundabout (see **Figure 25.7**)	BW34/20 – 490m outside the works area. BW34/21 – 330m outside the works area. BW34/22 – 490m outside the works area. BW34/23 - connects to site boundary.

Highways Site	PRoW Presence
M5 Junction 23 (see **Figure 25.8**)	BW28/3 - connects to pavement at the southeast end of the roundabout. BW28/4 – 50m outside the works area. BW28/5 – 120m outside the works area. BW28/6 - runs underneath the western end of the roundabout. BW28/7 – 180m outside the works area. BW28/9 - 160m outside the works area. BW28/11 – 180m outside the works area. BW28/13 (bridleway) – 270m outside the works area. BW28/15 – 220m outside the works area. BW28/UN (bridleway) – 120m outside the works area.
Washford Cross Roundabout (see **Figure 25.9**)	WL28/13 – 450m outside the works area. WL28/14 – 120m outside the works area.
Claylands Corner Junction (see **Figure 25.10**)	BW32/4 - connects to pavement within site boundary. BW32/7 – 370m outside the works area. WL23/88 – 310m outside the works area.
C182 / Farringdon Hill Lane, Horse Crossing (see **Figure 25.11**)	WL23/15 - connects to site boundary. WL23/57 (restricted byway) – 300m outside the works area. WL23/59 – 440m outside the works area. WL23/61 – 340m outside the works area. WL23/62 – 340m outside the works area. WL23/63 – 500m outside the works area. WL23/67 – 70m outside the works area.
Cannington Traffic Calming Measures (see **Figure 25.12**)	BW5/1 – connects to highway pavement. BW5/2 – 90m outside works area. BW5/3 – connects to highway pavement. BW5/4 – connects to highway pavement. BW5/5 - 220m outside works area. BW5/5A – connects to highway pavement. BW5/8 - 240m outside works area. BW5/16 – connects to highway pavement. BW5/22 – 230m outside works area. BW5/24 – 230m outside works area. BW5/25 – 60m outside works area. BW5/26 – 260m outside works area. BW5/27 - 260m outside works area. BW5/32 – 20m outside works area. BW5/33 – 50m outside works area. BW5/34 – 360m outside works area.
Huntworth Roundabout (see **Figure 25.13**)	BW23/4 - 490m outside works area. BW23/69 – 470m outside works area.

APPENDIX 25E: PROPOSED PROW MITIGATION AND ENHANCEMENT MEASURES AGREED UNDER SECTION 106 WITH SOMERSET COUNTY COUNCIL

APPENDIX 25E: PROPOSED PROW MITIGATION AND ENHANCEMENT MEASURES AGREED UNDER SECTION 106 WITH SOMERSET COUNTY COUNCIL

Table 1: Priority enhancement actions proposed from commencement of construction (see **Figures 25.17** and **25.18**)

Reference	Action	Length
1b-1	Resurfacing (550m) of PRoW WL24/7	550m
1b-2	Resurfacing Lilstock Car Park	$512m^2$
1b-3	Resurfacing (840m) of PRoW WL23/45 (Bullen Drove) and part of PRoW WL23/43 north of Bullen Drove PRoW to include verge side parking	840m
1b-4	Provision of 2 pedestrian gates, 2 small footbridges, and 3 waymarks along PRoW WL23/21	223m
1b-5	Provision of 4 pedestrian gates and 2 waymarks along PRoW WL23/55	305m
1b-6	Provision of 5 pedestrian gates, 1 footbridge, and 4 waymarks along PRoW WL23/59	760m
1b-7 & 1b-11	Provision of 4 pedestrian gates, 1 small footbridge, and 3 waymarks along PRoW WL23/44 (including part of WL23/42)	756m
1b-8 & 1b-11	Provision of 1 pedestrian gate and 1 waymark along PRoW WL24/21 (including part of WL23/42)	528m
1b-9 & 1b-10	Provision of surface improvements (950m), 7 pedestrian gates, 1 bridleway gate, 2 small footbridges, and 3 waymarks along PRoW WL23/61	1,679m
1b-12	Provision of 1 pedestrian gate at the southern end of the Development Site boundary on PRoW WL23/56 (to be carried out by EDF Energy)	185m

Table 2: Enhancement actions proposed from commencement of construction (see **Figures 25.17** and **25.18**)

Reference	Action	Length
2-1	Upgrade the permissive path from PRoW WL24/10 (Range Quadrant Hut) to WL11/22 to PRoW (footpath) also requiring 7 pedestrian gates and 2 waymarks	+2,388m
2-2	Create a new bridleway along Woolstone Lane also requiring 2 bridleway gates and 1 waymark	+620m
2-3	Diversion of PRoW WL23/43 north of WL23/110 to WL23/95	Decrease by 230m
2-4	Provision of surface improvements (470m), 4 bridleway gates, 1 small footbridge, and 1 waymark along PRoW WL23/71	1,102m
2-5	Diversion of PRoW WL23/95 from WL24/9 to WL23/43 (new junction) requiring 2 waymarks	+1,115m
2-6	Accommodation works along PRoW WL23/95 from WL23/61 to WL23/102	1,796m
2-7	Accommodation works along PRoW WL23/102	114m
2-8	Upgrade PRoW WL23/106 to bridleway also requiring 2 waymarks	+529m
2-9	Diversion of West Somerset Coast Path (WL24/9)	720m
2-10	Benhole Lane to Burton-Shurton Road (WL23/48) diversion of southern end onto alternative route created during construction to connect to Burton-Shurton Road	Decrease by 340m
2-11	Diversion of PRoW WL23/52, and surface works, two pedestrian gates, and two waymarks	+279m
2-12	Upgrade PRoW WL23/61 to bridleway, from WL23/71 north to WL23/95	+440m
2-13	Upgrade PRoW WL23/71 to bridleway	+1,102m
2-14	Upgrade PRoW WL23/102 to bridleway	+87m
2-15	Upgrade PRoW WL23/95 to bridleway from WL23/61 east to WL23/102	+1,669m

Table 3: Reinstatement of PRoW (including permanent diversions) to be carried out at the end of construction of Hinkley Point C (see **Figure 25.18**)

Reference	Reinstatement Action	Length
3-1	Permanent diversion of altered route of PRoW WL23/48 from WL23/110 north to WL23/95 along western bund	831m
3-2	Reinstate diverted route of PRoW WL23/110	1,070m
3-3	Upgrade part of PRoW WL23/110 (diversion) to bridleway	380m
3-4	Reinstate route of PRoW WL23/56 from WL23/110 to reconnect with WL23/56 to the south of the construction area; route would follow a line proposed by Somerset County Council, and will incorporate pedestrian gates and waymarks where required	836m
3-5	Create new PRoW bridleway from WL23/56 and connect to WL23/110	450m
3-6	Upgrade PRoW WL23/56 from 3-5 to 3-8, to bridleway status	637m
3-7	Reinstate diverted route of PRoW reference WL23/69; route would follow a line proposed by Somerset County Council, and will incorporate pedestrian gates and waymarks where required	991m
3-8	Create permanent PRoW (bridleway) from Shurton Lane (entrance to the Emergency Access Road) to C182	1,063m
3-9	Create permanent PRoW from WL23/48 to PRoW created for Action Reference 3-8	250m

APPENDIX 27A: COMMUNITY IMPACT REPORT

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FIGURES

APPENDICES

FOREWORD

This report provides a summary of the community impacts arising from the Hinkley Point C (HPC) Project.

The report draws upon the extensive Environmental Impact Assessment (EIA) and other assessments which form part of the HPC Development Consent Order (DCO) application to the Infrastructure Planning Commission (IPC). It does not contain new evidence or assessments.

The report is distinctive, however, in reporting those impacts as they affect individual communities, or groups of communities. For example, in relation to Bridgwater it brings together and reviews the principal impacts affecting the town that are otherwise set out in a range of assessments such as the **Transport Assessment**, the **Socio-economic Assessment**, the Noise or other chapters of the Environmental Statement. In this way, communities and other interested parties can gain an understanding of the principal impacts on their areas.

In the same way, the report also brings together the mitigation proposed in the application as it affects those communities.

The intention of the report is to provide an understanding of how particular communities are likely to be affected by the HPC project.

1. COMMUNITY IMPACT REPORT

1.1 Introduction

1.1.1 The proposed Hinkley Point C Project (the HPC Project) would be one of the largest construction projects in the UK. It would also be the first of a new generation of nuclear power stations which are necessary if the UK is to meet its energy needs and to do so in a way which is consistent with challenging targets for climate change mitigation. Its scale and characteristics suggest that it may have the potential to both bring significant benefits and to cause significant impacts over a wide area but, particularly, in the districts of West Somerset and Sedgemoor.

1.1.2 Those benefits and impacts are comprehensively assessed in a range of documents which support the application to the Infrastructure Planning Commission (the IPC) for a Development Consent Order (DCO). In particular, the application includes a comprehensive Environmental Impact Assessment (EIA), **Transport Assessment**, **Economic Strategy**, **Planning Statement** and a number of other supporting documents. The EIA includes a comprehensive **Cumulative Impact Assessment**.

1.1.3 It is also relevant, however, to consider the effects of the HPC Project on a spatial scale, i.e. to consider what the effects of the project would be on the individual communities which might be most affected by the HPC Project.

a) Study Areas

1.1.4 This report considers the principal effects of the HPC Project on those communities which have the potential to be most affected. Assessment areas are based on administrative boundaries, parishes for rural areas and wards or groups of wards/town council areas for urban areas. These have been the basis for assessments undertaken both by EDF Energy and by the local councils. Two criteria have been used to identify the areas to be studied, as follows:

- those communities which host either the main HPC development site or one or more of the proposed associated development (AD) sites, or where traffic impacts are likely to occur on public highways; and
- those areas slightly further afield where the assessments suggest that there may be a concentration of more than 100 non-home based workers drawn to the area to work on the HPC Project during its construction.

1.1.5 The combination of these two criteria means that the following areas have been selected for study:

- Stogursey Civil Parish (CP) – includes settlements of Shurton, Burton, Knighton, Wick and Stolford (HPC development site);
- Bridgwater CP (Associated developments: Bridgwater A and Bridgwater C accommodation campuses) and Bridgwater ward cluster;
- Cannington CP (Associated developments: Cannington bypass and Cannington park and ride);

- North Petherton CP (Associated developments: Junction 24 park and ride, freight management facilities and temporary postal courier consolidation facility and induction centre);
- Otterhampton CP (Associated developments: Combwich Wharf and freight laydown facility);
- Puriton CP (Associated developments: Junction 23 park and ride facility, freight management facility, consolidation facility for postalcourier deliveries and induction centre);
- Williton CP (Associated developments: Williton park and ride facility);
- Burnham and Highbridge (ward cluster);
- Minehead (ward cluster);
- Taunton (ward cluster); and
- Weston-super-Mare (ward cluster).

1.1.6 Between them, these areas include all areas where there is a direct physical impact of the HPC Project but also include the areas where the most significant transport or socio-economic effects might arise.

1.1.7 **Figure 27A.1** outlines the 'ward clusters' that have been derived from the Gravity Model, which compartmentalises the likely distribution of non-home-based workers across an area within 60 minutes travel distance from the Hinkley Point C site.

1.1.8 **Figure 27A.2** to **27A.8** show the spatial areas identified in the list above (Civil Parishes), covering local areas of Stogursey, Bridgwater, Cannington, North Petherton, Otterhampton, Williton and Puriton, including elements of the HPC development relevant to those areas.

b) Approach

1.1.9 The impacts which are described in this report are drawn directly from the other assessments undertaken to support the DCO application. This report does not repeat the findings of these assessments, therefore, an explanation of the baseline conditions or of the methodology which has been employed in order to determine the likely significant effects of the HPC Project are comprehensively set out elsewhere.

1.1.10 Instead, it concentrates on reporting the principal assessed effects as they would impact on the communities that have been studied.

1.1.11 It is important to make clear that this is not intended to be a full summary of the EIA or the other assessments. It is intended, however, to accurately reflect the principal effects of the HPC Project on individual communities.

1.1.12 The report concentrates only on principal effects. The nature of these effects inevitably varies between communities. For some, for instance, the visual impact of the proposed elements of the HPC Project is important. For others, different impacts may be important such as transport, accommodation impacts or other impacts such as education or leisure. For each community, the report draws upon the assessments to bring together the most relevant effects.

1.1.13 From this report, therefore, the reader will be able to understand the nature and the significance of the project's effects on individual communities. It may help, however, for the reader to have some more context about the HPC Project as a whole. For this purpose, **Appendix A** comprises Section 3 of the **Planning Statement** which is submitted with the Development Consent Order (DCO) application. The appendix explains EDF Energy's overall approach to the project, the strategies which have been put in place to manage transport, accommodation and other effects and it provides a brief description of the principal elements of the HPC Project, i.e. the development of the HPC development site itself and the development of locations for associated development. The associated development sites provide transport or accommodation facilities to support the HPC Project and to enable its effects to be managed and reduced.

c) Mitigation

1.1.14 In order to further limit and mitigate the potential adverse effects of the HPC Project, a series of mitigation measures are proposed. Where these relate to effects on individual communities, they are described in this report. It is appropriate, however, to set out some of the wider mitigation proposals which are relevant across the project as a whole because these have an effect wherever the HPC Project impacts fall. Again, a more detailed explanation is provided in Sections 7 to 9 of the **Planning Statement** but a summary of the principal mitigation obligations proposed as part of the DCO application is contained in **Appendix B**.

1.1.15 It may be helpful, however, to summarise some of the more relevant elements of the proposed mitigation strategies here, as they are relevant to each of the communities affected.

d) Accommodation

1.1.16 At the peak of construction, it is estimated that the HPC Project would require 5,600 workers. Through commitments to local education, training and recruitment, EDF Energy anticipates that 34% of the peak construction workforce would be recruited locally (i.e. from residents who would not need to move home in order to work at Hinkley) but that 66% or 3,700 workers would come into the area and require accommodation.

1.1.17 In order to estimate where these workers may live, a Gravity Model has been developed which takes account of journeys to Hinkley and the availability of accommodation. In this way, estimates have been made of the numbers of workers that would be likely to seek temporary accommodation within different towns and villages. The demand generated by Hinkley should bring benefits for the local housing sector and the tourist/bed and breakfast market. A significant number of people have also registered their interest in letting out rooms to Hinkley workers.

1.1.18 Nevertheless, it is possible that adverse effects could arise if there is too great a concentration of demand in one place or if the overall demand affects prices or disadvantages those who are less able to compete in the housing market. Accordingly, EDF Energy has proposed a series of mitigation and management measures including:

- 1,510 workers' campus spaces are to be provided on the HPC development site and at two sites in Bridgwater (Bridgwater A and C);

- An Accommodation Management Strategy is proposed, which would match workers with available accommodation and monitor any adverse effects. The Accommodation Management Office would have the ability to direct workers away from areas where too high a concentration of workers might begin to impact adversely on the housing market; and
- A Housing Fund of £5m is to be provided to the local authorities to assist with a range of initiatives targeting the low cost housing sector locally where housing impacts could have the most significant effect.

e) Leisure

1.1.19 The influx of workers into the area would generate increased demands for leisure facilities. At the same time, the development of the Bridgwater A campus would result in the loss of the former Innovia social club and playing fields. In order to address these effects, EDF Energy proposes the following commitments:

- £250,000 towards the provision of new or improved sports and leisure facilities within West Somerset;
- £500,000 towards providing new or improved sports and leisure facilities within the parish of Stogursey;
- £250,000 as a contribution towards the new swimming pool under construction in Bridgwater;
- £500,000 to provide new or improved sports and leisure facilities within Bridgwater;
- £500,000 to provide new or improved sports and leisure facilities within Cannington; and
- EDF Energy would also make available to the public the sport pitches proposed as part of Bridgwater A, Bridgwater C and HPC development site (on-site) accommodation campuses.

f) Public Services

1.1.20 EDF Energy is providing funding to meet the WSC, SDC and SCC's costs in addressing all of the planning issues raised by the HPC Project.

1.1.21 In addition, particular attention has been paid to the impact on public services such as education and health to ensure that the HPC Project pays for any increased costs on those services.

1.1.22 In relation to education, EDF Energy is committed to a programme in local schools which would help to educate and inspire children in subject areas such as science and technology. Commitments are being made to new training facilities for West Somerset Community College and investment is committed into the Energy Centre at Bridgwater College as well as funding being provided for a new Construction Skills Centre on land immediately north of Cannington. In addition, in order to mitigate potential impacts arising from workers' children coming to the area, EDF Energy proposes:

- £610,000 towards new or improved classrooms in Cannington and Bridgwater;

- funding a teaching post for five years to oversee the integration of Hinkley workers' children into local schools; and
- a funding formula based on existing Council policy to meet costs if the demand for Hinkley workers' children to be educated exceeds the capacity of local schools.

1.1.23 In relation to health, EDF Energy has contracted with a company called Duradiamond to operate medical facilities at HPC and to meet the large majority of the health requirements of HPC workers. Further commitments are made to meet any additional costs on the local health services arising from any need for construction workers to use local health services including, for instance, ambulance call out costs.

1.1.24 As part of the site preparation Section 106 Agreement, EDF Energy committed to fund a Hinkley Readiness Study for £60,000 which would enable the health services to prepare properly for the Hinkley Point C development. As part of the DCO Section 106 Agreement, EDF Energy intends additionally to commit to:

- A formula to fund ambulance call out costs, estimated to be in the region of £134,000;
- A formula also to cover the potential cost of additional NHS referrals from construction workers, estimated to cost £50,460; and
- A phased payment of £604,990 to the Primary Care Trust to address any additional costs of dealing with the health requirements of workers families – even though those families are expected to take up existing housing accommodation.

g) Community Safety

1.1.25 **Appendix B** includes a schedule which sets out a range of commitments which EDF Energy is making to the Emergency Services and other providers to ensure that they can provide an appropriate service to the HPC Project and to the community in relation to any matters associated with the HPC Project. The principal measures that would be put in place to ensure community safety include:

- **A Worker Code of Conduct**.
- Contingency Response Arrangements and any necessary training for the relevant services.
- Funding a local Community Safety Beat Team within the police service.
- Funding the Community Safety staff at West Somerset and Sedgemoor District Councils and Somerset County Council in order to enhance liaison between parishes, HPC, community partnerships and the Emergency Services.
- Funding two community outreach workers and one young person support worker to work with traditionally hard to reach groups in order to encourage them to engage with the training and employment opportunities available through the HPC Project.

h) Community Impact Fund

1.1.26 In recognition that it is unlikely to be possible to mitigate all impacts of the development directly, EDF Energy has proposed a Community Impact Fund of £20 million in order to address the effects of residual impacts which are not so easily defined. These less tangible impacts might be described as impacts on the "quality of life" of local communities.

1.1.27 Accordingly, it is intended that the Community Impact Fund is available for communities to submit bids for projects which enhance the local quality of life. An initial down payment from the Fund is proposed as part of the planning consent for the Site Preparation Works but the Fund as a whole would be available over the life of the construction programme.

i) Highway Improvements and Transport Strategy

1.1.28 A comprehensive transport strategy is proposed to reduce and manage traffic impacts of the development. The strategy seeks to maximise the use of sustainable modes of travel. For construction materials, therefore, investment is proposed into a temporary jetty at the HPC development site and into improvements to the wharf facilities at Combwich so that a significant proportion of abnormal indivisible loads (AILs) and bulky construction materials can arrive by sea. Freight management sites are also proposed so that heavy goods vehicle movements can be limited in the peak hours. A comprehensive bus strategy is also proposed, based on direct buses from the accommodation campuses in Bridgwater and main centres of population, from four park and ride sites and direct bus services from accommodation campuses. In this way, traffic impacts are limited but there would still be a substantial change in traffic flows on certain routes. The proposals also include the provision of a bypass around Cannington village, to the west, which would direct construction traffic away from Cannington village at the peak of the construction phase (in 2016).

1.1.29 As part of the proposed HPC Project, several highway improvement schemes (including modification to existing alignments and junctions/roundabout arrangements, and enhanced safety measures) are proposed to existing public highways. The proposed schemes would comprise:

- A38 Bristol Road/The Drove Junction – small increase in the width of the highway to improve the operation of the junction, through increasing the width of the right turn lane from Bristol Road into the Drove to reduce queuing.
- A39 Broadway/A38 Taunton Road Junction – changes to signal arrangements, minor carriageway realignments to improve operation of the junction and pedestrian facilities.
- A38 Bristol Road/Wylds Road Junction – increase in width of carriageway and right turn lane to assist right turns and reduce queuing.
- Wylds Road/The Drove Junction - carriageway widening to Wylds Road, The Drove and East Quay at approaches to the junction and provision of a left-turn slip road from Western Way into Wylds Road to improve operation of the junction.
- A39 New Road/B3339 Sandford Hill Roundabout – new four arm roundabout to improve safety of junction including minor realignment of existing carriageway.
- M5 Junction 23 Roundabout – provision of signalisation and minor carriageway alterations within highway land to improve operation of roundabout and minor improvements to road markings at Dunball roundabout.
- Washford Cross Roundabout – new four arm roundabout to improve safety of junction.

- Claylands Corner Junction – minor carriageway widening to improve operation of the junction.
- C182 Farringdon Hill Lane, Horse Crossing – provision of horse crossing to improve safety for horses and riders.
- Cannington Traffic Calming Measures – traffic management measures including skid resistant surfacing, 20 mph speed limit, new puffin crossing on High Street, new footway on High Street, new zebra crossing on Rodway and associated signage.
- Huntworth Roundabout – increase in width of eastern arm of roundabout to reduce queuing, amendments to white lining to improve circulation and provision of signage.

1.1.30 All of these wider strategies, therefore, provide an important context within which to consider the specific impacts of the HPC Project on individual communities.

1.1.31 An overarching **Framework Travel Plan** has been prepared to support of the DCO application and considers the management and movement of people involved in the construction and operation of the proposed development. Site-specific Travel Plans would be prepared for the HPC development site, for the associated development sites and for the operational phase of the HPC power station. These Travel Plans would encourage the overall modal share to be sustainable, and concentrate on areas where there could be further improvements (walking and cycling, public bus to park and ride sites, car sharing and rail use).

1.1.32 A Transport Co-ordinator would be appointed by EDF Energy and be in place throughout the construction and early operational phases of HPC. They would be responsible for the management, development and implementation of the Travel Plans for the duration of the HPC Project. Additionally, a Transport Review Group would be established with members of the key transport stakeholders and EDF Energy, and a separate Transport Forum, a body of town and parish councillors, would represent the views of the local community.

1.1.33 A range of measures have been developed to promote and facilitate the use of sustainable modes of travel wherever possible. Some of these measures are more prescriptive and would be delivered as part of the transport strategy for the HPC Project, whilst other softer measures are set out within the **Framework Travel Plan**. They include:

- a bus fleet funded by EDF Energy to transport workers to and from the HPC development site including direct bus services, park and ride bus services and campus bus services, the services would be free to workers (transport strategy);
- a strict requirement that workers would only use the mode of transport allocated to them be it direct bus, campus bus or park and ride bus (transport strategy);
- constraining and controlling on site parking to essential workers and visitors only (transport strategy); and
- the promotion of viable sustainable transport options such as walking, cycling, public bus and rail through encouragement, and provision of information and incentives as appropriate (Travel Plan).

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2. STOGURSEY/HINKLEY POINT C

2.1 Introduction

2.1.1 Hinkley Point is located on the north Somerset coast, in a relatively remote area to the east of West Somerset, in Stogursey Civil Parish. As the host of the HPC development site, Stogursey would experience a number of impacts throughout the construction, operational and post-operational phases of the development. These would include the direct impacts of construction activity and impacts on local villages and road networks related to construction traffic. The scale of the development itself would significantly affect the character of the areas closest to the HPC development site and there may be effects from the influx of construction workers to the area.

2.2 Context

a) Local Area and Community Impacts

2.2.1 The HPC development site is in the east of West Somerset District. The site is in Quantock Vale ward and Stogursey Parish, which is a rural parish comprised of Stogursey itself and a series of small hamlets, of which Shurton, Burton, Knighton, Wick and Stolford are the closest to the HPC development site.

2.2.2 The population of the area is around 1,270 (parish) or 2,100 (ward), and has a relatively old age profile compared to the national average, with the proportion of over 65's having grown significantly since 2001. There are around 600 homes in the area. In economic terms, the area has a low benefit claimant rate, although it has a high proportion of retired residents, low unemployment and does not suffer from high levels of deprivation. It is an attractive rural area.

2.2.3 Within the Stogursey area, the main HGV route from the M5 motorway via Bridgwater and Cannington (the C182 (Rodway)) runs past Combwich via Withycombe Hill to Wick Moor Drove, through to Hinkley Point.

2.2.4 The elements of the HPC Project anticipated to result in impacts on the community in Stogursey are:

- the proximity of the HPC development site, resulting in construction traffic and large scale on-site construction-related activity during the construction period;
- the proposed on-site accommodation campus for non-home-based construction workers; and
- the physical presence and operation of the power station through its estimated 60 year life until it is decommissioned and the land restored.

2.2.5 Indirectly, there could also be effects on local residents and users of community facilities and public services. Quantock Vale has a number of basic sports facilities, predominantly based in community halls. These are principally clustered around Holford and Kilve, outside the Stogursey parish. There is one primary school within the parish (with 21 surplus places). The general amenity of the area could be affected by the adverse impacts of the development on traffic, visual amenity, noise levels and recreation. The construction of the power station would also impact on a number of local rights of way in addition to the long distance coastal path.

2.2.6 **Figure 27A.2** shows a plan of the parish, including elements of the HPC project in the local area.

b) HPC Accommodation Campus

2.2.7 The nature of the HPC Project is such that associated development is required to support the construction phase – in this case an accommodation campus for up to 510 construction workers is proposed on the HPC development site during construction and would be removed after the construction phase of the HPC Project is complete.

2.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

2.3.1 The ward that includes the settlements listed above closest to Hinkley Point has a total population of around 2,100 people, and due to the presence of an on-site accommodation campus is forecast to accommodate around 510 construction workers at peak construction (in 2016), which is around nearly four times the average annual number of new residents in the area.

2.3.2 In terms of accommodation capacity in the local area, the overall increase of 510 people referred to above is based on an assumed 97% occupancy of the on-site accommodation campus to account for short-term stays and turnover of residents, which accounts for around 495 of the workers, with a remainder of around 15 construction workers requiring accommodation in other sectors in the area. In Stogursey Parish, immediately adjacent to Hinkley Point, the main direct socio-economic impact would therefore be from the on-site accommodation campus.

2.3.3 This equates to a significant population increase and, therefore, concerns about impacts of non-home-based construction workers on the supply of accommodation, public safety, community cohesion, the provision of services, movement of workers on local roads for leisure/recreation and the capacity of community facilities have been raised in consultation.

2.3.4 The 15 non-home-based construction workers which are estimated to be drawn to the local area but not to be staying in the accommodation campus are anticipated to be split between different types of accommodation (private rented (c.10), tourist (c.<5), owner-occupied (c.5). Using conservative estimates this is identified as being within existing capacity of local accommodation, taking into account turnover and vacancies.

2.3.5 EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce and accommodation management measures and the commitments outlined in Section 1 of this report. The number of workers attracted to seek accommodation in Stogursey should be regulated by the available supply, and the primary option would be for placement in the on-site accommodation campus, before consideration of other sectors. The campus would play a significant part in limiting the impact that might otherwise arise from large numbers of workers seeking accommodation very close to the HPC development site. The accommodation office for the HPC Project would have the ability to direct new applicants away from the area if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit Stogursey and its residents in the event that any problems occur.

2.3.6 Similar issues arise in relation to education. Workers resident in Stogursey may seek to place their children in the local primary school, although only a small proportion of workers are expected to bring children. In 2010/11 the school had spare capacity of 21 places, which would provide adequate capacity at peak construction. There may be some benefit from workers' children supporting the school.

2.3.7 The wider mitigation strategies outlined in Section 1 address other impacts on health and public services.

2.3.8 In terms of community cohesion, it is recognised that a concentration of worker population could have an impact on the quality of life of some residents for example in terms of perceptions of community safety, impacts or perceived impacts on access to public services and community facilities.

2.3.9 It is not possible to quantitatively assess the extent to which workers living on the on-site accommodation campus would seek to use facilities in the nearby villages. However the design and operation of the campuses has taken into account the lessons from previous experience of Sizewell B with facilities on site and direct bus services to the larger settlements to limit impacts on the immediate area.

2.3.10 The on-site accommodation campus has been located in an area as far north as possible, away from Shurton. EDF Energy recognises the concerns of some in the local community regarding an on-site accommodation campus and has proposed a number of mitigation methods to address them.

2.3.11 The accommodation campus layout has been designed to reduce potential noise, light and visual impacts on the local community. The quieter, residential buildings have been positioned along the southern boundary of the site and the recreational facilities have been positioned to the north of the campus development, at the furthest point from Shurton village. There is no direct pedestrian access or road to the village of Shurton and access would only be obtained from Wick Moor Drove, the main access point. This would ensure that the development includes effective measures that prevent unofficial shortcuts from the site to Shurton and Stogursey.

2.3.12 A Main Site Neighbourhood Support Scheme has been established which recognises that hamlets in the immediate vicinity of HPC (Shurton, Burton, Knighton, Wick and parts of Stolford) would be affected by a unique combination of issues throughout the duration of the construction period. The Scheme contains elements to mitigate potential effects of noise and property value impacts that may arise. This includes a property price support scheme to assist residents who wish to move away and a noise insulation scheme that offers properties double glazing and ventilation.

2.3.13 A Code of Conduct, attached as an Appendix to the **Community Safety Management Plan,** has been written to set expectations of how workers use accommodation and the way they interact with the local community, and would:

- communicate the behaviour expected of workers and outline the means by which the Code would be communicated to all workers;

- outline the role of employers;
- outline the monitoring mechanism for the Code during the construction works; and
- inform the community of the standard of behaviour they should expect from workers and their employers.

2.3.14 The potential for adverse health impacts has been addressed in the **Health Impact Assessment**, which has been informed by a survey of local residents to understand concerns about the possible effects of the development. Based on the level of emissions (air and noise) generated on site, their intermittent nature and duration and minimal opportunity for community exposure, the risk to community health is not assessed to be of a level to quantify any meaningful adverse health outcome, and would be further managed through a range of controls on the construction of HPC which are set out in the **Environmental Mitigation Management Plan (EMMP)** and related subject-specific management plans.

2.3.15 Once the HPC power station is operational, there are few activities with the potential to affect the health of local communities. The core community concern is the potential risk from radiological exposure. However, following a review of the available scientific evidence and a detailed radiological assessment, EDF Energy's assessment is consistent with that undertaken by the Government that, for an individual living near to Hinkley Point, the direct health risk from radioactivity to the environment would be low, and is well within International Commission on Radiological Protection (ICRP) guidelines set to protect health. EDF Energy recognises that regular communication is an important means of reducing concerns.

2.3.16 Specific mitigation and community support initiatives within the **Health Action Plan** are targeted to benefit the local communities surrounding the HPC development site and off-site associated development sites based on the demographic information contained within the community profile and feedback from consultation events. Mitigation includes continued communication, information provision and liaison to further reduce concerns, and where necessary support local communities. To address the possible perception of a change in the local environment, local hamlets would be supplied with monitoring data for air quality and noise compared against the modelling data contained in the ES.

2.3.17 In addition, a number of the project-wide mitigation proposals have a particular significance for Stogursey. In addition to the Main Site Neighbourhood Support Scheme, the mitigation proposals include:

- an investment of £500,000 in new or improved leisure and recreation facilities in the parish; and
- £500,000 from the Community Impact Fund is "ring fenced" for Stogursey Parish, for projects to enhance the local quality of life and the parish would be able to bid for further funds over the length of the construction period.

b) Transport

2.3.18 The main access road serving the existing Hinkley Point Power Station Complex is the C182 (Rodway), which is a single carriageway road passing from Hinkley Point south-east to the village of Cannington. The C182 (Rodway) routes to the east of

Shurton and to the west of Combwich and passes through the centre of Cannington to join the A39 to the south of the village.

2.3.19 Given the location of nearby villages to the key HGV route (the C182 (Rodway)) and HPC, the general area is likely to experience impacts related to traffic flows, and subsequent community impacts related to air quality, noise and vibration and visual amenity. The C182 (Rodway) is an important route for the community to access the main road network, Bridgwater and larger settlements and it would be a much busier route throughout the construction period. That said, increases in traffic flows on the C182 will not be of a scale that will create any issues of traffic congestion.

2.3.20 Unlike impacts in Cannington and Bridgwater, the local route in Stogursey would also experience increased flows of HGVs as a result of movements of HGVs between the Combwich freight laydown facility and the HPC development site as well as less frequent movement of Abnormal Indivisible Loads (AILs) from Combwich to the HPC development site.

2.3.21 The HPC transport strategy for the HPC Project limits these flows as far as possible by using Combwich Wharf for the water-borne delivery of AILs and bulky construction goods; using the temporary jetty to bring bulk concreting materials to the site by sea, by restricting car parking on the HPC development site, reducing trips by private car through consolidating trips at the proposed park and ride sites at Cannington, Williton, Junction 23 and Junction 24, and by managing HGV movements to limit impacts on the peak hours. Nevertheless the change in flows on the C182 (Rodway) would be significant throughout the construction phase. Measures are proposed to limit HGVs to the C182 (Rodway) locally to protect the amenity of the rural areas to the west.

2.3.22 Specific local junction improvements are proposed as part of a highway improvement package to be implemented in conjunction with the HPC Project. These works comprise minor junction realignment at Claylands Corner, approximately 500 metres east of Hillside Farm and 2km to the east of Stogursey. The works would comprise:

- minor widening at eastern edge of carriageway opposite junction;
- relocation of existing give-way line, approximately 2 metres to east;
- minor relocation of kerb line to edge of carriageway by approximately 1m;
- widened carriageway strip to be finished in tarmac to match existing;
- finish with new edging strip; and
- provision of various new signage.

2.3.23 In addition, to address effects on the C182 (Rodway) the following measures are proposed:

- Preparation of a scheme, and subsequent monitoring, to implement speed restrictions on the C182 (Rodway);
- a horse crossing at Farringdon Hill Lane to ensure the ability to cross the C182 (Rodway) safely at the busiest times for pedestrians and riders.

2.3.24 An assessment of the significance of the predicted increases in traffic as a result of the HPC Project is provided within **Volume 2, Chapter 10** of the **Environmental**

Statement and the **Transport Assessment**, (see **Annex 7** of the **Environmental Statement)**.

2.3.25 The scale of the increase in HGVs and buses on the C182 (Rodway), to the north of proposed Cannington bypass, in 2013, during the early construction phase of HPC, is predicted to increase from 206 HGVs/buses (2-way daily flows) in the Reference Case (existing flows, plus committed development plus background growth) scenario to 1,483 HGVs/buses with the HPC Project (including the mitigation package described above). This is an increase of approximately 620% of existing HGV and bus flows on the C182 (Rodway), to the north of the proposed Cannington bypass, although overall daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would only increase by around 25% as HGVs and buses only make up a small proportion of overall traffic.

2.3.26 In 2016, the 2-way daily flows at the same assessment point are predicted to be 1,698 HGVs/buses with the HPC Project, an increase from 246 HGVs/buses in the Reference Case. This is equivalent to an increase of approximately 590% of existing HGV and bus flows on the C182 (Rodway), to the north of the HPC development site. The above figures include existing and future road traffic associated with Combwich Wharf – including HGV movements between the Combwich freight laydown facility and the HPC development site - and is considered to be representative of the conditions likely to be experienced in Stogursey in 2016, when Combwich would be operational. Again overall increases in traffic flows as a result of the HPC Project (including mitigation) would be much lower at 24.1% in all vehicles on the C182 to the north of the proposed Cannington bypass.

2.3.27 In 2021, the 2-way daily flows on the C182 (Rodway) north of the bypass are predicted to decrease by around half from the 2016 peak to 773 HGVs/buses with the HPC Project, representing an increase from 218 in the Reference Case. This is equivalent to an increase of approximately 250% of existing HGV and bus flows on the C182 (Rodway), to the north of the HPC Project. Overall increases in traffic flows as a result of the HPC Project (including mitigation) would again be much lower at 15.2% on the C182 (Rodway) to the north of the proposed Cannington bypass.

2.3.28 The impact of these increases in traffic flows is assessed in relation to its impact on severance, pedestrian delay, pedestrian amenity, driver delay and accidents and safety. Severance is defined as perceived division that could occur within a community when it becomes separated by a major traffic artery and is therefore particularly relevant the consideration of impact on the community. The increases described above with regard to the C182 (Rodway), to the north of proposed Cannington bypass, in 2013, 2016 and 2021, is considered to be **moderate adverse** in terms of severance. For the other assessment criteria, the increase in total traffic does not meet the relevant thresholds and therefore the impact is considered to be **negligible,** with the exception of driver delay, which is considered to be **minor adverse** in 2013.

2.3.29 The character of the C182 (Rodway) through Stogursey would therefore experience a significant change as a result of HGVs and buses associated with the HPC Project. This would however only be temporary, throughout the course of the HPC Project, and would not persist following completion of the construction phase, when there would just be operational staff on the site. It is also relevant that the above figures are worst-case, particularly with regard to anticipated bus numbers. Timetables and routes have been developed for modelling purposes for the **Transport Assessment** to assess the worst-case impact that the provision of such services could have on the highway network. As the development progresses, EDF Energy would refine the bus services, routes and timetables to best serve the actual distribution of workers and this should enable the number of bus trips to be significantly reduced.

2.3.30 It is also relevant that the predicted increase in total traffic flows on the C182 (Rodway), to the north of the proposed Cannington bypass, is significantly lower than the predicted increase in HGVs and buses and is lower than 30% during all assessment years.

c) Noise and Vibration

2.3.31 The construction and operational phases of HPC are likely to result in local community impacts on residential properties and people using local amenity spaces, as a result of temporary HGV and bus traffic flow increases and construction-related noise during set hours.

2.3.32 Construction activity is to be concentrated north of grid line 144750mN, as far away from residents of Doggetts, Shurton and Burton as practical. The greatest potential for impact is from short-term construction activities associated with the construction of the emergency access road and early landscaping close to the southern site boundary, resulting in a noise increase at the nearest residential dwellings (related to construction traffic and works).

2.3.33 During short-term activities associated with construction of the emergency access road, close to Bishops Farm House, the daytime noise limit is likely to be exceeded.

2.3.34 Similarly, worst-case predicted noise levels during early landscaping and final landscaping operations at the closest approach to the southern boundary of the Southern Construction Phase Area (SCPA) are likely to exceed the adopted daytime noise limit at Doggetts. Due to their proximity to residential dwellings, these activities would be restricted to normal working daytime hours only. These occurrences would also be of short duration, and landscaping works early in the construction programme would help to reduce the noise impacts from the later works.

2.3.35 Whilst higher construction noise levels are expected at public amenity areas such as footpaths (West Somerset Coast Path and Benhole Lane) and open spaces (Pixies Mound), the overall significance of the disturbance caused to their users is likely to be lower than residential properties as the users would be transient and only in the area for a short period of time. A **minor** to **moderate adverse** impact is predicted, depending on the location along the Public Right of Way (PRoW).

2.3.36 The noise impact at the assessed residential receptor locations of all other construction activities associated with the HPC development site is assessed as being of **minor** to **moderate adverse** significance due to a combination of the additional distance attenuation and physical screening by the natural and formed topographical features. This assessment is applicable for both daytime and evening periods. Some activities could potentially result in more significant impacts at residential dwellings if undertaken at night (23:00-07:00hrs), notably, construction of the emergency access road and its bridge over Bum Brook, landscaping works south of the 144750mN site boundary, some activities associated with deep excavation works (rock ripping and crushing) and construction of the temporary accommodation campus. For this reason, these works would be prohibited during this period (23:00-07:00hrs) to minimise impacts to residential properties.

2.3.37 Potential noise impacts from the generation of road traffic on local public highways during HPC construction have been assessed. During this phase, without mitigation, **minor to moderate adverse** impacts would occur in 2016 (peak construction) along the main route connecting the Williton park and ride site with the HPC development site (through Stringston and Stogursey). This relates to noise from early morning and late evening minibus movements at the beginning and end of the principal shifts, for which the assessment assumes that all minibuses travelling between Williton and the HPC site will use this route. In reality, some of these services will route via the A39, through Cannington, with others (minibus only) travelling through Stringston and Stogursey to pick up construction staff that are resident there. Furthermore, given the relatively few houses that front directly onto this part of the road, the impacts would be limited.

2.3.38 Noise and vibration impacts from both on-site construction machinery and from construction vehicles on public highways has the potential to result in combined impacts at certain sensitive locations. Of the neighbouring residential dwellings, only Doggetts would be potentially affected by such in-combination effects, due to the relative short separation distance between the C182 (Rodway) (Wick Moor Drove) and construction works.

2.3.39 As part of the mitigation and control proposed, a **Noise and Vibration Management Plan** (**NVMP**) is to be implemented during construction. This plan includes a provision to continuously monitor noise levels at representative residential properties in the villages of Knighton, Shurton, Burton and Wick. In addition, residents would be able to contact a 24-hour noise complaints telephone number so appropriate mitigation steps could be investigated. In recognition of the overall scale of the proposed HPC development construction, EDF Energy has committed to the Main Site Neighbourhood Support Scheme which allows residential property owners in the villages of Shurton, Burton, Knighton, Wick and Stolford to apply for either secondary glazing or new double-glazing, with acoustic ventilation, to be fitted. These schemes are offered irrespective of the significance of the fact that the noise impacts are not forecast to be at a level that would normally trigger the need for insulation.

2.3.40 Once built, each UK EPR unit would undergo a commissioning phase which would result in short-term noise generation as machinery and processes are being tested. However, the significance of the potential noise impacts to residential and amenity receptors in Stogursey would be **minor adverse**.

2.3.41 Noise from the fully operational nuclear power station would also result in both continuous and intermittent noise generation. Whilst the noise levels from this phase would be significantly lower than during construction, noise impacts would be permanent. The assessment, using worst-case assumptions, determined that the predicted operational noise levels in Shurton, Burton and Knighton might be audible under certain meteorological conditions. However, the levels predicted would be below recommended guidelines values for the protection of amenity and the prevention of sleep disturbance. The operational impact on residential properties in Stogursey was therefore assessed as being of **minor adverse** significance.

2.3.42 Road traffic noise impacts on the C182 (Rodway) and Stogursey village once the site is operational would be of **minor adverse** significance.

d) Air Quality

2.3.43 The community impact in terms of air quality is anticipated to be in relation to dust and particulate emissions resulting from the HPC development site construction works, and off-site road traffic emissions linked to construction traffic.

2.3.44 The construction phase of Hinkley Point C is likely to result in impacts on properties close to the HPC development site, in terms of temporary reductions in air quality predominately from construction dust from on-site sources during particularly dust-generating construction activities.

2.3.45 Whilst the potential impact may vary throughout the various stages of the construction phase, the primary air pollution sources will be those typical of any industrial construction site that may cause dust and particulate matter to be emitted to the atmosphere. These sources relate to activities which will include (but not be limited to) earthworks; excavations, drilling and compacting; crushing and grinding and cement batching. This source will dominate the overall particulate concentrations at nearby receptors, with the contribution from the other sources being comparatively insignificant.

2.3.46 The potential for construction dust impacts at residential dwellings in proximity to the HPC development site will be limited to the period between 2011/2012 and late 2014, given that after 2014 the works with significant dust-generating effects would have been concluded, and the separation distance between the source and receptors will be at maximum.

2.3.47 The potential for construction dust impacts will be greatest at the time when an earth bund to the south of latitude 144750mN is being formed (2013 construction scenario). However, once the bund and early landscaping land profiling are completed, these works will result in an increase in the separation distance between potential dust generating construction activities and the human receptors during later construction phase works, thus having an overall effect of reducing potential long-term construction phase impacts. Similarly, whilst the on-site workers accommodation campus located in the south-east of the SCPA is being constructed during this phase, there is the potential for elevated construction dust levels to be experienced, particularly at the closest residential receptors to the site (e.g. Doggetts). Once completed, however, it will result in separation between potential dust generating construction activities and the receptors, and will also provide some screening. There will therefore be an overall effect of reducing the potential for long-term construction dust impacts at nearby residential receptors post construction of the on-site workers accommodation campus.

2.3.48 EDF Energy is committed to implementing best practice to reduce dust impacts to acceptable levels. However, to make the impact assessment more transparent, impacts from dust have been assessed in the ES, prior to implementation of best practices for dust control.

2.3.49 The majority of the human receptors in Stogursey, will be located over 200m from the closest point of site activity during this period of construction. Of the assessed human receptor locations only Bishops Farm House, Doggetts and Shurton village are be closer than 200m, therefore, with the exception of these three receptors, the significance of construction dust impacts at human receptor locations is predicted to be negligible during this phase of the construction works.

2.3.50 The significance of construction dust impacts at Shurton Village have been assessed as of **minor** significance during this phase of the construction works. Potential impacts at Bishops Farm House and Doggetts would be considered to be of **major** significance during this phase of the construction works without mitigation. Meteorological conditions that may lead to elevated dust and particulate matter at Doggetts and Bishops Farm House from on-site construction activities are prevalent for only 4.2% and 2.4% of the time, respectively. The impact from dust at these three human receptors would be local, direct, likely and medium-term.

2.3.51 Best practice guidance control methods would be implemented to manage fugitive nuisance dust and particulate emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site, are presented within the **Air Quality Management Plan**. As a result of the implementation of control methods, the assessment carried out for the Environmental Impact Assessment concludes that there would be **no significant residual impacts**.

2.3.52 Regardless of which of the two modelling methodologies are adopted for both annual mean and 1-hour mean future year NO_2 concentration predictions, with regard to potential impact on the 104 human receptor locations along those routes associated with traffic generated by the combined HPC Project, vehicular emissions during the construction and operational periods of the combined HPC Project (i.e. 2013, 2016 and 2021 scenarios), are **not significant**.

2.3.53 Mitigation measures will include regular inspection, maintenance and optimisation of the backup diesel generator combustion, and the use of fuels with a <0.1% sulphur content. In addition, the **Freight Management Strategy** and the **Framework Travel Plan** would be implemented to minimise vehicular movements, and use of vehicles compliant with emissions standards.

e) Landscape and Visual

2.3.54 The nature of the construction phase of HPC would have a significant adverse impact on landscape character and visual receptors during construction that cannot be completely mitigated by landscape screening due to its scale.

2.3.55 The most significant temporary visual impacts (up to **major adverse**) would be on the residents of Shurton, Burton, Knighton, Wick and local farms, and also on users of other elevated areas of landscape, such as the north-eastern summits of the Quantock Hills AONB.

2.3.56 The assessment of the potential impact to the visual amenity of users of the Public Right of Way (PRoW) within the study area and of amenity space at Wick Common during the construction concludes that medium-term and temporary impacts, ranging from **minor adverse** to **major adverse**, are predicted to occur for users of the individual PRoW as they pass through the zone of influence.

2.3.57 In the residential areas around the application site, where landscaping including landform and vegetation has the highest screening potential, the majority of visual impacts would be of **moderate adverse** significance. However, due to the proximity of the HPC, localised **major adverse** impacts would remain for users of PRoW along the coastline adjacent to the site. Some of these impacts would slightly decrease in the long-term, when the planting proposals, including off-site mitigation measures, mature.

2.3.58 Landscape proposals adjacent to the local settlements to the south of the site would be implemented in the first phase of construction to provide early screening and reduce adverse impacts on the local community. Temporary screening along the north-west site boundary (during construction), and off-site planting on Fairfield Estate would also be implemented in the early stages of construction to provide additional screening and minimise impacts.

2.3.59 A screening bund along the north-west boundary would offer some screening for PRoW users to the west of the site during early phases of construction, and the early implementation of landscape proposals in the southern part of the site would reduce visual impacts on the local residents of Shurton, Burton, Knighton, Wick and local farms and would continue to provide mitigation through the operational phase of HPC

2.3.60 The planted landscape bund (area of raised ground) is proposed to screen the on-site accommodation campus at the time of construction, providing visual mitigation and some noise attenuation both for Doggetts and for the residents of Shurton. The lighting design, together with the landscaping strategy, has been designed to minimise light spill to the residential properties to the south.

2.3.61 The main visual impacts within the Parish of Storgursey during the operational phase of HPC would occur to PRoW users along the coastline to the west of the site, residents of Wick and nearby farms, residents along the northern edge of Stogursey, residents of Stolford and PRoW users around Pixies Mound.

2.3.62 Impacts would range from major to minor adverse during year 1 of the operational phase, and from moderate to minor adverse during year 15 of the operational phase.

2.3.63 During construction and operational phases, the most efficient mitigation measure with most immediate screening effect would be the proposed bund along the north-western boundary of the HPC development site varying in height from 2m to 8.5m (relative to adjacent ground levels). The temporary bund would be implemented during site preparation works and would be effective for screening the HPC development in the short distance, predominantly from the adjacent PRoW. On completion of the construction phase, the land outside of the permanent development site would be restored as proposed in the **Landscape Restoration Plan**. The proposed landform and planting would be effective in screening views of the lower levels of the proposed development and from the majority of viewpoints within the Parish, only the highest HPC structures would be seen above the existing ridge of Green Lane (to be retained) or the proposed landform and planting.

2.3.64 The HPC construction mitigation measures include off-site mitigation measures proposed following consultation with the owners of the land to the west of the HPC development site. The off-site landscape and visual mitigation measures include:

- wildflower meadow planting;
- hedgerow reinforcement;
- changes in management of the existing hedgerows allowing their full growth; and

- woodland screen planting.

2.3.65 This off-site planting is aimed specifically to minimise visual impacts on Fairfield House and the surrounding land. It also aims to mitigate local visual impacts from some local PRoW within the Coastal – Lilstock sub character area. The off-site planting scheme proposed following consultation with the landowners of the land to the west of the HPC development site would continue mitigating landscape and visual impacts during the HPC operational phase (at year 1 (to a lesser extent) and year 15 of the operational phase and beyond).

2.3.66 The visual receptors likely to be affected by the proposed off-site mitigation include users of PRoW in the vicinity of the north-western boundary of the HPC development site and around Burton; residents of Knighton, Burton and Fairfield; walkers and users of PRoW within the Fairfield and eastern part of the Coastal - Lilstock landscape character sub areas.

2.3.67 Visual receptors on PRoW (No. WL 23/46) and the residents of adjacent Knighton Farm would benefit from the change in the management of existing hedgerows on the local ridge in the foreground of the view. The fully grown hedgerows would contribute to screening of the proposed HPC development and the existing Hinkley Point Power Station Complex, however the magnitude and nature of impacts would not change significantly, even when the hedgerows are fully grown.

2.3.68 Visual receptors on PRoW around Burton and motorists would benefit from the change in the management of existing hedgerows visible on the local ridge in middle ground. The fully grown hedgerows would contribute to screening of HPC.

2.3.69 Off-site planting proposals have also been prepared to mitigate the impacts on Pixies Mound. They include predominantly woodland and hedgerow planting along Wick Moor Drove to screen the HPC proposed development when viewed from Pixies Mound. It is estimated that the landscape proposals around Pixies Mound would reach their full screening potential at year 15 of the operational phase (while providing only partial screening during the construction phase), when the proposed HPC development would be almost entirely screened from this viewpoint , due to the proximity of planting.

f) Amenity and Recreation

2.3.70 The nature of the HPC Project would result in temporary impacts on the access to and amenity of users of recreation features currently in use by the community – this includes public rights of way and amenity spaces.

2.3.71 During construction, all Public Rights of Way (PRoW) within the development site boundary (including the coastal edge) of the HPC development would be obstructed and public access would be prohibited for health and safety reasons for the duration of the construction works. This loss of PRoW is considered to be a **moderate adverse** impact. This includes the temporary obstruction of the West Somerset Coast Path during the construction, and dismantling and removal of the jetty and seawall, which as a nationally important PRoW would result in a **major adverse** impact.

2.3.72 In terms of the wider PRoW network, the presence and retention of PRoW to the east, south, and west of the HPC development site would maintain an indirect access route to Stolford from the settlements of Burton, Shurton and Knighton. Consequently, although direct routes would be affected, particularly during the closure of the West Somerset Coast Path, indirect routes would be available which have minimal lengths along or crossing roads and lanes.

2.3.73 The reopening of the West Somerset Coast Path would reinstate many of the routes from Knighton, Shurton and Burton to the coast and to the east of Hinkley Point.

2.3.74 Following consultation with local residents, Stogursey Parish Council, and SCC's Rights of Way officers, it was agreed that a temporary alternative route should be provided around the boundary of the development site. This route would also be used by those following the West Somerset Coast Path for the duration of jetty and seawall construction. On completion of these, it was agreed that the West Somerset Coast Path would be reinstated as soon as possible, incorporated into the sea wall design.

2.3.75 Mitigation measures to be implemented through PRoW diversions and alternative routes would reduce the overall loss of PRoW and provide improvements to over 13.3km of Public Rights of Way after the construction phase is complete.

2.3.76 During the construction phase, access would be permitted to the southern area between the inner security fence and the development site boundary fence (in response to requests from local residents for the provision of circular walks). This would provide a maximum of 13ha of 'permissive' access land (the equivalent of more than 15 full-sized football pitches) for public recreation and amenity for the residents of Shurton in particular.

2.3.77 Once HPC is complete, as well as designated and permissive PRoW and bridleway enhancement action, general access would be permitted to the land north of Shurton up to Green Lane, which would be restored and enhanced as a nature reserve. This would provide up to 87ha of 'permissive' access land for amenity and recreation for the residents of Shurton as well as the wider public.

2.4 Summary of Impacts and Mitigation

2.4.1 This section of the report has reviewed the impacts which the HPC Project would be likely to have on the settlements in the direct vicinity of Hinkley Point – Shurton, Burton, Knighton, Wick, Stolford and Stogursey.

2.4.2 A summary of the cumulative impacts of the elements of the HPC project on community receptors in Stogursey has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

2.4.3 Due to its location on the road network and its direct proximity to the HPC site, the area is forecast to experience some of the most significant impacts of the HPC Project during all stages. As a result, significant mitigation proposals have been proposed for the area, including:

- a Noise Insulation Scheme for properties most affected by construction noise;
- a Property Price Support Scheme;
- £500,000 from the Community Impact Fund is to be committed to projects within Stogursey parish;

- £500,000 is to be spent in Stogursey parish on new or improved leisure facilities. In addition, on-site sports facilities at the accommodation campus would be accessible to members of the public; and
- early landscaping of the southern boundary and the longer term creation of a landscaped site including a large nature reserve with full public access.

2.4.4 In addition, of course, Stogursey parish is well placed to secure income from construction workers who wish to stay close to the HPC development site and to benefit from the employment and training opportunities offered by HPC.

3. BRIDGWATER

3.1 Introduction

3.1.1 As the closest large town to Hinkley Point, and being located on the principal transport route from the M5 motorway to Hinkley Point, Bridgwater is anticipated to experience a number of impacts arising from the construction and operational phases of the HPC Project and any post-operational phases associated with the off-site associated developments, where relevant. It is also well placed to secure a number of the benefits of the HPC Project.

3.2 Context

a) Local Area and Community Impacts

3.2.1 Bridgwater is the principal town in the vicinity of Hinkley Point, and is the administrative centre of Sedgemoor District, approximately 12km south-east from the HPC development site. The town lies on strategic transport routes, between Junction 23 and Junction 24 of the M5 motorway and on the River Parrett and has historically maintained a strong industrial base. From Bridgwater, the A39 runs from the motorway through to Cannington and on to Hinkley Point.

3.2.2 The population has grown at a relatively fast rate and is younger in profile than the district, county and region. Unemployment is currently relatively high, however, and there are pockets of deprivation (within the 10% most deprived in the UK), particularly to the east of the town centre. The area suffers from a number of economic weaknesses, including a low skills base and low qualifications and educational attainment, and there is a high level of benefit claimants.

3.2.3 Bridgwater has a number of community assets, including sports and recreation facilities. These include Bridgwater Sports and Social Club, Bridgwater and Albion Rugby Football Club, Bridgwater College and Sports Centre and the East Bridgwater Sports Centre. There is one library in Bridgwater and five community centres. A swimming pool is under construction at Chilton Trinity School. There are five GP surgeries and a cluster of other primary healthcare facilities, including an optician.

3.2.4 Community impacts are most likely to arise during the HPC Project in Bridgwater as a result of:

- the nearby location of the HPC development site, which would make Bridgwater an attractive location for non-home-based construction workers;
- the location of Bridgwater on strategic transport links from the M5 motorway and on and around the A39; and
- the construction of the associated developments.

3.2.5 Community impacts are most likely to arise during the construction phase of both the HPC development site and the local associated developments, during this period traffic would be at its highest and workforce numbers would be greatest.

3.2.6 Bridgwater would experience the largest increase in population (close to 1,400) of non-home-based construction workers during the peak of the construction phase compared to other areas in the vicinity of HPC, because it is the largest population and service centre in the area and the closest to Hinkley Point. As such, there are concerns locally that there could be indirect impacts on community cohesion, access to public services, capacity of community facilities (for example, schools) and the capacity of the accommodation and housing sectors.

3.2.7 **Figure 27A.3** shows a plan of the parish, including elements of the HPC project in the local area.

b) Associated Developments

3.2.8 Bridgwater urban area would host two of the associated developments which are proposed to support the construction of HPC during the construction phase (Bridgwater A and Bridgwater C accommodation campuses). Freight Management and oark and ride facilities are also proposed at Junctions 23 and 24 of the M5 motorway and these are considered in other sections of this report.

3.2.9 The nature of the HPC Project is such that a significant non-home-based workforce is required during the construction phase. The need for purpose-built accommodation campuses is explained in the **Accommodation Strategy**.

3.2.10 The sites for the accommodation campuses are located to the north-east of Bridgwater town centre. The accommodation campuses at Bridgwater A and Bridgwater C would provide bedspaces and associated leisure and recreational facilities for 1,000 construction workers at peak. EDF Energy considers that the sites are well suited to accommodation campus development as they are sustainably located close to the centre of Bridgwater, and are of sufficient size to accommodate the necessary number of occupants to support the provision of communal services and facilities.

3.2.11 The **Alternative Sites Assessment** describes the site's credentials compared with other sites, whilst the **Consultation Report** describes how the sites were selected.

3.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

3.3.1 In Bridgwater the local impacts would be likely to include:

- an influx of non-home-based construction workers which, at its peak would represent 57% of the usual average annual number of new residents moving to Bridgwater – the workers would principally occupy the accommodation campuses, although they would also be attracted to a range of other accommodation types in the town;
- Loss of existing sports facilities at associated development sites (Bridgwater Sports and Social Club and Bridgwater Albion Rugby Football Club training pitch) – addressed through re-provision and/or financial mitigation;
- potential impacts on community cohesion, crime, anti-social behaviour and policing; and

- the largest concentration of non-home based workers in private rented accommodation, and probably the largest number of families.

3.3.2 The Bridgwater ward cluster (the population of which is predominantly made up of Bridgwater urban area) is expected to accommodate close to 1,400 non-home-based construction workers in 2016, when the construction workforce is at its peak (up to 1,000 of these construction workers would be accommodated in the Bridgwater A and Bridgwater C campuses, although it is assumed that there will be around 3% vacancy at peak construction). This is equivalent to around 57% of annual new residents, based on the number of new residents observed in the 2001 Census. The cluster itself has a population of 50,000 people.

3.3.3 Although non-home-based workers would represent a relatively low proportion of the total population of Bridgwater, concerns about impacts of non-home-based construction workers on public safety, community cohesion, the provision of services and the capacity of community facilities have been raised by SDC, the Town Council and by others during consultation.

3.3.4 In particular, concerns have been expressed that there may be impacts relating to the capacity of tourist and private rented accommodation sectors, and the capacity of local schools, particularly if the level of non-home-based construction workers exceeds the 'central scenario' estimated by EDF Energy, and which is outlined in **Volume 2**, **Chapter 9** of the **Environmental Statement**.

3.3.5 The central scenario is based on a workforce profile at peak construction of 5,600 construction workers on the HPC development site and Bridgwater A and C sites combined, of which 66% would be 'non-home-based' i.e. requiring short-term accommodation. In Bridgwater, taking account of the existing supply of accommodation, the cost of accommodation and the proximity to Hinkley Point to the site, approximately 1,400 non-home-based construction workers are estimated to be accommodated at the peak of construction activity. It is estimated that they would be split between accommodation sectors in the following proportions: around 970 in purpose-built accommodation campuses (assuming a small level of spare capacity due to allow for effective management), 110 in the private rented sector, 110 in owner-occupied accommodation, 65 in tourist accommodation and 135 in latent accommodation (rooms let within existing houses).

3.3.6 In Bridgwater, at a conservative estimate there is currently capacity to accommodate this demand in existing capacity with an estimated 100 vacant tourist bedspaces and at least 130 private rented bedspaces even in the August peak. At other times of the year, vacancy is estimated to be much higher in the tourist sector. If non-home-based construction workers exceed the central scenario (as modelled and assessed in **Volume 2**, **Chapter 9** of the **Environmental Statement**), capacity issues could arise, although the extent of available capacity means that the increase would need to be significant.

3.3.7 The figures demonstrate the benefit of the campus accommodation in meeting the majority of the demand. The nature of the accommodation campuses also means that they would be attractive to workers seeking short-term accommodation, sometimes at short notice, which might otherwise be more difficult to find. Through the managed signposting of workers, the HPC accommodation office would seek to reduce pressure in specific locations or on specific public services. The influx of workers would also provide a boost to the local housing market and to the bed and breakfast sector, as well as providing welcome income for those who choose to let out rooms. It is likely that this would cause some increase in supply and some investment to enhance the quality of local accommodation which would be a benefit which would last beyond the peak period of construction activity.

3.3.8 There is a potential for adverse effects to arise if the demand for accommodation is too great, although the accommodation campuses address the bulk of demand. Nevertheless, the peak period may see a lower availability of accommodation in some sectors. There is already considerable movement within Sedgemoor and Somerset between different towns, particularly amongst private tenants, so in part this would be addressed by the natural flow of people moving to other locations with lower rents and/or higher capacity.

3.3.9 However EDF Energy has also been concerned to prepare for possible adverse impacts locally and to address this potential impact EDF Energy has committed to a Housing Fund of £5 million described in Section 1 of this report. That Fund has the capacity to assist households or to create at least 1,000 bedspaces and, as a result, the overall impacts on the accommodation sector in Bridgwater are assessed to be **negligible**. Any investment from the Housing Fund in permanent housing would result in long-term benefits for Bridgwater.

3.3.10 The campus sites would be provided with 24 hour security and would be pro-actively managed. EDF Energy would put in place a **Worker Code of Conduct** to ensure high standards of worker behaviour. The Code of Conduct is attached as an appendix to the **Community Safety Management Plan.** It has been prepared to set expectations of how workers use accommodation and the way they interact with the local community.

3.3.11 Based on experience at Sizewell and elsewhere, EDF Energy does not expect difficulties to arise in the local community from the temporary presence of construction workers. The Code of Conduct would be rigorously enforced if necessary but, in practice, the workers are expected to contribute positively to local shops and services. Many would be short-term residents, focused on their work at Hinkley. Others would stay longer, some would bring families and there is no reason to expect that they would not make a positive contribution to Bridgwater.

3.3.12 As described in Section 1, EDF Energy has worked closely with the local authorities and with the Emergency Services and has committed to a range of measures that would assist community safety and co-ordination between services to address any issues arising from the introduction of workers into the area. Funding is proposed for Community Safety services and a Community Beat Team. In addition, measures are proposed to ensure that the existing community benefits from the investment at HPC. Bridgwater schools would receive investment to inspire interest in science, technology and energy. Outreach workers and a dedicated Youth worker would work in the community to encourage hard-to-reach groups to engage with the training and employment opportunities available at Hinkley and the procurement team at EDF Energy is already working with local companies to help them become "Hinkley Ready" so that they can compete for contracts at Hinkley. A visitor centre is established at Kings Square in Bridgwater and an employment Brokerage has been established in Bridgwater with Job Centre Plus to provide maximum access locally to Hinkley employment opportunities.

3.3.13 Through these and other measures, the HPC Project has the potential to become integrated into the local community and to contribute positively.

3.3.14 Potential impacts, on public services are addressed in the mitigation package of measures described in Section 1. The **Heads of Terms for the Section 106 Agreement** propose advanced mitigation through early investment in school capacity in Bridgwater and a formula for payment towards increasing education capacity if monitoring identifies further impacts beyond existing capacity. In addition, EDF Energy is investing £3 million in the Energy Centre at Bridgwater College to further enhance its capacity as a leading centre for education in low carbon energy technologies.

3.3.15 The proposed accommodation campuses at Bridgwater A and C would result in the loss of existing sporting facilities. The rugby training pitch at Bridgwater C would be relocated and, as explained in Section 1 of this report, commitments are proposed to contribute towards the construction of the Chilton Trinity swimming pool (£250,000) and to invest £500,000 in new or enhanced sports and leisure facilities in Bridgwater, part of which would mitigate the loss of the Bridgwater Sports and Social Club at the Bridgwater A site. EDF Energy has suggested that this money could be spent on enhancing facilities in east Bridgwater. In addition, public access would be provided to the new sports pitches proposed as part of the Bridgwater A accommodation campus.

b) Transport

3.3.16 Given the location and size of Bridgwater in relation to HPC and main road transport links from the M5 motorway, the general area is likely to experience impacts related to traffic flows, pedestrian amenity and severance, as a result of an increase in HGV and bus traffic, and subsequent community impacts related to air quality, noise and vibration and visual amenity.

3.3.17 The construction of the associated developments (at Bridgwater A and Bridgwater C) could contribute to these impacts, although planning permission already exists for the development of the Bridgwater A site and the HPC proposals would principally bring forward the remediation of that site.

3.3.18 The assessment of transport impacts is based on the build-up of highway use and capacity over the construction phase, at intervals (2013 Quarter 3, in the early construction phase) leading up to the peak of the construction phase (in 2016 Quarter 4).

3.3.19 Building up to peak construction, 2013 represents the early construction phase of the HPC Project before all of the associated developments are operational. In terms of highway improvements, the analysis has been undertaken on the basis of only some site preparation works improvements and with improvements at Huntworth roundabout and M5 motorway, Junction 23 being in place. The Somerfield site at Junction 24 would also be in operation as a park and ride and freight management site.

3.3.20 In 2016 all highway improvement measures outlined in the **Transport Assessment** would be in place. Based on workforce and freight movement profiles, the 2016 Quarter 4 is the period when traffic impacts are likely to be at their greatest.

Additionally, the Bridgwater accommodation campuses would be fully occupied leading to peak bus flow to and from the HPC development site.

3.3.21 Once the construction phase of the HPC Project is complete, HPC would be operational and impacts related to on-going operation of HPC have been identified at 2021 when both reactors would be online and the majority of construction works are complete, with a full operational staff on-site. Compared with the peak of construction activity, impacts would be significantly less.

3.3.22 EDF Energy would, however, seek to implement the entire highway improvement package as soon as possible and, therefore, some additional improvement measures may be in place before the assessment period of Quarter 3 2013. In 2016, the assessment assumes that the remainder of the highway improvements proposed by EDF Energy as part of the application for development consent would be in place.

3.3.23 The transport strategy for the HPC Project is explained in full in the **Transport Assessment.** In order to limit the impact of construction traffic from the M5 motorway, two HGV routes have been identified:

- From Junction 23 of the M5 motorway travelling west to Dunball Roundabout, south via the A38 (Bristol Road) to Bridgwater, onto The Drove and Western Way to join the A39 (Quantock Road) at Quantock Roundabout, then travelling west on the A39 towards Cannington and Hinkley Point; and
- From Junction 24 of the M5 motorway (Huntworth Roundabout) and north via the A38 to Bridgwater (Taunton Road) joining the A38 (Broadway) travelling west, on to Cannington and Hinkley Point.

3.3.24 Monitoring would ensure that HGV traffic would be limited to these routes so that there would not be HGV traffic impacts on other routes. These routes would also be the principal bus routes for construction workers to and from Hinkley. Car traffic is expected to be relatively limited because only very restricted parking is to be provided on the HPC development site and workers would be required to use dedicated buses. Nevertheless, some environmental transport-related impacts would remain in Bridgwater as a result of the HPC Project.

3.3.25 In 2013, The Drove, Western Way and the A39 west of Quantock roundabout would experience significant increases in traffic. The Drove, however, runs through industrial areas with virtually no pedestrian activity or adjacent residential properties. For Western Way, the predicted level of HGVs and buses is 893 (2-way daily movements), an increase in HGVs and buses of 559 vehicles per day from the Reference Case. The increase represents an average of 23 vehicles per hour or one every 3 minutes. On A39 west of Quantock roundabout, the predicted level of HGVs and buses is 1,764 (2-way daily movements), an increase in HGVs and buses of 1,139 vehicles per day from the Reference Case. The increase represents approximately one vehicle every minute.

3.3.26 The impact of these increases in traffic flows is assessed in relation to severance, pedestrian delay, pedestrian amenity, driver delay and accidents and safety. Severance is defined as perceived division that could occur within a community when it becomes separated by a major traffic artery and is therefore particularly relevant the consideration of impact on the community. The increases in traffic flow at the above three links are assessed as of **moderate adverse** significance on severance,

minor adverse on driver delay and **minor adverse** on accidents and safety. Due to the increase in HGV and buses on certain links, the impact on pedestrian amenity has been assessed as **moderate adverse**.

3.3.27 The increase from current level in all vehicle daily traffic flows as a result of the HPC Project on these routes in 2013 are 6.9%, 6.7% and 15.9% for The Drove, Western Way and A39 west of Quantock roundabout respectively.

3.3.28 At present the proportion that HGVs represent of the total flow along Western Way is 1.7% which is a low percentage especially for an “A” road (national average is 7%). Even with the addition of HPC HGVs at peak construction (2016) the proportion would increase to 3.7%, which is still a low figure for this type of road.

3.3.29 In terms of pedestrian amenity, at peak construction in 2016, Way and A39 Broadway would experience a daily flow increase of HGVs and buses of more than 100%, resulting in a **moderate adverse** impact, and potentially greater at peak. However the number of days of peak HGVs would be relatively small and the large majority of time the flows would be less than the peak.

3.3.30 By 2016, project-wide mitigation measures and highway improvements would be in place. Junctions where potential safety improvements have been identified are shown below. In addition to the proposed highway improvements EDF Energy propose to offer potential safety enhancements and pedestrian and cycle improvements within Bridgwater that Somerset County Council are progressing as part of their ongoing programme of improvements.

- The A38 Taunton Road/Wills Road Junction;
- Wylds Road/The Drove;
- A38 Bristol Road/A39 Bath Road/The Clink (Cross Rifles Roundabout);
- A38 Taunton Road/Rhode Lane;
- A39 Broadway/A38 Taunton Road;
- A39 Broadway/A372 St John Street;
- A39 North Street/Albert Street; and
- A39 North Street/West Street.

3.3.31 In 2016, The Drove, Western Way, A39 west of Quantock Roundabout and the A39 Broadway would experience significant increases in HGV and buses arising from the peak of construction employment. There are predicted to be 698, 1,022, 1,740 and 849 HGVs/buses (2-way daily flows) on these four links respectively, with the HPC Project. This is an increase from 296, 312, 595 and 460 HGVs/buses on these four links respectively in the Reference Case. This is equivalent to an increase of approximately 135%, 225%, 190% and 85% respectively of Reference Case HGV and bus flows on these four links.

3.3.32 However total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would see a significantly lower increase on all four routes as a result of the HPC Project. The total increase in daily 2-way vehicle trips on each link is approximately 0%, 15%, 4% and 27% for The Drove, Western Way, A39 west of Quantock Roundabout and A39 Broadway, respectively.

3.3.33 The impact of the increase in HGV and bus flows on The Drove and Western Way is considered to be **moderate adverse** and **substantial adverse** for a short stretch of the A39 west of Quantock Roundabout, in terms of severance. The impact in Bridgwater in terms of pedestrian amenity is considered to be **moderate adverse**. The increases in total traffic flows through Bridgwater as a result of the HPC Project are all less than 30%, although HGV flows increase by greater than 30% in some locations. On this basis, the potential impact on safety is assessed as **minor adverse**.

3.3.34 In terms of the other assessment criteria, with the DCO highway improvements in place, the impact is considered to be **negligible**.

3.3.35 In 2021, the increase in HGVs and buses on the above links as a result of the HPC Project significantly reduce. There are predicted to be 427, 634, 1,171 and 679 HGVs/buses (2-way daily flows) on The Drove, Western Way, A39 west of Quantock Roundabout and the A39 Broadway respectively with the HPC Project. This is an increase from 331,343, 643 and 515 HGVs/buses on these four links respectively from the Reference Case. This is equivalent to an increase of approximately 29%, 85%, 82% and 32% respectively of Reference Case HGV and bus flows on these four links.

3.3.36 The impact of the increase in HGV and bus flows on A39 Broadway is considered to be **minor adverse** and **moderate adverse** for A39 west of Quantock Roundabout and Western Way, in terms of severance. The impact in Bridgwater in terms of pedestrian amenity is considered to be **moderate adverse**. The potential impact on safety is assessed as **minor adverse**.

3.3.37 In terms of the other assessment criteria, the increase in total traffic does not meet the relevant thresholds and therefore the impact is considered to be **negligible**.

3.3.38 As in 2013 and 2016, it is relevant that the total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would result in a significantly lower increase of total vehicles on all four routes as a result of the HPC Project. The total increase in daily 2-way vehicle trips Western Way and A39 west of Quantock Roundabout is approximately 5.6% and 12%, respectively. Total traffic flows for The Drove and A39 Broadway improve as a result of the HPC development with total daily traffic flows reducing by -4.5% and -0.2% respectively, in 2021.

3.3.39 Bridgwater is an urban area; nevertheless, some change in character would be experienced as a result of HPC traffic, as described above. This would however only be temporary, throughout the course of the HPC Project, and would not persist following completion of the construction phase, when there would just be operational staff on the site. It is also relevant that the above figures are worst-case, particularly with regard to anticipated bus numbers. Timetables and routes have been developed for modelling purposes for the **Transport Assessment** to assess the worst-case impact that the provision of such services could have on the highway network. As the development progresses, EDF Energy would refine the bus services, routes and timetables to best serve the actual distribution of workers and this should enable the number of bus trips to be significantly reduced.

3.3.40 Notwithstanding the environmental transport-related impacts for certain links in Bridgwater, as described above, the **Transport Assessment** submitted with the application for development consent shows that the package of transport improvements proposed as part of the HPC Project reduces the impact on the highway network in Bridgwater Bridgwater in terms of journey times, junction performance and total network delay to acceptable levels in 2013 and 2016; and provides some benefit to the highway network in 2021.

c) Noise and Vibration

3.3.41 The construction phase of the HPC Project is likely to result in impacts on the local community in terms of temporary traffic- and construction-related noise, and particular concerns have been raised in relation to residential amenity.

d) Traffic Noise Increase

3.3.42 Areas likely to be affected by road traffic noise are along the A39, notably between Cannington and Bridgwater, and North Street and Broadway in Bridgwater, as well as the Northern Distributor Road (NDR). These routes are affected due to their being on the two HGV (and main bus) routes through Bridgwater.

3.3.43 In Bridgwater noise impacts from daytime HGV movements along the NDR are assessed as being of **moderate adverse** significance in 2016. In 2013 and on the other designated HGV route in 2013 and 2016, these daytime impacts are assessed as no more than **minor adverse**.

3.3.44 Where other **moderate and major adverse** impacts have been assessed in Bridgwater these relate to the shorter periods of time associated with early morning and late evening bus movements which have been modelled on robust worst case assumptions. These impacts are limited to the two designated routes for HPC traffic and are on ‘A’ roads which are recognised as the main corridors for traffic through Bridgwater. The absolute noise levels which would arise from HPC related traffic, in Bridgwater, are not predicted, at any point in the construction programme, to breach any statutory limits in relation to road traffic noise.

3.3.45 The associated development sites form part of an overall mitigation strategy to minimise the number of vehicle movements on the highway network associated with the HPC Project. The associated development sites have been designed to ensure that all site workers (excluding minimal office based staff) would use buses to travel to and from the HPC development site. Noise effects may also arise from the construction of the Bridgwater A site. The highest predicted noise levels during the construction phase would occur at the southern boundary of the proposed development site, closest to existing dwellings on Bath Road (south of the existing Bridgwater Sports and Social Club). The significance of impact reduces as works are undertaken further to the north and for properties east of Bath Road as the separation distance increases.

3.3.46 Typical construction and demolition working routines are unlikely to generate levels of vibration at local receptors above which cosmetic damage would be expected to be sustained. Due to the distance to the nearest sensitive receptor (30m) and the level of vibration likely to be caused an adverse impact on residential properties is possible. Adherence to typical construction working hours, during which existing road traffic noise from the A39 Bath Road dominates, would minimise the potential for disturbance. There would be short-term impacts for the nearest properties, therefore, but Bridgwater A is a brownfield site with planning permission for development and any construction activity there is likely to have similar effects.

3.3.47 The construction of the Bridgwater C site would also generate noise which would be perceptible at dwellings on Fairfax Road and Bath Road and at Bridgwater College but the noise levels would not be unexpected for an urban development site.

e) Air Quality

3.3.48 The construction phase of HPC is likely to result in impacts on the local community in terms of temporary reductions in air quality, and particular concerns have been raised in relation to sensitive receptors in and around traffic routes in Bridgwater.

3.3.49 Short-term particulate matter and NO_2 emissions associated with traffic during the construction of both the HPC development site and the majority of the associated development sites is not considered to cause a significant impact on human receptors in Bridgwater during early years (2013) or at peak construction (2016)[1]. In any case, to avoid potential adverse impacts the **Freight Management Strategy** and the **Framework Travel Plan** would be implemented to minimise vehicular movements, and use of vehicles compliant with emissions standards.

3.3.50 Best practice guidance control methods would be implemented to manage fugitive nuisance dust and particle emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site, are presented within the **Air Quality Management Plan**.

f) Landscape and Visual

3.3.51 No adverse impacts of greater than minor significance have been identified on townscape character areas including Sydenham and Bower and North East Bridgwater, Town Centre and Wylds Road as a result of the HPC development.

3.3.52 The effects of the development on local landscape and visual amenity are related to:

- the construction, operational and post-operational phases of Bridgwater A and Bridgwater C leading to impacts in terms of changes in landscape/townscape character, historical and cultural associations, landcover and vegetation and land use / settlement; and
- adverse impacts on visual amenity of number of selected local daytime views as a result of the associated developments.

3.3.53 During operation of the associated developments, planting would be employed to mitigate any adverse impacts, including a screen on the boundary of the Bridgwater A site, along the line of the main western Taunton to Bristol railway, and along the

[1] The worst-case annual mean NO_2 vehicular contributions in the Bridgwater model for the 2021 'with development' scenario are of no greater than medium magnitude. Maximum worst-case vehicular contributions are observed at '86 Bath Road' for the 2021 'with development' scenario for annual mean NO_2. The worst-case ambient concentration value at '86 Bath Road' for annual mean NO_2 for the 2021 'with development' is just below the EU objective threshold and so is predicted to be **moderate adverse**. However, concentration values at the other 43 human receptors are below the EU objective threshold and so are predicted to be either **slight adverse** or **negligible**.

eastern boundary. Planting is proposed within the road verge, further screening views towards the proposed development site from residential properties along the Bath Road.

g) Recreation and Amenity

3.3.54 The nature of the HPC Project would result in temporary impacts on the amenity of users of local recreation facilities currently used by the local community, including the closure and removal of sport facilities at Bridgwater Sports and Social Club, comprising a playing field, a bowling green, and a single storey clubhouse (as a result of Bridgwater A), and Bridgwater and Albion Rugby Football Club training pitch (as a result of Bridgwater C).

3.3.55 Further to this, the construction and operational phases at Bridgwater C would result in an adverse impact in terms of visual disturbance to users of sports and leisure facilities at Bridgwater and Albion Rugby Football Club.

3.3.56 As explained above and in Section 1 of this report, however, a comprehensive package of mitigation measures is proposed by EDF Energy. The net effect of these is that Bridgwater would experience no net loss of recreation, leisure or amenity facilities during the construction period of HPC and would be left with a legacy of improved facilities as a result of the investment of £750,000 proposed in new or improved leisure facilities in the town.

3.4 Summary of Impacts and Mitigation

3.4.1 A summary of the cumulative impacts of the elements of the HPC project on community receptors in Bridgwater has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

3.4.2 This section of the report has focussed on identifying the impacts which the HPC Project is likely to have on Bridgwater. As it is the largest population centre in the vicinity of Hinkley Point C, Bridgwater is forecast to experience some of the most significant impacts of the HPC Project, although these are principally temporary.

3.4.3 Bridgwater also benefits from some of the more significant mitigation proposals which would address those impacts during the construction phase, and in some cases offer positive future benefits in terms of transport and community infrastructure provision. Mitigation and best practice measures would include:

- A series of local education, training, outreach and recruitment initiatives to maximise the opportunity for local people to gain employment in the construction and operation of HPC.
- A Housing Fund has been proposed as “advance mitigation”, i.e. to be used to put in place measures to assist local households and to bring forward additional local accommodation in case an impact does arise when the peak of the construction workforce arrives in the area. EDF Energy’s research suggests that a housing fund of £5 million would be sufficient to create at least 1,000 additional housing opportunities locally.
- Money is to be spent on public realm heritage improvements in the local area. In particular, funds are to be spent against a detailed programme of activity agreed

with the County Council which would see improvements to public realm heritage assets in both Cannington and Bridgwater.

- Investment in traffic calming and pedestrian improvements and Junction improvements in Bridgwater and on the A39 which would leave a legacy of an enhanced transport network in Bridgwater.
- The relocation of the rugby training pitch at the Bridgwater C campus site.
- £250,000 towards the construction of a new swimming pool in Bridgwater.
- £500,000 to provide new playing fields and social club facilities to off set the loss of such facilities at the former Innovia site.
- Investment of £3 million in the existing Energy Skills Centre at Bridgwater College in order to enhance its capacity.
- A public information centre in Kings Square, Bridgwater, to provide a point of contact for the community and visitors to the area who have an interest in the HPC Project.

3.4.4 Every effort has been made to assess and address the potential impacts which the HPC Project would have on the community of Bridgwater. Overall, based on the assessed impacts and proposed mitigation/best practice including implementation and management strategies, and financial contributions, the residual impacts of the project on Bridgwater have the potential to be beneficial, stimulating improvements in supply chain investment and potentially stimulating further low carbon investment. The HPC Project should leave lasting benefits in terms of the local economy, a skilled and trained workforce and lasting improvements in the accommodation market, leisure facilities and the highway network. Perhaps even more importantly, it would bring large numbers of construction and operational jobs to Bridgwater.

4. CANNINGTON

4.1 Introduction

4.1.1 As one of the closest larger settlements to the HPC development site, and on the current transport route from Bridgwater and the M5 motorway to Hinkley Point, Cannington is anticipated to experience a number of effects from the construction, operational and post-operational phases of the HPC Project.

4.2 Context

a) Local Area and Community Impacts

4.2.1 Cannington is a village to the north-west of Bridgwater, and around 8km to the south-east of HPC. The built-up area comprises the majority of the 2,381 population of Cannington Civil Parish (CP) (Census 2001). The population has experienced a low level of growth in recent years, and has an older and ageing population, generally low levels of deprivation and very low levels of unemployment. Cannington was designated a Conservation Area in 1991 and the designation covers the central area of the village, through which the C182 (Rodway), leading to Hinkley, passes.

4.2.2 At Cannington, the A39 passes to the south of the village, connections can be made to the C182 (Rodway) via either High Street to the west of the village, or Main Road through the centre. The C182 (Rodway) connects to north-west to the HPC main development site.

4.2.3 The elements of the HPC Project anticipated to result in impacts on the community in Cannington are:

- the proximity of the HPC development site, and the location of Cannington on strategic transport links from the M5 motorway to Hinkley Point;
- the proposed park and ride site, just to the south of Cannington, which would include two parking areas for workforce and visitors, a bus waiting area, ancillary development and a new access on to the A39; and
- the proposed Cannington bypass, which would run in a north-south direction to the west of Cannington village, commencing at the existing roundabout on the A39 Cannington southern bypass and terminating at the C182 (Rodway) to the north of Cannington.

4.2.4 As such, community impacts are most likely to arise in Cannington as a result of the construction of associated developments, and from the traffic and employment generation linked to the construction phase of the HPC Project.

4.2.5 Cannington has a number of community assets, including public rights of way (PRoW), areas of landscape character, and facilities such as Bridgwater College and Brymore School, which would be directly affected as a result of the proposals.

4.2.6 Indirectly, there could also be effects on local residents and users of community facilities, where amenity levels are affected by adverse impacts of the HPC Project on traffic, visual amenity, noise levels and recreation.

4.2.7 **Figure 27A.4** shows a plan of the parish, including elements of the HPC project in the local area.

b) Associated Developments

4.2.8 Even with the HPC transport strategy and freight management strategy there would inevitably be an increase in traffic movements (HGVs; buses and cars) on the local network. After careful consideration and consultation EDF Energy has concluded that a bypass around the west of Cannington should form part of the DCO application proposals. This would mitigate the impact of additional traffic and in particular HGVs and buses through the village, once the bypass has been constructed, and leave a lasting benefit for the amenity of the village.

4.2.9 The nature of the HPC Project is such that associated developments are required to support the construction phase – in this case the bypass around the west of Cannington, and a park and ride facility to the south which would provide a location to bring together construction workers from the local area and visitors and transport them to the HPC development site by bus. The park and ride site would be removed once the power station is constructed but the bypass would be retained permanently.

4.2.10 The **Alternative Sites Assessment** describes the sites credentials compared with other sites, whilst the **Consultation Report** describes how the site were selected.

4.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

4.3.1 The Cannington ward cluster (with a population of 7,000 this includes the village of Cannington but also a wider area) is forecast to accommodate around 120 non-home-based construction workers in 2016, when the construction workforce is at its peak. This is equivalent to around 22% of annual new residents, based on the number of new residents observed in the 2001 Census.

4.3.2 Although this is a relatively low proportion of the population, concerns about impacts of non-home-based construction workers on the supply of accommodation, public safety, community cohesion, the provision of services and the capacity of community facilities have been raised in consultation.

4.3.3 The 120 non-home-based construction workers are anticipated to be split fairly equally between types of accommodation (private rented (c. 25), tourist (c. 30), owner-occupied (c. 35) and latent (c. 30)). Using conservative estimates this is identified as being within existing capacity, taking into account turnover and vacancies.

4.3.4 EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The number of workers attracted to seek accommodation in Cannington should be regulated by the available supply. The accommodation office for the HPC Project, however, would have the ability to direct new applicants away from Cannington if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit Cannington and its residents in the event that hardship is being caused.

4.3.5 Similar issues arise in relation to education. Workers resident in Cannington may seek to place their children in the primary school, although only a small proportion of workers are expected to bring children. In 2010/11 the school had room for 175 pupils and had 164 pupils on roll, so spare capacity of 11. In order to head off any potential shortfall in capacity, EDF Energy's proposals described in Section 1 include investment intended to provide new or enhanced classroom facilities in Cannington (and Bridgwater) and a formula for payment towards increasing education capacity further if monitoring identifies further impacts beyond the enhanced capacity. Such improvements would ultimately need to be agreed between the County Council and individual schools.

4.3.6 The wider mitigation strategies outlined in Section 1 address other impacts on health and public services. In relation to leisure impacts, the overall effects on facilities in Cannington are likely to be very small. However, in discussions with the local planning authorities, Cannington has been identified as a sensible location in which to invest part of the mitigation package proposed by EDF Energy. Accordingly, the **Heads of Terms for the Section 106 Agreement** propose an investment of £500,000 towards new or enhanced leisure facilities in the village, which should provide a significant long-term benefit for Cannington residents and those living nearby.

4.3.7 Cannington would also benefit from the Community Impact Fund described in Section 1. £500,000 of the Fund has been "ring fenced" for projects in Cannington. Those projects are to be suggested by the local community as projects which would add to the local quality of life. Again, this should be a significant benefit for the village.

4.3.8 EDF Energy is also committed to invest in training and education facilities in order that local people can gain the skills and qualifications to work on the HPC Project both in the construction phase and in the completed development. The **Economic Strategy**, and the **Construction Workforce Development Strategy** which is appended to it set out a series of actions and investments which EDF Energy would undertake. This includes investment of £1.5 million in a Construction Skills Centre in partnership with Bridgwater College at Cannington.

b) Transport

4.3.9 Given the location of Cannington in relation to the HPC development site and main road transport links from the M5 motorway and population centres such as Bridgwater and Taunton, the general area is likely to experience impacts related to increased traffic flows, severance, and an increase in HGV and bus frequency, and consequent community impacts related to air quality, noise and vibration and visual amenity. Cannington would experience greater impacts than any other community because of its location on the C182 (Rodway), which provides the principal access north to Hinkley Point.

4.3.10 Two associated developments are proposed in Cannington, including the bypass and around the west of the village and park and ride facility to the south. These would be constructed early in the construction programme to facilitate the construction of HPC. In particular, the bypass would direct construction traffic away from being routed through the centre of Cannington.

4.3.11 The construction of the associated development sites at Cannington park and ride and Cannington bypass, together with the location of the HPC development site nearby would bring impacts of their own but both developments would reduce traffic through Cannington by intercepting car traffic and converting it to buses and by diverting traffic around Cannington. These facilities together would reduce both traffic and associated noise and other impacts that would otherwise affect the High Street and southern part of the C182 (Rodway).

4.3.12 The assessment of transport impacts is based on the build-up of highway use and capacity over the construction phase, with specific assessments made at 2013 Quarter 3, in the early construction phase, and in 2016 Quarter 4 at the peak of the construction activity.

4.3.13 In 2013, construction on the HPC development site would have commenced, but the Cannington bypass would not be completed at this stage. This, therefore, represents the worst-case impacts on Cannington.

4.3.14 In 2016 all highway mitigation measures are assumed to be in place, including the Cannington bypass. Based on workforce and freight movement profiles, 2016 Quarter 4 is the period when general traffic flows are likely to be at their greatest.

4.3.15 HPC would commence operation in 2021 at which pint the main construction works would be complete by 2021. HPC would have an operational life of 60 years.

4.3.16 In Cannington, significant increases in HGV and bus flows on High Street and C182 (Rodway), south of the bypass, are anticipated in 2013. There is also an anticipated impact on the A39 west of Quantock roundabout. More details of the assessment are contained in **Volume 2, Chapter 10** of the **Environmental Statement**.

4.3.17 The impact of these increases in traffic flows is assessed in terms of severance, pedestrian delay, pedestrian amenity, driver delay and accidents and safety. Severance is defined as perceived division that could occur within a community when it becomes separated by a major traffic artery and is therefore particularly relevant the consideration of impact on the community. The most significant impact is the impact on High Street and C182 (Rodway) prior to the opening of the bypass. The **Transport Assessment** estimates that daily vehicle flows would increase by 1,391 vehicles or 64% of the existing flow. A significant proportion of that flow would be buses and HGVs. Limits are proposed to prevent more than 500 HGV movements per day on average over a quarter but with a daily flexibility up to 750 movements within that overall average. There would also be significant movement of buses carrying construction workers - both before the first principal shift which starts at 07:00 and after the last principal shift which finishes at 22:00. C182 (Rodway) and High Street are predicted to experience **major adverse** impacts, in terms of severance.

4.3.18 In terms of pedestrian amenity, the magnitude of impacts is considered substantial; however the proposed improvement scheme in Cannington would improve the pedestrian environment by creating wider footways, and improved crossing facilities and the impact is therefore predicted to be **moderate adverse**. The potential impact on safety is assessed as **minor adverse**, taking into account the proposed pedestrian improvements in the village. In terms of driver delay, the impact in 2013 is predicted to be **minor adverse**. The impact on pedestrian delay is predicted to be **negligible**.

4.3.19 EDF Energy recognise the impact that traffic travelling through Cannington would have and have therefore included provision of the Cannington bypass within the DCO application proposals. However, given the land and other requirements it is not possible to implement the bypass before DCO consent. Therefore the impact of traffic through Cannington would occur for a short period of the HPC development site construction phase. After the construction of the bypass, traffic levels would fall to less than they are currently in Cannington.

4.3.20 Recognising the increases of traffic EDF Energy has proposed traffic management measures within Cannington which would be implemented as part of the Site Preparation Works. These works would control traffic and improve the pedestrian environment, and include (outlined in detail in **Chapter 16** of the **Transport Assessment**):

- a new footway to the northern edge of High Street, opposite Clifford Park;
- provision of skid-resistant surfacing;
- revised parking and waiting restrictions;
- a new puffin crossing at High Street;
- provision of tactile paving and widening of existing uncontrolled crossing at junction of Church Street and High Street;
- new speed restriction signs enforcing existing speed restrictions;
- new zebra crossing on C182 (Rodway) before junction with Toll House Road; and
- tactile paving at junction of C182 (Rodway) and Toll House Road.

4.3.21 Notwithstanding these measures, the net effect on Cannington during the early years period before the bypass is complete would be adverse – with **moderate to major** adverse effects on amenity depending on the location:

4.3.22 In terms of severance, in the A39 to the south and south-east would experience increased HGV and bus flows of over 90% as these links are on HGV/bus routes to HPC. As such, this is considered a **moderate adverse** impact (although for the affected sections of the A39, these areas are rural in nature with virtually no pedestrian activity or residential properties). Additionally, no such vehicles would be permitted on Main Road therefore no increase is anticipated at that location.

4.3.23 On Cannington High Street, re-siting of the existing zebra crossing near the Memorial Junction and its conversion to a pelican crossing, and the addition of a new crossing on the C182 (Rodway) close to Bridgwater college would in fact lead to a **moderate beneficial** impact on pedestrian delay.

4.3.24 In terms of pedestrian amenity, substantial increases in daily flow rates are anticipated on highways in Cannington, although as the proposed improvement scheme in Cannington would improve the pedestrian environment by creating wider footways, and improved crossing facilities the significance of the impact is considered **moderate adverse.**

4.3.25 In recognition of the short-term effect on the village, the **Heads of Terms for the Section 106 Agreement** propose that a sum of up to approximately £200,000 is made available for public realm improvements in Cannington and Bridgwater. Work undertaken with the Somerset County Council and Sedgemoor District council (SDC) has identified heritage assets in the village which could be restored or enhanced in order to offset the adverse impacts of increased traffic flows through the Conservation Area.

4.3.26 Once the bypass is complete, there would be a beneficial impact compared to existing conditions within Cannington. All construction traffic (including park and ride buses and HGVs) would be required to use the bypass, with the exception of some buses which would be routed through Cannington to pick who workers who live in the village, if required, rather than local roads through the village. It is proposed that the Cannington bypass would remain as permanent legacy, so that operational traffic and traffic associated with maintenance outages at HPC would also avoid passing through the village.

4.3.27 At peak construction in 2016, both Main Road and C182 (Rodway) (south of Cannington bypass) would experience reductions in general daily traffic flow of between 30% and 60% as a result of the Cannington bypass. However, the A39 south-east and south of Cannington would still experience **moderate adverse** impacts, in terms of severance, as a result of being direct HGV/bus routes to the site, and **minor adverse** impacts in terms of accidents and safety. **Negligible** impacts are predicted with regard to all other environmental-related transport criteria.

4.3.28 The construction and operation of the bypass itself could create impacts on the operation of Brymore School, particularly changes to its existing access and severance from the community, and loss/severance of agricultural land used by the school (see the **Consultation Report** for details).

4.3.29 Taking into account design features of the proposed development, including a toucan crossing close to the access to Brymore School to enable pedestrians to cross safely and the inclusion of a cattle crossing and the use of acoustic bunds to mitigate noise impacts, the impacts in relation to severance from agricultural land and potential traffic safety impacts on pupils is considered to be mitigated.

c) Noise and Vibration

4.3.30 The construction phase of HPC is likely to result in impacts on the local community in terms of temporary traffic and construction-related noise, and particular concerns have been raised in relation to residential amenity in terms of:

- daily road traffic noise impacts between the A39 and the HPC site at specific sensitive areas;
- noise from construction works related to the Cannington bypass and Cannington park and ride facility at residential properties including Knapp Farm and Withiel Farm, Rothay Cottage, and neighbouring properties; and
- disruption to amenity of users of PRoWs close to the associated development sites and resulting from traffic increases.

4.3.31 In addition, Construction of the Sandford Corner roundabout, a highway improvement scheme that would replace the existing priority junctions, is expected to last a maximum of six months. The closest noise sensitive receptor to this proposed work is a single residential dwelling approximately 25m to the east and southeast, which is anticipated to experience noise level of 73dB $L_{Aeq,12h}$ (excluding ambient noise level). The impact of these short-term activities is predicted to be of **moderate adverse** significance.

4.3.32 In 2013, the daily road traffic noise impacts would be most significant between the A39 and the HPC development site (through Cannington High Street and on the C182 (Rodway) prior to the opening of the proposed Cannington bypass, resulting in a **major adverse** impact.

4.3.33 The proposed Cannington bypass would reduce the predicted noise impacts from HPC construction traffic in Cannington village in 2016. As a result of the proposed bypass, **beneficial** impacts are predicted along the route through Cannington.

4.3.34 In recognition of the adverse noise impacts which have been assessed prior to the opening of the Cannington bypass, the consideration that some of the adverse impacts occur late in the evening and in the early morning and taking account of the existing character of the affected areas, EDF Energy proposes to offer a Noise Insulation Scheme to the most affected residents in Cannington. The Noise Insulation Scheme would offer measures including window glazing, and acoustic ventilation.

4.3.35 The construction of the associated developments would lead to temporary noise and vibration impacts at Knapp Farm and Withiel Farm (**major adverse** impact), Rothay Cottage, and neighbouring properties (**moderate adverse** impact), residential properties close to the C182 (Rodway) (**moderate adverse** impact), and in terms of the amenity of users of public footpaths within 300m of the proposed development (**minor adverse** to **moderate adverse** impacts). In relation to the Cannington park and ride site, these impacts are primarily as a result of the immediate proximity of the site to public rights of way (one is located within the site, although it is not physically affected). Such impacts would be temporary and should be viewed in the context of the transient nature of users of the footpaths. In this case, the impact has also been limited as far as possible through the provision of a 2 metre bund to the west of the site.

4.3.36 The design of the proposed Cannington bypass includes 2 metre high acoustic bunds with vegetated slopes along parts. The construction of these bunds would be undertaken at the earliest possible stage during the earthworks. The bunds would screen the closest residential dwellings to the proposed development from the subsequent phases of construction works.

d) Air Quality

4.3.37 The construction phase of the HPC Project is likely to result in impacts on the local community in terms of temporary reductions in air quality, and particular concerns have been raised in relation to locations in and around Cannington. The key impacts relate to:

- secondary effects of increased traffic in the local area; and
- impacts related to dust and particulate matter generated from construction activities at the associated development sites.

4.3.38 Specifically, properties likely to experience **moderate to major** adverse impacts related to the construction of the Cannington bypass have been identified near to the site boundary and along the affected road network (15 Withiel Drive; 22 Withiel Drive; Brymore Lodge; Brymore Lodge (external buildings); Brymore Secondary Technical School; Hensfield Farm; Chad's Hill; Knapp Farm; Chad's Hill; Pavilion; 58m from (C182) Rodway; Putnell Barn; Rothay; High Street; Withiel Barn; Withiel Drive; Withiel Farm; Withiel Drive), along with users of PRoWs.

4.3.39 The closest homes which could experience **moderate** adverse impacts as a result of the Cannington park and ride facility include those near to the site boundary and along the affected road network (32 Brownings Road).

4.3.40 Best practice guidance control methods would be implemented to manage fugitive nuisance dust and particulate matter emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site, are presented within the **Air Quality Management Plan**. As a result of the implementation of control methods, there are predicted to be **no significant residual impacts** related to the construction, operational and post-operational phases of the associated development sites themselves.

4.3.41 In terms of impacts arising from increased traffic flows, for all assessed pollutants, the potential impact of vehicular emissions from road traffic movements associated with the HPC Project on human receptors for the 2013 and 2016 ‘with development’ scenario is local, adverse, direct, likely and medium-term but temporary. The impact on the human receptor locations for all assessed pollutants is determined to be **not significant**.

4.3.42 The purpose of the proposed Cannington bypass is to minimise adverse effects on the local highway network, particularly through the centre of the village, during the HPC construction phase. There will be a benefit with respect to air quality associated with the operation of the Cannington bypass within the village, as HPC development traffic will be routed away from the centre of Cannington. In addition some of the non-HPC traffic that would have previously used the existing roads through Cannington will in preference travel along the bypass. The ‘with development’ concentration values for annual mean NO_2 in the Cannington model are all well below the EU threshold levels and so are predicted to be **minor adverse**. Their impact on the human receptor locations is therefore **not significant** during the ‘worst-case’ scenario (peak construction, 2016).

e) Landscape and Visual

4.3.43 The effects of the development on the landscape and visual amenity are related to:

- a change of land use and break in landscape connectivity as a result of the Cannington bypass, leading to **major adverse** impacts on the visual amenity of users of public rights of way (BW5/20, BW5/8, BW5/17, PRoW BW5/7 and BW7/4) and identified viewpoints; and
- **moderate to major adverse** impacts resulting from the Cannington park and ride facility, which would change the local landscape by adding built elements including roads, small buildings, lighting and CCTV columns and security fencing and additional vehicle movements.

4.3.44 The moderate and major significant impacts at the construction, operational and post-operational (i.e. removal/restoration) phase of Cannington park and ride are confined to a small area close to the site. The site is currently in agricultural use and the temporary change of use to a park and ride site represents a significant change to the landscape character and inevitable landscape impacts. The mitigation provided inherent within the design has aimed to reduce this impact as far as possible and achieve an attractive and appropriate landscape setting to the proposal.

4.3.45 The assessment of the potential impact to the visual amenity of leisure and recreation facilities within the local area during the construction phase of the park and ride facility concludes that there could be a **moderate adverse** impact at Cannington Cemetery and the sports pitch by Shark's Lane.

4.3.46 The design of the proposed bypass includes measures to mitigate the impacts on landscape and visual amenity within the design. These include screen planting, highway boundary planting of hedgerows with trees and ecological mitigation measures. Acoustic bunds would also provide further visual screening of the bypass when it is complete and operational.

f) Recreation and Amenity

4.3.47 The nature of the HPC Project would result in temporary impacts on the amenity of users of recreation features currently in use by the community – this includes the PRoW BW5/8 and local facilities including Cannington Cemetery and the sports pitch by Shark's Lane. Throughout the process, consultation has been undertaken with SCC's Rights of Way Officers, The Ramblers Association, and users of the PRoW network.

4.3.48 The impacts identified are most specifically related to direct impacts of connectivity arising from the severance and obstruction of PRoW BW5/8 that is crossed by the proposed Cannington bypass.

4.3.49 PRoW BW5/8, which connects southern Cannington with other local settlements (Combwich, Otterhampton and villages to the east via joining with other PRoWs) would be bisected by the route of the bypass construction works, which would result in the obstruction of this PRoW.

4.3.50 A diversion route would be provided for users of PRoW BW5/8 to gain access across the route of the bypass during the construction phase. The diversion would either cross the construction site or divert around the area under construction. This would ensure that the right of passage is maintained and that connectivity to the PRoW network to the west from Cannington or west into Cannington would be assured, leading to a **minor adverse** residual impact. After the opening of the bypass the traffic flows on the bypass are predicted to be such that the PRoW can be reopened.

4.3.51 There would also be indirect amenity impacts on users of public rights of way in the immediate vicinity of the Cannington park and ride site, primarily arising from predicted noise and visual impacts identified during the course of construction, operation and post-operation. These should be viewed in the context of the transitory nature of the users of the public rights of way and the relatively limited sections of footpath that are likely to be affected.

4.4 Summary of Impacts and Mitigation

4.4.1 A summary of the cumulative impacts of the elements of the HPC project on community receptors in Cannington has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

4.4.2 This section of the report has focussed on identifying the negative impacts which the HPC Project is likely to have on Cannington. Because of its location on the road network, Cannington is forecast to experience some of the most significant impacts of the project, although these are principally limited to the short-term period up to the opening of the Cannington bypass. Partly as a result, Cannington also benefits from some of the more significant mitigation proposals, including:

- the long-term benefit of a permanent village bypass;
- a Noise Insulation Scheme for properties most affected by short-term traffic noise;
- investment in traffic calming, public realm and pedestrian improvements;
- potential investment in the village primary school;
- £500,000 to be spent on leisure facilities in the village;
- at least £500,000 to be spent on community backed projects to enhance the quality of life of the local community; and
- £1.5 million towards a Construction Skills Centre in Cannington.

4.4.3 As a result the principal impacts that the HPC Project may be likely to have on Cannnigton have been mitigated where practical. The village is well placed for its residents to benefit from the extensive training and employment opportunities that would be available as a result of the HPC Project.

5. OTTERHAMPTON

5.1 Introduction

5.1.1 Otterhampton CP is located to the south-east of Hinkley Point, and comprises the village of Combwich as the main population centre. Although the village is relatively small, Combwich is anticipated to experience a number of effects from the HPC Project, mostly resulting from the proposed Combwich Wharf refurbishment and extension and the construction of a new temporary freight laydown facility which is proposed as one of the associated developments in the HPC Project. Additionally, there would be increased traffic flows on the C182 (Rodway) from Cannington. Combwich is also close to Hinkley Point and so it could become an attractive place for construction workers to seek accommodation.

5.2 Context

a) Local Area and Community Impacts

5.2.1 Otterhampton Parish is largely comprised of rural, agricultural land, with the majority of its 1,335 population located in Combwich, which has around 550 dwellings. The population of the village has an older profile, and has been growing in recent years. The area supports relatively few jobs (around 160), although there is a low level of unemployment among residents, and low levels of deprivation. The village has an attractive, close knit character and it adjoins the River Parrett.

5.2.2 At Combwich, the C182 (Rodway) from Cannington passes to the west of the village and continues on to Hinkley Point. Once operational, the Cannington bypass would join the C182 (Rodway) just south of Stradling's Hill, to the north of Cannington and south of Combwich, and would form a key route to the HPC development site for HGVs and buses.

5.2.3 EDF Energy operates an existing Roll-on Roll-off port facility at Combwich Wharf on the River Parrett. This facility is periodically used by National Grid and EDF Energy for the transport of AILs to the existing Hinkley Point Power Station Complex. EDF Energy owns a private access road which connects Combwich Wharf to the C182 (Rodway), passing to the south of the village (the Combwich Wharf access road).

5.2.4 The community at Combwich are expected to be impacted by the HPC Project as a result of the following:

- the nearby location of the HPC development site;
- the location of Combwich on strategic transport links from the M5 motorway, via Bridgwater and Cannington, to Hinkley Point;
- impacts relating to the construction and operation of the proposed Combwich Wharf refurbishment and extension and the new, temporary freight laydown facility plus the deconstruction of the freight laydown facility and its restoration to agricultural land The proposed development at Combwich Wharf would enable its continued use for the import of AILs and of other bulky construction goods during the construction phase for the HPC Project and thereafter to support its operation. The freight laydown facility would store goods received principally via Combwich

Wharf pending their onward transportation to the HPC development site. Priority would be given to use of the freight laydown facility for the storage of goods arriving via Combwich Wharf but it could also be used to hold general construction goods arriving by road when there is spare capacity and when storage space is not available at the HPC development site. Combwich Wharf would be retained in its refurbished state to support the operation of HPC and would be used at similar levels as currently (up to twice a year). The freight laydown facility would be removed once the construction of HPC has been completed and the land restored to agricultural land; and

- traffic generation associated with the construction, operational and post-operational phases of Combwich Wharf and the freight laydown facility and general traffic associated with the construction of HPC which would use the C182 located a short distance to the west of Combwich village.

5.2.5 Long-term, Combwich has a number of community assets, including the Combwich Motor Boat and Sailing Club (CMBSC). The club's facilities, which are located at Combwich Wharf and which are leased from EDF Energy, include clubhouse buildings, one slipway, pontoon and mooring and berthing points. The area around Combwich Wharf is currently in public usage for the mooring of boats.

5.2.6 Indirectly, there would also be adverse effects on local residents and users of PRoWs that cross and run close to the site, where noise, visual and recreational amenity levels are likely to be affected by adverse impacts resulting from the proposed development.

5.2.7 **Figure 27A.5** shows a plan of the parish, including elements of the HPC project in the local area.

b) Associated Developments

5.2.8 The refurbishment and extension of the existing Combwich Wharf facility is an important element of the commitment within EDF Energy's transport strategy to maximise the use of the sea to bring construction materials to the HPC site.

5.2.9 The proposals would involve the demolition of redundant features and the creation of new berthing facilities including an Abnormal Loads Quay and a Goods Wharf) in addition to modifications to the berthing bed within the River Parrett. This would be a permanent facility which would continue to be used by the National Grid and EDF Energy during the operation of HPC (see **Volume 7, Chapters 2** to **5** of the **Environmental Statement** for further details). Combwich Wharf has been selected as the location for this facility as it is the closest existing such facility to Hinkley that is available and which can be modified to meet the requirements for AIL deliveries to support the construction of HPC. The temporary jetty at the HPC development site can not be used to receive AIL deliveries as it has not been designed for this purpose and it is too exposed. Combwich Wharf is more sheltered and better suited to receiving AILs (see the **Alternative Site Assessment** appended to the **Planning Statement** for more details).

5.2.10 The proposed development would also include provision of a new, temporary freight laydown facility in an area to the south of Combwich village for the handling and storage of AILs and bulky construction goods before they are transported to the HPC development site (see **Volume 7, Chapters 2** to **5** of the **Environmental Statement** for details).

5.2.11 The new freight laydown facility is proposed to be constructed in an area very close to Combwich Wharf. The origin for many of the AILs means that they need to be transported long distances by sea with sailings booked many months in advance. Sailings may be subject to fluctuation due to adverse weather conditions. In recognition of this, and due to space constraints at the HPC development site, it is proposed to provide a holding area for AILs at Combwich. As there is no laydown area available at Combwich Wharf itself, a laydown facility in close proximity to Combwich Wharf would provide a degree of contingency against any supply disruption before AILs are transported to the HPC development site. At times when the freight laydown facility would not be used for AILs i.e. where limited or no AIL are delivered to Combwich, the available area would be used in the short-term for storing other construction items.

5.2.12 Use of the laydown would be prioritised for water-borne deliveries arriving at Combwich Wharf. Any surplus storage areas would be used to store road borne deliveries where practicable.

5.2.13 The **Alternative Sites Assessment** describes the site's credentials compared with other sites, whilst the **Consultation Report** describes how the site was selected.

5.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

5.3.1 Combwich falls within the wider Cannington ward cluster identified in **Volume 2**, **Chapter 9** of the **Environmental Statement**. The Cannington ward cluster (the population of which is predominantly made up of the Cannington urban area) is expected to accommodate 120 non-home-based construction workers in 2016, when the construction workforce is at its peak. This is equivalent to around 22% of annual new residents, based on the number of new residents observed in the 2001 Census.

5.3.2 In particular, impacts may arise relating to the capacity of tourist and private rented accommodation sectors, and in terms of the capacity of local schools, particularly if the level of non-home-based construction workers exceeds the 'central scenario' outlined in **Volume 2**, **Chapter 9** of the **Environmental Statement**. The central scenario is based on a workforce profile at peak construction of 5,600 construction workers on the HPC development site and associated development sites combined, of which 66% would be 'non-home-based' i.e. requiring short-term accommodation. In the wider Cannington ward cluster, based on functions of existing supply of accommodation, cost of accommodation and distance to the HPC development site, the 120 non-home-based construction workers are anticipated to be split fairly equally between accommodation sectors (private rented (around 25), tourist (around 30), owner-occupied (around 35) and latent (around 30)).

5.3.3 Based on the size of Combwich village, only a small proportion of these 120 non-home-based construction workers would be expected to live in Combwich.

5.3.4 Although this is a relatively low proportion of the population, concerns about impacts of non-home-based construction workers on public safety, community cohesion, the provision of services and the capacity of community facilities have been raised by the local community.

5.3.5 In the Cannington/Combwich area, at a conservative estimate there is capacity to accommodate this demand in existing vacant bedspaces, although if non-home-based construction workers exceed the central scenario (as modelled and assessed in **Volume 2**, **Chapter 9** of the **Environmental Statement**), capacity issues could arise.

5.3.6 Potential impacts would be mitigated through the workforce or accommodation management measures and contributions outlined in Section 1 of this report. The number of workers attracted to seek accommodation in Cannington/Combwich should be regulated by the available supply. The accommodation office for the HPC Project, however, would have the ability to direct new applicants away from the Cannington and Combwich area if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit Cannington/Combwich and its residents in the event that hardship is being caused.

5.3.7 Similar issues arise in relation to education. The few workers resident in Combwich could seek to place their children in the primary school in Combwich (Otterhampton Primary School) or nearby Cannington (Cannington Church of England Primary School), although only a small proportion of workers are expected to bring children. In 2010/11 the Cannington Primary School had room for 175 pupils and had 164 pupils on roll, so spare capacity of 11. Otterhampton Primary School currently has only three surplus places. Local schools currently have spare capacity but, in order to head off any potential shortfall in capacity EDF Energy’s proposals described in Section 1 include investment in new or enhanced classroom facilities in Cannington (and Bridgwater) and a formula for payment towards increasing education capacity further if monitoring identifies further impacts beyond the enhanced capacity.

b) Transport

5.3.8 At Combwich, the C182 (Rodway) from Cannington passes to the west of the village and continues on to Hinkley Point. Once operational, the Cannington bypass would join the C182 (Rodway) just south of Stradling’s Hill, to the north of Cannington and south of Combwich, and would form a key route to the HPC development site for HGVs and buses.

5.3.9 The Combwich Wharf access road provides direct access to the C182 (Rodway) from Combwich Wharf which means that traffic can avoid going through the village. During the HPC construction period, there would be a significant increase in traffic on the C182 (Rodway). Whilst this is unlikely to impact directly on Combwich residents, the C182 (Rodway) is the principal road used for journeys to and from the village. Transport impacts on the C182 (Rodway), to the north of Cannington, are also indicative of the conditions on the C182 (Rodway) to the west of Combwich and are summarised in this report under transport impacts at Storgursey, in Section 2.0, and repeated below.

5.3.10 The scale of the increase in HGVs and buses on the C182 (Rodway), to the north of proposed Cannington bypass, in 2013, during the early construction phase of the HPC power station, is predicted to increase from 206 HGVs/buses (2-way daily flows) in the Reference Case (existing flows, plus committed development plus background growth) scenario to 1,483 HGVs/buses with the HPC Project (including the mitigation package described above). The total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would result in a*n* increase of 25.9% in all vehicles on the C182 (Rodway) to the north of the proposed Cannington bypass.

5.3.11 In 2016, the 2-way daily flows at the same assessment point are predicted to be 1,698 HGVs/buses with the HPC Project, an increase from 246 HGVs/buses in the Reference Case. This is equivalent to an increase of approximately 590% of existing HGV and bus flows on the C182 (Rodway), to the north of the HPC development site. The above figures include existing and future road traffic associated with Combwich Wharf and is considered to be representative of the conditions likely to be experienced at the C182 (Rodway) to the west of Combwich in 2016, when Combwich would be operational and there would be regular HGV movements between the Combwich freight laydown facility and the HPC development site. However total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would result in a much lower increase of 24.1% in all vehicles on the C182 (Rodway) to the north of the proposed Cannington bypass.

5.3.12 In 2021, the 2-way daily flows on the C182 north of the bypass are predicted to decrease to 773 HGVs/buses with the HPC Project, an increase from 218 in the Reference Case. This is equivalent to an increase of approximately 300% of existing HGV and bus flows on the C182 (Rodway), to the north of the HPC Project. Again total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would see a far lower increase of 15.2% on the C182 (Rodway) to the north of the proposed Cannington bypass.

5.3.13 The impact of these increases in traffic flows is assessed in terms of severance, pedestrian delay, pedestrian amenity, driver delay and accidents and safety. Severance is defined as perceived division that could occur within a community when it becomes separated by a major traffic artery and is therefore particularly relevant the consideration of impact on the community. The increases described above with regard to the C182 (Rodway), to the north of proposed Cannington bypass, in 2013, 2016 and 2021, is considered to be **moderate adverse** in terms of severance. In terms of the other assessment criteria, the increase in total traffic does not meet the relevant thresholds and therefore the impact is considered to be **negligible,** with the exception of driver delay, which is considered to be **minor adverse** in 2013.

5.3.14 Nevertheless, the character of the C182 (Rodway) to the west of Combwich would experience a significant change as a result of HGVs and buses associated with the HPC Project. This would however only be temporary, throughout the course of the HPC Project, and would not persist following completion of the construction phase, when there would just be operational staff on the site. It is also relevant that the above figures are worse case, particularly with regard to anticipated bus numbers. Timetables and routes have been developed for modelling purposes for the **Transport Assessment** to assess the worst-case impact that the provision of such services could have on the highway network. As the development progresses, EDF Energy would refine the bus services, routes and timetables to best serve the actual distribution of workers and this should enable the number of bus trips to be significantly reduced.

5.3.15 The principal mitigation proposed is the transport strategy itself, with its commitment to the use of the sea, the limitation of car parking and the management of HGV flows to reduce their number during the peak periods. In addition, to address the predicted effects on the C182 (Rodway) the following measures are proposed:

- Speed restrictions on the C182 (Rodway);
- A horse crossing at Faringdon Hill Lane to ensure the ability to cross the C182 (Rodway) safely at the busiest times for pedestrians and riders.

c) Noise and Vibration

5.3.16 An assessment has been undertaken of the potential noise and vibration impacts that might arise during the construction, operational and post-operational phases of Combwich Wharf and the freight laydown facility at the nearest residential dwellings, as well as from local amenity and recreation facilities. The construction phase for the refurbishment and extension of the wharf is likely to take up to 12 months (Q1 2013 to Q1 2014).

5.3.17 The construction of the freight laydown facility is also likely to take up to 12 months (Q1 2014 to Q1 2015). The normal hours of work for the construction of the proposed development would be Monday-Friday 07:00 to 19:00 and Saturday 07:00 to 13:00. In the operational phase, the freight laydown facility would be in use between 07:00 and 20:00 Monday to Friday and between 08:00 and 18:00 at weekends. Restricted operational hours and good working practices, including the operation of plant and machinery are the subject of proposed planning controls. Unloading of both AILs and general construction goods deliveries would be restricted to 07:30-18:30 seven days per week.

5.3.18 All AIL and general construction goods deliveries to Combwich Wharf would require a minimum 4.5m neap spring tide. Due to the specific tidal requirements, the arrival and departure of vessels to Combwich Wharf would be unrestricted and would occur at any time, 24 hours per day, seven days per week. AIL deliveries, which rely on a low tide for unloading, would need to be appropriately timed such that the low tide would fall within the specified unloading hours. In circumstances where arrivals occur outside of the specified unloading hours, the contractor would not be permitted to commence unloading until 07:30 the next day. During the operational phase, the freight laydown facility would be in use between 07:00 and 20:00 Monday to Friday and between 08:00 and 18:00 at weekends, Bank and Public Holidays.

5.3.19 The highest predicted noise levels at nearby residential dwellings would occur during the Combwich Wharf refurbishment and extension works. Using a conservative assessment, with all plant assumed to be working at the closest point, the impact of these short-term activities is predicted to have a **moderate adverse** impact on the closest residential receptors at ‘No 24 Riverside’ and ‘No 62 Estuary Park’.

5.3.20 A significant noise impact is predicted at CMBSC during the Combwich Wharf refurbishment and extension. This is associated primarily with the demolition works and is assessed as being of **moderate adverse** significance.

5.3.21 The predicted operational impacts can be separated between the two main proposed uses. The key activities during the operational phase that may cause noise impacts are:

- Refurbished and extended Combwich Wharf facility, comprising;

  - movement and berthing of ships or barges; and
  - un-loading of heavy plant and equipment.
- Freight laydown facility, comprising;
  - loading and unloading operations; and
  - HGV movements on the site.

5.3.22 At the nearest properties on Riverside and Estuary Park, high magnitude noise levels are predicted during AIL and construction goods vessel arrivals and departures, daytime AIL unloading operations and unloading of other construction goods cargo at Combwich Wharf, and their transfer to the freight laydown facility. The impact of these operations is assessed as being of **major adverse** significance.

5.3.23 In recognition of the adverse noise impacts which have been assessed, the fact that some of the adverse impacts would occur at night and in the early morning due to tidal requirements, and taking account of the relatively rural character of the affected areas, EDF Energy propose to offer a Noise Insulation Scheme to the most affected residents closest to Combwich Wharf.

5.3.24 The proposed development includes proposals which are designed to reduce the impacts of noise upon sensitive receptors. These proposals include the construction of a noise bund on the north-west boundary of the proposed freight laydown facility and the erection of an acoustic fence to the west of the Wharf.

5.3.25 Restricted construction and operational hours and adopting best working practices as set out in the **Environmental Management and Monitoring Plan** and **Noise and Vibration Management Plan** would also ensure that adverse imapcts are minimised wherever possible.

d) Landscape and Visual

5.3.26 The activities which are anticipated to have an impact at the construction phase would primarily be associated with the construction of the laydown facility to establish the platform level, attenuation ponds and noise and flood bunds involving the movement of large vehicles. This phase of work is assessed as **moderate adverse**. A **major adverse** impact would also be anticipated at Combwich harbour during the construction phase of the wharf works. During the operational phase the impact would primarily be associated with the arrival of shipping and the associated movement of vehicles transporting goods and the general off-loading activities, and this would result in a **major adverse** impact.

5.3.27 The proposed development site is located about half way along the Parrett Riverscape local character area, and close to Combwich Village and Harbour local character area. The elevated levee, part of the Parrett Riverscape, that runs along the north-east boundary of the freight laydown facility, gives clear views over this part of the site. The impact on the Parrett Riverscape character area as a whole is assessed as of **moderate adverse** significance, although proposed increases in activity on the River Parrett would not be out of character with the current use of the river. A **major adverse** impact would also be anticipated at Combwich Village and Harbour during the operational phase.

5.3.28 The proposed development would have an impact on the River Parrett Trail where it adjoins the freight laydown facility and the footpath along the levee on the opposite bank of the River Parrett. During the construction phase this would be associated with the refurbishment and extension of Combwich Wharf and the establishment of the platform for the freight laydown facility. These operations would involve the movement of large vehicles and machinery. The impact is assessed to be **moderate adverse**. During the operational phase the impact at the Wharf would be associated with the arrival and the unloading of the AILS and vessels and the associated movement of vehicles along the access road. At the freight laydown facility the impact would be associated with the presence of the site itself in a previously agricultural location with associated fencing, lighting infrastructure and stored material and large vehicles the impact is assessed as being of **moderate adverse** significance.

5.3.29 The proposed development would have the greatest impact on the visual receptors at the harbour and immediately surrounding roads, paths and residential properties. There would also be views from the levee, immediately opposite the Combwich Wharf on the opposite bank of the River Parrett, but little visual impact beyond this, as the levee screens most ground level views.

5.3.30 EDF Energy carefully considered the design of the freight laydown facility in order to minimise its impacts on the countryside and on Combwich. The design of the proposed Combwich development has been refined with the benefit of feedback from consultees and through an understanding of the character and visual structure of the landscape as well as the functional and operational requirements of the proposed development.

5.3.31 The proposals aim to create a strong landscape setting which is in character with the surrounding landscape and which can be removed at the end of the operational phase of the freight laydown facility. The landscape strategy for the wharf and the laydown area seeks to respond to the character of the area and to complement the ecological objectives of the project. Through the use of appropriate planting, the landscape strategy aims to screen ground level activities as much as possible from key views to the north from the village and nearby Public Rights of Way (PRoW). This includes:

- visual screen planting in the form of mixed native planting of species around the laydown area to screen views from the River Parrett Trail PRoW and long views from the south-west;
- the height of the containers on the laydown area have been limited to two containers high only at the laydown site;
- a 4m high noise attenuation bund at the northern boundary of the laydown platform is proposed and would provide some visual screening. It would be formed from topspoil arising from the site at 1:3 slopes and planted on the northern side facing Combwich village and Combwich Ponds. The side of the bund facing the laydown area would be grassed; and
- an acoustic fence is to be provided along the edge of the abnormal loads access route, which would include planting which is intended to screen the fence. The fence and planting would assist to screen activities on the wharf.

e) Air Quality

5.3.32 The impacts identified as of moderate significance in terms of air quality are related to fugitive dust and particulate matter generation causing potential nuisance to local receptors.

5.3.33 The construction and post-operational phases of the proposed development would result in **moderate adverse** impacts (prior to mitigation) on local residential receptors at 71 Estuary Park and 24 Riverside (within 50m of the proposed development site).

5.3.34 Best practice guidance control methods would be implemented to manage fugitive nuisance dust and particulate emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site. These are presented within the **Air Quality Management Plan**. With controls in place no significant impacts are anticipated, although there may be some dust during the construction of the facilities.

f) Amenity and Recreation

5.3.35 The River Parrett Trail Public Right of Way (PRoW) (BW25/31) runs along the north-east boundary of the freight laydown facility and crosses the Combwich Wharf access road at the entrance to Combwich Wharf. In terms of other recreationa and amenity receptors, CMBSC is located at Combwich Wharf.

5.3.36 During the construction phase at Combwich Wharf and the freight laydown facility including works to construct the new flood defence bund, part of the construction for the Goods Wharf access road would take place where the River Parrett Trail PRoW BW25/31 crosses the existing Combwich Wharf access road. These works would temporarily obstruct and prevent access to and along the River Parrett Trail. The obstruction would be for a short duration but due to the sensitivity of the River Parrett Trail to obstruction (given the long distance from any other existing route) a high magnitude effect would arise. Consequently, given the high importance of this PRoW, a short-term and temporary **major adverse impact** is predicted. A diversion route would be provided for users of the River Parrett Trail to maintain access at all times during the construction phase including where required, around the area where the new flood defence bund would be constructed (and during the post-operational phase when the flood bund would be removed).

5.3.37 The construction works at the Wharf would result in an obstruction to the vehicular and pedestrian access to and from the CMBSC. This potential obstruction would extend for the 18 month duration of the construction phase and, without mitigation, would effectively prevent the Club from operating, unless mitigating measures are put in place. In addition, the presence of the Goods Wharf access road would result in the loss of an area of boat storage (around 300m^2) currently used by the Club.

5.3.38 Access to the CMBSC will not be obstructed at any time during the construction phase at Combwich Wharf. A temporary access road would be provided until the new Goods Wharf access road is constructed and access made available to the CMBSC. In addition, there will be no net loss of hardstanding area for the storage of boats as result of the proposed development. The extension to Combwich Wharf would result in the need to replace an existing pontoon currently located to the west of the Abnormal Load Quay. EDF Energy is committing to provide a replacement pontoon.

The timing for delivery of the replacement pontoon and its new location and design will be agreed at a later date in consultation with the CMBSC.

5.4 Summary of Impacts and Mitigation

5.4.1 This section of the report has focussed on identifying the negative impacts which the HPC Project is likely to have on Combwich. Because of its location at the mouth of the River Parrett, and its proximity to Hinkley Point plus the fact that Combwich is the location for one of the HPC Project off-site associated developments, Combwich is forecast to experience changes as a result of the project, particularly through the construction phase of the HPC development site. The principal effects are the landscape and visual impact of the new laydown area and the noise associated with unloading barges at the wharf – which may be necessary at anti-social hours in order to catch the tides. A series of measures are proposed to mitigate potential impacts, including landscape screening and a Noise Insulation Scheme, although impacts would remain. The laydown area would be removed and the land restored to countryside at the end of the HPC development site construction period. The existing wharf access road ensures that the village is not directly affected by the traffic generated by the use of the wharf or the laydown area.

5.4.2 Combwich is well placed for its residents to benefit from the extensive training and employment opportunities that would be available as a result of the HPC Project. Income for the village should also be generated by the demand from workers for accommodation during the construction period. Like other communities locally, Combwich is also eligible to apply for funds from the Community Impact Fund to support schemes that would enhance the quality of life in the village.

5.4.3 A summary of the cumulative impacts of the elements of the HPC project on community receptors in Otterhampton has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

6. WILLITON

6.1 Introduction

6.1.1 As one of the closest settlements to the west of the HPC development site, and on the current transport route from Minehead and other settlements in West Somerset to Hinkley Point, Williton is anticipated to experience a number of effects from the construction, operational and post-operational phase of HPC.

6.2 Context

a) Local Area and Community Impacts

6.2.1 Williton is the main settlement in Williton CP, which also includes smaller villages including Doniford, to the north-east. Williton, the administrative centre for West Somerset Council, is at the junction of the A39, A358 and B3191 and roughly equidistant between Minehead, Taunton and Bridgwater, around 12 km from Hinkley Point. Williton has a population of around 2,750 people, with an older age profile than the national average. Existing levels of deprivation in Williton are relatively high (the east of Williton is within the 20% most deprived areas in England).

6.2.2 The elements of the HPC Project anticipated to result in impacts on the community in Williton are:

- the relative proximity of Williton to the HPC development site, and the location of Williton on transport links from the west to Hinkley Point; and
- the proposed park and ride site, to the west of Williton. The Williton facility principally proposes a park and ride facility for 160 parking spaces and a bus waiting area to facilitate the transfer of workforce to the HPC development site.

6.2.3 The transport strategy for the HPC Project has limited impacts on Williton through locating any associated development outside of the main settlement (the park and ride site is approximately 1.3km to the west of Williton). This was primarily in response to concerns raised through EDF Energy's consultation and the availability of a brownfield site outside of the village which met EDF Energy's requirements and provided a genuine alternative to providing a site in Williton itself. Nevertheless, because of Williton's location on the route to the HPC development site from the west, community impacts are most likely to arise in Williton as a result of the construction of the park and ride facility, and from the traffic generation linked to the construction phase of HPC. Impacts may also arise from workers who choose to live in Williton.

6.2.4 **Figure 27A.6** shows a plan of the parish, including elements of the HPC project in the local area.

b) Associated Developments

6.2.5 The nature of the HPC Project is such that associated developments are required to support the construction phase – in this case a park and ride facility is proposed to the west of Williton, south of Watchet, which would transport construction workers to the HPC development site. Without the park and ride site, construction workers from the west of Hinkley Point would be likely to drive to the site or along the A39 to Cannington. The park and ride site would cease to be needed once the power station is constructed and the site would revert to its previous condition and lawful use, which is as a lorry park**,** depot and storage area.

6.2.6 The proposal responds to a need to limit car movements through the rural area to the south-west of Hinkley and the site is considered to be well located to collect traffic from the rural area and allow its transfer to buses. Williton is the principal settlement in the area and proximity to it should assist in reducing the overall length of car journeys. The site at Williton was chosen because it has good access to the A39, its use would reduce the need for traffic to pass through Williton, it is previously-developed land and it is well screened by existing mature vegetation. Previously, EDF Energy proposed a site closer to Williton on greenfield land, which proved to be unpopular locally, as explained in the **Consultation Report.**

6.2.7 The **Alternative Sites Assessment** describes the site's credentials compared with other sites, whilst the **Consultation Report** describes how the site was selected.

6.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

6.3.1 The Williton ward cluster used as the basis for spatial analysis of population distribution in the socio-economic assessment (**Volume 2, Chapter 9** of the **Environmental Statement**) covers a wider area than Williton, also incorporating the settlement of Watchet and Old Cleeve, Crowcombe and Stogumber. This spatial area has a population of 11,000, while Williton has around 2,700 residents.

6.3.2 The number of non-home-based construction workers at peak forecast to be seeking accommodation in the area (150) is equivalent to around 20% of average annual new residents in the ward cluster, based on the number of new residents observed in the 2001 Census.

6.3.3 Although this is a relatively low proportion of the population, concerns about impacts of non-home-based construction workers on the supply of accommodation, public safety, community cohesion, the provision of services and the capacity of community facilities have been raised in consultation.

6.3.4 The ward cluster is anticipated to accommodate around 150 non-home-based residents, of which around 40 might be expected to stay in Williton village. Tourist accommodation is likely to account for around 60 of these construction workers, with around 40 in latent accommodation, around 25 in the private rented sectors and 25 in the owner-occupied sector. Using conservative estimates this is identified as being well within existing capacity (an estimated 120 tourist sector bedspaces are available even at August peak and 30 private rented sector bedspaces), taking into account turnover and vacancies.

6.3.5 EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The number of workers attracted to seek accommodation in Williton should be regulated by the available supply. The Accommodation Office for the HPC Project, however, would have the ability to direct new applicants away from Williton if there is evidence that the demand is excessive.

6.3.6 Workers resident in Williton may seek to place their children in the local primary school, although only a small proportion of workers are expected to bring children. There are two primary schools in the area: St Peter's Church of England First School, which has 33 surplus places, and Knights Templar Community School, to the north of Williton, with 40 surplus places. The local secondary school, Danesfield Community Middle School only takes pupils between the ages of 9 and 13 and has 56 surplus places. To a limited extent, demand from workers' children may help to support the schools.

6.3.7 Wider mitigation strategies outlined in Section 1 address other impacts on health and public services. In relation to leisure impacts, the overall effects on facilities in Williton are likely to be very small.

6.3.8 EDF Energy is also committed to invest in training and education facilities in order that local people can gain the skills and qualifications to work on the HPC Project both in the construction phase and in the completed development. The **Economic Strategy**, and the **Construction Workforce Development Strategy** which is appended to it set out a series of actions and investments which EDF Energy would undertake. These include investment in training facilities at Cannington and at Minehead, which should be accessible to Williton residents.

6.3.9 The project-wide mitigation package explained in Section 1 includes £250,000 for new or improved leisure facilities in West Somerset and Williton and WSC may decide that Williton is an appropriate location for that investment. Similarly, £2 million of the Community Impact Fund is ring-fenced for West Somerset (in addition to the money committed at Stogursey) and Williton would be well placed to bid for that money and for further awards from the wider Fund.

b) Transport

6.3.10 Given the location of Williton in relation to HPC and main transport links from Minehead and the rest of West Somerset, the general area could experience impacts related to traffic flows, severance and an increase in bus (and potentially limited HGV) frequency, and consequent community impacts related to air quality, noise and vibration and visual amenity.

6.3.11 The construction of the associated development site at Williton park and ride facility, together with the location of the HPC development nearby, would affect these impacts. The proposed park and ride facility at Williton would be located on an existing lorry park site on the B3190 to the west of Williton.

6.3.12 The main part of the transport mitigation comprises the transport strategy and the highway improvements. In addition, the effects of the construction of the HPC Project would be monitored throughout and if any unforeseen impacts are identified then EDF Energy would work with the authorities to mitigate their impact. Specifically in the context of Williton, the Washford Cross roundabout is proposed for improvement with a new, 4-arm roundabout at the existing junction of the B3190 and A39, approximately 1.5km to the west of Williton. These proposals would address an existing local safety problem with the junction and would comprise:

- realignment of existing carriageway and creation of new, four-arm roundabout;
- new full-depth carriageway constructed off the line of the existing road;

- existing carriageway to be broken out and area grassed or landscaped at eastern approach;
- existing carriageway at northern and southern approaches to be resurfaced;
- clearance of existing vegetation and removal of hedgerows;
- extension of field access to new boundary at northern approach;
- provision of new signage and road markings; and
- provision of new street lighting to meet standards to be agreed withSCC.

6.3.13 An assessment of the significance of the predicted increases in traffic as a result of the HPC Project is provided within **Volume 2, Chapter 10** of the **Environmental Statement** and the **Transport Assessment**, which is appended to the **Environmental Statement**.

6.3.14 As Williton is not located on the construction route for the HPC Project, the main increase would be as a result of an increase in the number of buses transporting workers to the HPC site. The scale of the increase in HGVs and buses through Williton, in 2013 and 2016, is predicted to increase from 308 HGVs/buses (2-way daily flows) in the Reference Case (existing flows, plus committed development plus background growth) scenario to 460 HGVs/buses with the HPC Project (including the mitigation package described above). This is equivalent to an increase of approximately 50% of existing HGV and bus flows through Williton. It is relevant however that the total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) would result in a significantly lower increase of 0.6% in all vehicles through Williton.

6.3.15 In 2021, the 2-way daily flows at the same assessment point are predicted to significantly decrease to 326 HGVs/buses with the HPC Project, an increase from 308 in the Reference Case. This is equivalent to an increase of approximately 5.8% of existing HGV and bus flows through Williton. The total daily traffic flows (2-way) as a result of the HPC Project (including mitigation) through Williton would be 0% in 2021.

6.3.16 The impact of these increases in traffic flows is assessed in terms of severance, pedestrian delay, pedestrian amenity, driver delay and accidents and safety. Severance is defined as perceived division that could occur within a community when it becomes separated by a major traffic artery and is therefore particularly relevant the consideration of impact on the community. The increases described above through Williton, in 2013 and 2016 is considered to be **moderate adverse** in terms of severance. In terms of the other assessment criteria, the increase in total traffic does not meet the relevant thresholds and therefore the impact is considered to be **negligible**. In 2021, all transport-related impacts through Williton would be reduced to **negligible**.

6.3.17 The character of the A39 through Williton would therefore experience some change as a result of HGVs and buses associated with the HPC Project, although it is relevant that there would only be a marginal increase in total traffic (less than 1%). This would however only be temporary, and would not persist following completion of the construction phase, when there would just be operational staff on the site. It is also relevant that the above figures are worst-case, particularly with regard to anticipated bus numbers. Timetables and routes have been developed for modelling purposes for the **Transport Assessment** to assess the worst-case impact that the provision of such services could have on the highway network. As the development progresses, EDF Energy would refine the bus services, routes and timetables to best serve the actual distribution of workers and this should enable the number of bus trips to be significantly reduced.

c) Noise and Vibration

6.3.18 The construction phase of HPC could result in impacts on the local community in terms of temporary traffic- and construction-related noise, and particular concerns have been raised in relation to residential amenity in terms of:

- daily road traffic noise impacts on the A39 in Williton at specific sensitive areas in the village;
- noise from construction works related to the Williton park and ride facility at residential properties including Smithyard Cottages; and
- disruption to amenity of users of PRoWs close to the associated development sites and resulting from traffic increases.

6.3.19 Without mitigation, significant adverse effects are projected to occur in 2016 (peak construction workforce) along the A39, at Williton and along the main route connecting the Williton park and ride site with the HPC development site (through Stringston and Stogursey). A medium magnitude of change is also predicted for some of the assessed night-time hours (before the start and after the completion of the principal shifts) on roads through Williton. This represents an impact of **moderate adverse** significance.

6.3.20 In terms of the impact of the construction phase of the park and ride facility, with all plant working at the closest approach, the impact of the construction works is predicted to be of **moderate adverse** significance at the closest residential properties (Smithyard Cottage). The highest predicted noise levels would occur during the earthworks and site preparation.

6.3.21 Specific mitigation that is required to reduce the predicted impact from site preparation and construction activities during works at the closest approach to the neighbouring residential property would include sites/compounds being provided with industry standard 2.4m hoardings within 100m of existing properties, or other barriers, where appropriate, and continuous noisy plant to be housed in acoustic enclosures.

d) Air Quality

6.3.22 The construction phase of HPC could result in impacts on the local community in terms of temporary reductions in air quality, and particular concerns have been raised in relation to locations in and around Williton relating to the construction and post-operational phases of the proposed development of the Williton park and ride facility, which would result in **moderate** impacts (prior to mitigation) on local human receptors at Smithyard Cottage.

6.3.23 Best practice guidance control methods would be implemented to manage fugitive nuisance dust and particulate matter emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site, are presented within the **Air Quality Management Plan**. As a result of the implementation of control methods, there are **no significant residual impacts**.

6.3.24 Ambient NO_2 pollutant concentrations at properties close to the main highway are currently relatively high in Williton owing to relatively high traffic flows, reduced speed (congestion) and narrowing of the A39.

6.3.25 The worst-case annual mean NO_2 vehicular contributions in the Williton model for the 2013, 2016 and 2021 'with development' scenarios are of no greater than small magnitude. Maximum worst-case vehicular contributions are observed at 'Williton County Stores' for the 2013, 2016 and 2021 'with development' scenarios for annual mean NO_2. The worst-case ambient concentration values for annual mean NO_2 for the 2013, 2016 and 2021 'with development' scenarios are all above the EU threshold limit. However, worst-case ambient concentration values for annual mean NO_2 for the 2013, 2016 and 2021 'without development' scenarios are all also above this threshold. This indicates that the annual mean NO_2 threshold would be exceeded without HPC Project traffic, and so would thus not be caused by either the construction or operation of the combined HPC Project.

6.3.26 The increase in traffic volume when comparing the 2013 'without development' and 'with development' scenarios represents only construction traffic for the Williton park and ride site, hence the extremely small NO_2 concentration increase associated with the HPC development in this assessment year. When comparing 2016 and 2021 'without development' and 'with development' scenarios, the increase in traffic volume represents only operational traffic associated with the Williton park and ride site, which is entirely composed of LDVs, hence the small NO_2 concentration increase. Therefore the impacts of 'with development' NO_2 ambient concentration values are predicted to be **minor adverse**. The worst-case potential impact on the human receptor locations is therefore **not significant**.

6.3.27 As such, for all assessed pollutants, the potential impact of vehicular emissions from road traffic movements associated with the HPC Project on human receptors for the 2013, 2016 and 2021 'with development' scenario is local, adverse, direct and likely. Potential impacts will be medium-term and temporary during the 2013 scenario, long-term and temporary during the 2016 scenario, and long-term during the 2021 scenario. The impact on the human receptor locations for all assessed pollutants is determined to be **not significant**.

6.3.28 Nonetheless, The **Freight Management Strategy** and the **Framework Travel Plan** would be implemented to minimise vehicular movements, and use of vehicles compliant with emissions standards in order to mitigate for any potential adverse impacts relating to traffic flow increases in the area.

e) Landscape and Visual

6.3.29 The effects of the development on the landscape and visual amenity are related to:

- **Moderate adverse** impacts resulting from the construction phase of the Williton park and ride facility. Although the proposed development site itself would not be visible from the PRoW beside Cleeve Abbey, construction traffic would be visible moving across the landscape from Washford Cross along the B3190. During construction it is anticipated that there would be approximately 300 (two-way) HGV movements along the B3190.

- Moderate adverse impacts resulting from lighting within the proposed development on users of the PRoW beside Cleeve Abbey. Impacts or lighting during the operational phase are assessed as of **moderate adverse** significance at Viewpoint 4 (B3190 Footway) and Viewpoint 7 (National Trail near Orchard Wyndham).

6.3.30 Hours of working would be restricted to 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays. Construction lighting would be shielded where possible and restricted to an hour either side of working hours to enable workers to arrive and leave safely, so potentially lit between 07:00 and 19:00.

6.3.31 The proposed development site is visible to drivers, pedestrians and users of the PRoW at Five Bells, however, in the Summer months, activities within the proposed development site would be strongly screened by existing, retained, vegetation along the bund to the north of the proposed HPC development site.

f) Recreation and Amenity

6.3.32 There are currently no PRoWs within or immediately adjacent to the Williton park and ride site. Consequently, there would be **no impact** on PRoW arising from obstruction during construction. However, impacts of **moderate adverse** significance may potentially arise as a result of visual and noise disturbance to users of PRoWs WL28/13, WL28/14, WL28/16, and WL28/18 during the construction phase of the Williton park and ride site, and during the operational phase at PRoW WL28/16 and WL28/18 due to the movement and activities of personnel and vehicles, and the presence of park and ride structures, which could result in an adverse impact on the amenity value of the PRoW in the study area.

6.4 Summary of Impacts and Mitigation

6.4.1 This section of the report has focussed on identifying the negative impacts which the HPC Project is likely to have on Williton. Because of its location on the road network, and being the only park and ride to the west of HPC, Williton is forecast to experience a certain degree of impacts, although these are limited due to the anticipated limited number of non-home-based workers in this area. However, Williton is likely to receive benefits from the wider scheme, including good access to the training and employment opportunities at HPC.

6.4.2 A summary of the cumulative impacts of the elements of the HPC project on community receptors in Williton has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

6.4.3 In addition, Williton would be likely to benefit from the project-wide mitigation strategies explained in Section 1, including the Housing Fund, the investment in new or enhanced leisure facilities in West Somerset and a share of the Community Impact Fund.

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7. PURITON

7.1 Introduction

7.1.1 Puriton CP is located to the north of Bridgwater, on the east of the River Parrett and includes the village of Puriton directly to the east of Junction 23 of the M5 motorway, and the smaller villages of Downend and Dunball to the west. Located around Junction 23 of the M5 motorway and the Dunball roundabout (A39 (Bristol Road)), this area is likely to experience impacts arising from the construction, operational phase and post-operational phase of the HPC Project.

7.2 Context

a) Local Area and Community Impacts

7.2.1 Puriton is a village to the north of Bridgwater, around 12 kmto the south-east of Hinkley Point. The population of the parish, which is mainly centred in Puriton but also in Downend and Dunball, is just over 2,000, with a slightly older than average age profile. There are around 900 homes in the area, although significant development is underway in the area to the south of Junction 23 of the M5 motorway, known as the North East Bridgwater development. The area does not suffer from high levels of deprivation and has low unemployment rates. A significant proportion of the jobs in the area are in distribution and manufacturing sectors.

7.2.2 Puriton lies directly to the east of Junction 23 of the M5 motorway, and Dunball roundabout on the A39. These junctions form part of one of the two main HGV routes from the motorway to HPC, which then run through Bridgwater and via Cannington to the HPC development site.

7.2.3 The elements of the HPC Project anticipated to result in impacts on the community in Puriton are:

- the nearby location of the village to strategic transport links from the M5 motorway to Hinkley Point; and
- the proposed Junction 23 site between the River Parrett and A38, which would include a park and ride facility, freight management facility, consolidation facility for postal/courier deliveries and an induction centre.

7.2.4 As such, community impacts are most likely to arise in Puriton as a result of the construction, operational and post-operational phases of facilities at Junction 23 to support the construction phase of HPC, and from subsequent traffic generation.

7.2.5 Indirectly, there could also be effects on local residents and users of community facilities, where amenity levels are affected by adverse impacts of the development on traffic, visual amenity, noise levels and recreation.

7.2.6 **Figure 27A.7** shows a plan of the parish, including elements of the HPC project in the local area.

b) Associated Developments

7.2.7 The nature of the HPC Project is such that associated developments are required to support the construction phase – in this case the park and ride facility, freight management facility, postal/courier consolidation facility and induction centre, to the west of Junction 23 of the M5 motorway.

7.2.8 The site is located directly to the west of the A38 Dunball roundabout and is currently used for agricultural purposes, comprising improved grassland fields and a large area of ruderal vegetation. It lies adjacent to commercial development to the north and to the south-east.

7.2.9 It is proposed to develop a hardstanding marked out for 1,300 vehicle parking spaces for use as a park and ride facility, 85 HGV spaces for a freight management facility, a consolidation facility for postal/courier deliveries and an induction centre on the site. A proportion of the vehicle parking spaces would be kept available for use in exceptional events such as unexpected peaks in demand or the temporary unavailability of other sites.

7.2.10 The site is considered suitable for this development as it is well located in proximity to Junction 23 of the M5 motorway and the A38 which leads to the HPC development site. It is ideally situated to intercept supply chain and construction worker traffic from the north before it enters Bridgwater. The site is large enough to accommodate the proposed development and is not in active use. It is reasonably enclosed by existing development and by vegetation and it can be developed without substantial intrusion into open countryside.

7.2.11 The proposals at Junction 23 would not be needed after the end of the HPC construction programme. Their future use would be controlled through the **Post-Operation Strategy** which would allow the local authority to determine the extent to which the built facilities whould be removed and the site restored.

7.2.12 The **Alternative Sites Assessment** describes the site's credentials compared with other sites, whilst the **Consultation Report** describes how the site was selected.

7.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

7.3.1 Puriton CP falls within the Burnham and Highbridge ward cluster used as the basis for spatial analysis of population distribution in the socio-economic assessment (**Volume 2, Chapter 9** of the **Environmental Statement**), although it is just on the edge of the Bridgwater ward cluster to the south. The Burnham and Highbridge cluster has a total population of over 41,000 people, although the Puriton area only accounts for around 2,000. As such, the Burnham and Highbridge area is anticipated to accommodate around 380 non-home-based construction workers at peak construction, but only around 10 are likely to be accommodated in Puriton.

7.3.2 This is a relatively low proportion of the local population and the scale of impact is unlikely to be such as to warrant concerns for the very local housing market or for wider issues such as community cohesion.

7.3.3 EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The number of workers attracted to seek accommodation in Puriton should be regulated by the available supply. The accommodation office for the HPC Project, however, would have the ability to direct new applicants away from Puriton if there is evidence that the demand is excessive.

7.3.4 Workers resident in Puriton may seek to place their children in the local primary school, although only a small proportion of workers are expected to bring children. Puriton Primary School is the only local school, and currently has 47 surplus places. The nearest secondary schools are in Bridgwater.

7.3.5 Wider mitigation strategies outlined in Section 1 address other impacts on health and public services. In relation to these impacts, the overall effects on facilities in Puriton are likely to be very small.

b) Transport

7.3.6 Given the location of Puriton in relation to HPC and main transport links from the M5 motorway, the general area could experience impacts related to traffic flows, severance and an increase in bus and HGV frequency.

7.3.7 As a result of the construction and operational phases of HPC, traffic flows on the M5 motorway Junction 23 southbound off-slip and northbound on slip roads are anticipated to increase from the present situation to 2016, as do flows on the A38 south of Dunball.

7.3.8 The main part of the transport mitigation comprises the transport strategy and the highway improvements. In addition, the effects of the construction of the HPC Project would be monitored throughout and if any unforeseen impacts are identified then EDF Energy would work with the authorities to mitigate their impact. Specifically in the context of Puriton, highway improvement proposals relate to minor physical works required to facilitate partial signalisation of Junction 23 of the M5 motorway. The proposals would be entirely within the existing carriageway and would comprise:

- minor carriageway widening;
- installation of traffic signals including signal control loops in approach carriageways;
- application of anti-skid coatings, road markings and additional signage; and
- provision of new street lighting to meet standards to be agreed with Somerset County Council (SCC).

7.3.9 Works also comprise minor improvements to the lane markings at Dunball roundabout which would improve links to Junction 23 of the M5 motorway, although these do not comprise physical works and therefore are not included as part of the Development Consent Order application. They have however been assumed to be part of the package of highway improvements for the purposes of the **Transport Assessment**.

c) Noise and Vibration

7.3.10 As a worst-case assessment, it is predicted that a maximum of 50 HGV movements per hour (including park and ride buses) would be generated on the A38 Bristol Road in 2016 between 05:00-06:00. Given the nature of the A39 in Puriton, there are very few residential properties that front the road, therefore the significance of increased traffic noise as a result of the operation of the Junction 23 site and construction phase of the HPC development site is **minor adverse**. Moreover, this assessment does not take account of potential screening by the proposed induction centre and postal/courier consolidation buildings on the site which are likely to significantly reduce potential impacts.

7.3.11 Additionally, potential noise and vibration impacts arising from the construction phase of the Junction 23 site on the closest residential property (The Woodlands) and PRoWs are considered to be of **minor adverse** significance given their distance from the site.

d) Air Quality

7.3.12 The construction phase of HPC could result in impacts on the local community in terms of temporary reductions in air quality, and particular concerns have been raised in relation to locations in and around Puriton relating to the construction and post-operational phases of the proposed development of the Junction 23 site. The closest residential properties to the proposed development site at are Junction 23 are '10 Bristol Road, located 144m from the site, and '2 Walpole Cottage' which is located 177m from the proposed site.

7.3.13 The significance of fugitive dust and particulate matter impacts at these receptors are predicted to be **negligible**, however best practice guidance control methods would be implemented to manage fugitive nuisance dust and particulate matter emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site, are presented within the **Air Quality Management Plan**.

e) Landscape and Visual

7.3.14 Potential impacts have been identified in relation to the construction phase of HPC in terms of community effects on visual amenity:

- Impacts associated with the construction phase when the movement of materials and the noise of construction of the Junction 23 site would disturb the peace of the Level and Moors landscape and Parrett riverscape character areas. This has been assessed as of **moderate to major adverse** significance;
- Also during the construction phase, views would be available of construction activities on the Junction 23 site including movement of materials, heavy machinery and HGVs. Impacts for the construction phase have been assessed as **moderate to major adverse** significance for certain viewpoints on the banks of the River Parrett;
- During operation disturbance would still be present with the daily movement of freight and other vehicles, along with users of the proposed induction centre. Impacts on the Levels and Moors and Parrett riverscape character areas have been assessed as of **minor to moderate adverse** significance; and

- During the operational phase the Junction 23 site lighting would be required 20 hours a day and from certain viewpoints on-site activities could be visible. Impacts have been assessed as of **moderate to major adverse** significance for certain viewpoints on the banks of the River Parrett and from Puriton Hill.

7.3.15 There are no specific measures being proposed as further mitigation for landscape and visual impacts during operation and post-operation. However, a number of design measures are included in the proposals which include:

- maintaining and reinforcing the landscape features of hedgerow, trees and ditches;
- Providing visual screen planting in the form of a 20m wide, 2m high bund and native screen planting of both young and semi mature plants (between 2m and 4m initial height) on the southern boundary to screen views from the River Parrett footpath; and
- providing additional planting along existing hedgerows to reinforce their value for screening.

7.3.16 Hours of construction working would be restricted to 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays. Construction lighting would be shielded where possible and restricted to an hour either side of working hours to enable workers to arrive and leave safely, so potentially could be lit between the hours of 06:00 and 20:00 Monday to Friday and 06:00 to 14:00 on Saturdays. As described above, operational lighting would be required 24 hours a day at the Junction 23 site.

7.3.17 Close to the most southern boundary, where the Junction 23 site is closest to the River Parrett, a grassed bund with semi-mature trees planted along its crest and thick planting of smaller trees along the slopes, is proposed up to a maximum of 2m high to screen views from the river and from the PRoW which runs along both the eastern and western bank.

f) Amenity and Recreation

7.3.18 The main construction and operation area of the Junction 23 site does not contain any PRoW and, therefore, would not result in any obstruction. However, during the construction phase, the construction of flood defence works would result in a temporary (approximately eight weeks) obstruction to PRoW BW28/10, which runs along the east side of the River Parrett to the south and west of the development site (a strategic link between Bridgwater, Pawlett and Burnham and Highbridge). Consequently, prior to mitigation, a short-term reversible **moderate adverse impact** is predicted. However, a diversion route would be provided for users of PRoW BW28/10 to gain access around the construction area for the flood defence works. This diversion would add less than 50m to the existing route and would ensure that the right of passage is maintained, and that connectivity with the settlements of Bridgwater, Pawlett, Burnham and Highbridge would be maintained.

7.3.19 The assessment of visual and noise and vibration disturbance has identified **minor to moderate adverse** impacts on PRoW in the area, depending on the distance to the site. However, walkers using the PRoW usually would be transient and are, therefore, unlikely to be subject to more than short-term impacts. Hence, whilst the predicted noise and vibration and landscape and visual impacts might result in short-term disturbance as walkers pass near to the site, the impact on a person's enjoyment of the amenity is likely to be less significant than has been assessed.

7.3.20 Monitoring of access along the PRoW diversion would be undertaken on a weekly basis or in response to any concerns raised by users of the PRoW (or any member of the public) to the site office or site contact. The monitoring would ensure that access is not obstructed by growing vegetation or any other obstructions, and would lead to maintenance measures being carried out immediately (as necessary) to ensure that access is maintained. Furthermore, an appropriate mechanism for reporting, logging and investigating PRoW diversion complaints would also be employed and monitored during the construction programme, accompanied by an action plan to ensure that routes are not obstructed where issues arise.

7.4 Summary of Impacts and Mitigation

7.4.1 This section of the report has focussed on identifying the negative impacts which the HPC Project is likely to have on Puriton. Because of its location on the road network, and being a suitable location for a park and ride facility, freight management facility, consolidation facility for postal/courier deliveries and induction centre, the Puriton area is forecast to experience a certain degree of impacts. The principal impacts are transport related, with limited impact on residential amenity. A limited number of non-home-based workers are expected to seek accommodation in the area and this is not expected to generate adverse effects. As with other locations, Puriton is likely to benefit from access to the training and employment opportunities available at HPC.

7.4.2 A summary of the cumulative impacts of the elements of the HPC project on community receptors in Puriton has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

8. NORTH PETHERTON

8.1 Introduction

8.1.1 North Petherton, directly to the south of Bridgwater, is anticipated to experience impacts as a result of the HPC Project as a result of its location close to Bridgwater, the main urban centre in the area, and to Junction 24 of the M5 motorway. The A38 Taunton Road also runs directly through the parish and village, which is a strategic link between Taunton and Bridgwater running alongside (and linked to at Junction 24) the M5 motorway. A site close to Junction 24 of the M5 motorway would also be the location of an associated development for HPC, incorporating a park and ride facility, freight management facility, temporary consolidation facility for postal/courier deliveries and a temporary worker induction centre.

8.2 Context

Local Area and Community Impacts

8.2.1 North Petherton CP covers a wide area both sides of the M5 motorway south of Bridgwater, although the main population centre is in the North Petherton village on the A38 directly to the west of the M5 motorway. However, significant developments at Willstock Village and Stockmoor Village (also known as 'South Bridgwater'), adjacent to the Huntworth roundabout to the west of the M5 motorway between Bridgwater and North Petherton also fall within the area.

8.2.2 The population of North Petherton is approximately 6,000 people, and has experienced a fast increase since 2001, with an above average proportion of older people resident. In 2001, there were 2,200 dwellings in the area. Ward level data indicates that the dwelling stock increased by around 10% between 2001 and 2009. The area is not significantly deprived, with a strong employment base built on a significant proportion of warehouse and distribution jobs. Unemployment is generally low.

8.2.3 North Petherton has a number of outdoor grass pitches for cricket and rugby. There are facilities for gymnastics, cricket and athletics at North Petherton Community Junior School. There are additional accessible indoor leisure facilities in Bridgwater (see above and see **Volume 2, Chapter 9, Appendix 9E** of the **Environmental Statement**).

8.2.4 The elements of the HPC Project anticipated to result in impacts on the community in North Petherton are:

- the proximity of the HPC development site, and the location of North Petherton on strategic transport links from the M5 motorway to Hinkley Point; and
- the proposed associated development site, just to the north-west of Junction 24 of the M5 motorway, which would include a park and ride facility, freight management facility, temporary consolidation facility for postal/courier deliveries and temporary worker induction centre.

8.2.5 Community impacts are most likely to arise during the HPC Project in North Petherton as a result of the traffic generation linked to the construction phase of HPC and construction activities at Junction 24 affecting residential amenity.

8.2.6 Indirectly, there could also be adverse effects on local residents and users of community facilities, where amenity levels are affected by adverse impacts of the development on air quality, noise levels and recreation.

8.2.7 **Figure 27A.8** shows a plan of the parish, including elements of the HPC project in the local area.

b) Associated Developments

8.2.8 The nature of the HPC Project is such that associated developments are required to support the construction phase – in this case a park and ride facility, freight management facility, temporary consolidation facility for postal/courier deliveries and temporary worker induction centre. Junction 24 is a key location at which to intercept freight and worker journeys to Hinkley Point.

8.2.9 EDF Energy originally proposed the use of a greenfield site known as 'Bridgwater Gateway' for the location of the associated development at Junction 24. More recently, however, the former Somerfield storage/distribution facility came onto the market and, following consultation, EDF Energy has now adopted that site as its proposed location for the Junction 24 associated development facilities.

8.2.10 The Somerfield site was preferred by many because of its brownfield location. It also offers the important opportunity, given the existing infrastructure already available on the proposed development site, of being available and ready for use almost as soon as the DCO consent is granted, thereby providing a platform to manage and reduce transport impacts in the early years of the project.

8.2.11 The park and ride facility and freight management facility would be temporary facilities, but would be used for the entire construction phase of the HPC Project. After the construction of HPC, the site would be made available for alternative employment development.

8.2.12 The **Alternative Sites Assessment** describes the site's credentials compared with other sites, whilst the **Consultation Report** describes how the site was selected in preference to an alternative greenfield site, which had been proposed in earlier consultation.

8.3 Local Community Impacts and Mitigation

a) Population and Socio-economics

8.3.1 North Petherton falls within the wider Bridgwater ward cluster identified in **Volume 2**, **Chapter 9** of the **Environmental Statement**. However, on a ward level, the local area is anticipated to accommodate around 120 construction workers at peak construction in 2016 (around 9% of the non-home-based construction workers anticipated to live in the Bridgwater area).

8.3.2 Although this is a relatively low proportion of the population, concerns about impacts of non-home-based construction workers on public safety, community cohesion, the provision of services and the capacity of community facilities are relevant impacts that may be experienced by the local community.

8.3.3 In particular, impacts may arise relating to the capacity of tourist and private rented accommodation sectors, and in terms of the capacity of local schools, if the level of non-home-based construction workers exceeds the 'central scenario' outlined in **Volume 2**, **Chapter 9** of the **Environmental Statement**. The central scenario is based on a workforce profile at peak construction of 5,600 construction workers on the HPC development site and AD sites combined, of which 66% would be non-home-based i.e. requiring short-term accommodation. Modelling of anticipated distribution of construction workers estimates that there would be very low demand placed on the tourist and private rented sectors in this local area, with around 20 and 10 anticipated bedspaces required in each sector respectively, and around 75 in latent sectors (based on supply observed locally).

8.3.4 At a conservative estimate there is capacity to accommodate this demand in existing vacant bedspaces, although if non-home-based construction workers exceed the central scenario (as modelled and assessed in **Volume 2**, **Chapter 9** of the **Environmental Statement**), capacity issues could arise.

8.3.5 Potential impacts would be mitigated through workforce or accommodation management and contributions to policing and the public services described above. This includes a project-wide Housing Fund, and Community Fund, and an **Accommodation Strategy** that outlines measures that would be undertaken by EDF Energy to direct non-home-based construction workers to suitable accommodation to relieve capacity issues. In some cases such as leisure, local facilities would be enhanced and there would also be benefit from job and business opportunities, as identified through the **Economic Strategy**.

8.3.6 The demand for owner-occupied accommodation in the local area is also projected to be relatively low, and this would result in a low impact on demand for places in local schools. The **Heads of Terms for the Section 106 Agreement** propose advanced mitigation through early investment in primary school capacity in the wider Bridgwater area and a formula for payment towards increasing education capacity if monitoring identifies further impacts beyond existing capacity.

8.3.7 However, it is recognised that a concentration of worker population could have an impact on the quality of life of some residents. Therefore EDF Energy is proposing a Community Fund to spend on local initiatives which enhance the quality of life in local settlements. In addition, a **Worker Code of Conduct** would be implemented to pre-mitigate any adverse effects on public safety in the local area.

8.3.8 EDF Energy would also work with public service providers to identify potential impacts and ensure that measures are in place to mitigate them and, in some cases, provide local enhancements. These measures include contributions to emergency service and health providers based upon the numbers of workers assumed for their area. For education it includes contributions towards additional school places should these be required; and for leisure, EDF Energy also plans to make contributions to enhance the local recreational facilities.

b) Transport

8.3.9 Given the location of North Petherton in relation to HPC and main road transport links from the M5 motorway and population centres such as Bridgwater and Taunton, the general area has the potential to experience impacts related to traffic flows, severance, and an increase in HGV and bus frequency, and subsequent community impacts related to air quality, noise and vibration and visual amenity.

8.3.10 Impacts may also arise as a result of traffic flows related to the short-term construction activities at the Junction 24 site.

8.3.11 EDF Energy is promoting potential safety improvements at the A38/M5 motorway Junction 24 Huntworth Roundabout to improve the access to/egress from the Huntworth Business Park. This includes provision of a footway along the service road access to the Huntworth Business Park and an improved pedestrian crossing island across the service road access. These improvement works are anticipated to be in place by 2013.

8.3.12 In addition to proposed highway improvements EDF Energy proposes to contribute to potential safety enhancements and pedestrian and cycle improvements within Bridgwater that SCC are progressing as part of their ongoing programme of improvements.

8.3.13 In addition, the effects of the construction of the HPC Project would be monitored throughout and if any unforeseen impacts are identified then EDF Energy would work with the authorities to mitigate their impact.

c) Noise and Vibration

8.3.14 An assessment of construction activities at the Junction 24 site was undertaken with regard to potential noise and vibration impacts at the nearest noise-sensitive receptors (residential dwellings on the A38 and the new Stockmoor Village housing development). In addition, The Brainwave Centre to the north of the Junction 24 site was included as a receptor of high sensitivity.

8.3.15 The noise impacts of Junction 24 construction works are predicted to be of **minor adverse** significance in the short-term on all local residential properties assessed and The Brainwave Centre. With regard to vibration from construction activities on the Junction 24 site, due to the distance to the nearest sensitive residential property (over 70m from the site) the significance of the impact is predicted to be **minor adverse**.

8.3.16 During the operational phase, the principal noise sources associated with the operation of the proposed development include vehicle movements (HGVs, cars and buses) and plant operation on-site. Existing noise sources include the dominant road traffic noise from the nearby A38 and M5 motorway. The noise impacts of operation of the Junction 24 development is predicted to be of **minor adverse** significance. Due to the typically low vibration levels that are likely to be generated during the operation of the site (primarily by on-site vehicle movements), it is expected that operational activities would not result in perceptible vibration impacts on any of the identified receptors.

8.3.17 Best practice measures would be undertaken and are considered to form part of the proposed development. They would be based on the principles set out in the **Environmental Management and Monitoring Plan** (**EMMP)** with further information provided within the Subject Specific Management Plan: **Noise and Vibration (SSMP)**.

d) Air Quality

8.3.18 The construction phase of HPC could result in adverse impacts on the local community in terms of temporary reductions in air quality, and particular concerns have been raised in relation to sensitive receptors in and around North Petherton.

8.3.19 The key impacts of the construction of the Junction 24 site relate to fugitive dust and particulate matter generation causing potential nuisance to the closest human and residential receptors at '1 Dawes Farm Cottages', 'Moto Hospitality Services' and the 'Dwelling at Corner of Marsh Lane'. These receptors, located within 100m of the site are affected by predominantly easterly, north-easterly and southerly winds respectively, with meteorological conditions that may lead to fugitive dust and particulates at these locations occurring up to 4.7% of the time. The impact from dust at these receptors would be local, direct, **moderate adverse**, possible and temporary, lasting at most for the six month duration of the proposed construction activities at the Junction 24 site.

8.3.20 Best practice guidance control methods would be implemented to manage fugitive nuisance dust and particulate matter emissions during the construction works, and to ensure associated impacts are prevented in areas in proximity to the site, are presented within the **Air Quality Management Plan**. As a result of the implementation of control methods, there are no significant residual impacts.

8.4 Summary of Impacts and Mitigation

8.4.1 This section of the report has focussed on identifying the negative impacts which the HPC Project is likely to have on North Petherton, and nearby receptors at Willstock and Stockmoor Village.

8.4.2 A summary of the cumulative impacts of the elements of the HPC project on community receptors in North Petherton has been undertaken as part of the Environmental Statement (**Chapters 5** and **6**, **Volume 11**).

8.4.3 Because of its location close to the M5 motorway and A38 on the strategic road network from Taunton to Hinkley Point via Bridgwater, the local area is forecast to experience impacts from the Project, principally related to construction traffic, and the construction and operation of the associated development at Junction 24 of the M5 motorway.

8.4.4 In terms of traffic flows, M5 motorway Junction 24 southbound off slip is the only link to have an impact of between 60% and 90% during the post-operational phase (2021), as the park and ride facility would remain operational at this point (in 2021). This is a moderate magnitude of impact but the slip road is a minor sensitivity receptor. Therefore the significance of the impact is **minor adverse**. During the early years, the Junction 24 site would be operational and highway improvements in place at the Huntworth roundabout, and no significant increase in flow is anticipated at this stage of peak construction in 2016.

8.4.5 Due to the Junction 24 site's current brownfield use, and history of operation as a freight handling site (and consequent short-term construction phase), the significance of impacts is lower than for other localities.

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9. DISTRIBUTION OF NON-HOME-BASED CONSTRUCTION WORKERS

9.1 Introduction

9.1.1 A model has been developed as part of this project to estimate the likely spatial distribution of non-home-based workers in areas within 60 minutes[2] of the HPC site, at peak construction in 2016.

9.1.2 The Gravity Model applies to a peak workforce of 5,600 construction employees of whom approximately 66% (3,696) would be non-home-based. As referred to above, it is anticipated that the purpose-built accommodation campuses would account for around 500 of these construction workers at the on-site accommodation campus, and around 1,000 in Bridgwater, although actual numbers in campuses at any one time will be slightly lower due to turnover of workers. The remaining non-home-based construction workers would be split between private rented, tourist, owner occupied and latent accommodation.

9.1.3 This section outlines the community impacts for those areas (ward clusters) slightly further afield where the assessments suggest that there may be a concentration of more than 100 non-home based workers drawn to the area to work on the HPC Project during its construction, and therefore where there may be community impacts in terms of capacity of public services and community facilities.

9.2 Minehead

9.2.1 The Minehead area includes the coastal town of Minehead and smaller surrounding villages including Dunster, Carhampton and Withycombe, as well as Porlock further to the west. The total population is around 17,000 people, of whom around 10,000 live in Minehead town.

9.2.2 As a result of the peak construction phase at HPC, it is anticipated that around 120 non-home-based workers would live in this area. This is equivalent to around 8% of average annual new residents, and a very small proportion of the current existing population.

9.2.3 Given the relatively high proportion of tourist accommodation in the area, around 50 of these construction workers are likely to take up accommodation in the tourist sector, with around 30 in private rented sector and 15 in owner occupied homes. The remaining 25 would be anticipated to take up spaces in latent accommodation (where local residents have expressed an interest in renting spaces, often spare rooms in houses).

9.2.4 Based on calculated supply, there are currently around 230 vacant bedspaces in tourist accommodation at the August peak, and around 60 bedspaces in the private rented sector. Using conservative estimates, therefore, the take up by Hinkley

[2] This includes drive time to the closest park & ride, transfer, and bus journey to site.

workers is identified as being within existing capacity, taking into account turnover and vacancies.

9.2.5 Nonetheless, EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The accommodation office for the HPC Project would have the ability to direct new applicants away from Minehead if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit Minehead and its residents in the event that hardship is being caused.

9.2.6 Of the non-home-based construction workers anticipated a peak construction around 15 would be likely to move their families into the area, resulting in an estimated six primary and four secondary school aged children moving to the area. Primary schools in the Minehead area currently operate at only 64% capacity, with around 370 surplus places, anticipated to be more than enough capacity to support any construction workers' children. There is also significant capacity at secondary level (15% surplus capacity, or around 290 surplus places).

9.2.7 EDF Energy is committed to investment in training and education facilities in order that local people can gain the skills and qualifications to work on the HPC Project. As such, Minehead would benefit from investment at West Somerset Community College including the Hinkley Ready skills project and an Enterprise Project in order to enable local people to gain the necessary skills to provide services to the construction and operational workforce.

9.2.8 Wider mitigation strategies outlined in Section 1 address other impacts on health and public services. In relation to leisure impacts, the overall effects on facilities in Minehead are likely to be very small.

9.3 Weston-super-Mare

9.3.1 The Weston-super-Mare area includes the large coastal town of Weston-super-Mare and Clevedon to the north, as well as local villages including Hutton, Locking, Winscombe and Churchill, in the unitary district of North Somerset. The total population of the area is around 124,000 people, of whom around 72,000 live in the wider Weston-super-Mare area.

9.3.2 As a result of the peak construction phase at HPC, it is anticipated that around 450 non-home-based workers would live in this area. This is equivalent to around 8% of average annual new residents, and a very small proportion of the current existing population.

9.3.3 Given the relatively high proportion of tourist and private rented accommodation in the area, around 70 of these construction workers are likely to take up accommodation in the tourist sector, with around 290 in the private rented sector and 100 in owner occupied homes. Due to the low level of interest expressed locally in renting spare rooms, latent accommodation is likely to constitute a negligible portion of supply.

9.3.4 Based on calculated supply, there are currently around 360 vacant bedspaces in tourist accommodation at the August peak, and around 780 bedspaces in the private rented sector. Using conservative estimates the likely Hinkley take up is identified as being well within existing capacity, taking into account turnover and vacancies.

9.3.5 Nonetheless, EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The accommodation office for the HPC Project would have the ability to direct new applicants away from Weston-super-Mare if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit Weston-super-Mare and its residents in the event that hardship is being caused.

9.3.6 Of the non-home-based construction workers anticipated a peak construction around 100 would be likely to move their families into the area, resulting in an estimated 35 primary and 25 secondary school aged children moving to the area. Primary Schools in the area currently operate at 85% capacity, with around 1,400 surplus places, anticipated to be more than enough capacity to support construction workers' children. There is also significant capacity at secondary level (13% surplus capacity, or around 800 surplus places).

9.4 Burnham and Highbridge

9.4.1 The Burnham and Highbridge area includes the area either side of the M5 motorway north of Bridgwater from Junction 23 to the River Axe, including the coastal town of Burnham-on-Sea and Highbridge, and smaller surrounding villages including Woolavington and Puriton to the south, and Wedmore to the east. The total population is around 41,000 people, of whom around 20,000 live in the Burnham-on-sea and Highbridge urban area.

9.4.2 As a result of the peak construction phase at HPC, it is anticipated that around 380 non-home-based workers would live in this area. This is equivalent to around 14% of average annual new residents, and a very small proportion of the current existing population.

9.4.3 Given the relatively high proportion of tourist accommodation in the area, around 200 of these construction workers are likely to take up accommodation in the tourist sector, with around 65 in private rented sector and 75 in owner occupied homes. The remaining 40 would be anticipated to take up spaces in latent accommodation (where local residents have expressed an interest in renting spaces, often spare rooms in houses).

9.4.4 Based on calculated supply, there are currently around 590 vacant bedspaces in tourist accommodation at the August peak, and around 90 bedspaces in the private rented sector. Using conservative estimates this is identified as being within existing capacity, taking into account turnover and vacancies.

9.4.5 Nonetheless, EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The accommodation office for the HPC Project would have the ability to direct new applicants away from the Burnham and Highbridge area if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit the Burnham and Highbridge area and its residents in the event that hardship is being caused.

9.4.6 Of the non-home-based construction workers anticipated a peak construction around 75 would be likely to move their families into the area, resulting in an estimated 25 primary and 20 secondary school aged children moving to the area. Primary Schools in the area currently operate with around 6% capacity, with around 175 surplus places. This is anticipated to be more than enough capacity to support construction workers' children.

9.4.7 In order to head off any potential shortfall in capacity, EDF Energy's proposals described in Section 1 include a formula for payment towards increasing education capacity further if monitoring identifies further impacts beyond the enhanced capacity. Such improvements would ultimately need to be agreed between the County Council and individual schools.

9.4.8 Wider mitigation strategies outlined in Section 1 address other impacts on health and public services. In relation to leisure impacts, the overall effects on facilities in Minehead are likely to be very small.

9.5 Taunton

9.5.1 The Taunton area includes the built-up area of Taunton, along with nearby Staplegrove, North Fitzwarren and Trull. It also contains villages to the north and west including Kingston St Mary and Bishops Lydeard. The total population is around 74,000 people, of whom around 61,000 live in the Taunton urban area. Taunton is the county town (and largest town) of Somerset.

9.5.2 As a result of the peak construction phase at HPC, it is anticipated that around 360 non-home-based workers would live in this area. This is equivalent to around 7% of average annual new residents, and a very small proportion of the current existing population.

9.5.3 Given the relatively high proportion of private rented accommodation in the area, around 135 of these construction workers are likely to take up accommodation in the private rented sector, with around 85 in the owner-occupied sector and 30 in the tourist sector. Given the high level of interest registered by local residents in providing accommodation, the remaining 120 would be anticipated to take up spaces in latent accommodation (where local residents have expressed an interest in renting spaces, often spare rooms in houses).

9.5.4 Based on calculated supply, there are currently around 170 vacant bedspaces in tourist accommodation at the August peak, and around 240 bedspaces in the private rented sector. Using conservative estimates this is identified as being within existing capacity, taking into account turnover and vacancies.

9.5.5 Nonetheless, EDF Energy would seek to avoid any workforce concentrations in excess of local capacity through workforce or accommodation management measures and contributions outlined in Section 1 of this report. The accommodation office for the HPC Project would have the ability to direct new applicants away from the Taunton area if there is evidence that the demand is excessive. Similarly, the wider Housing Fund would be available to benefit the Taunton area and its residents in the event that hardship is being caused.

9.5.6 Of the non-home-based construction workers anticipated a peak construction around 85 would be likely to move their families into the area, resulting in an estimated 30 primary and 20 secondary school aged children moving to the area. Primary Schools in the area currently operate with around 7% capacity, however this is equivalent to around 370 surplus places. This is anticipated to be more than enough capacity to support construction workers' children. Secondary Schools are currently operating close to capacity, with around 30 surplus places.

9.5.7 In order to head off any potential shortfall in capacity, EDF Energy's proposals described in Section 1 include a formula for payment towards increasing education capacity further if monitoring identifies further impacts beyond the enhanced capacity. Such improvements would ultimately need to be agreed between the County Council and individual schools.

9.5.8 Wider mitigation strategies outlined in Section 1 address other impacts on health and public services. In relation to leisure impacts, the overall effects on facilities in Taunton are likely to be very small.

9.5.9 As a result of the above analysis, and with the proposed project-wide mitigation strategies in place, adverse impacts are not anticipated to arise in the areas beyond the local settlements.

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FIGURE 27A.1: WARD CLUSTERS

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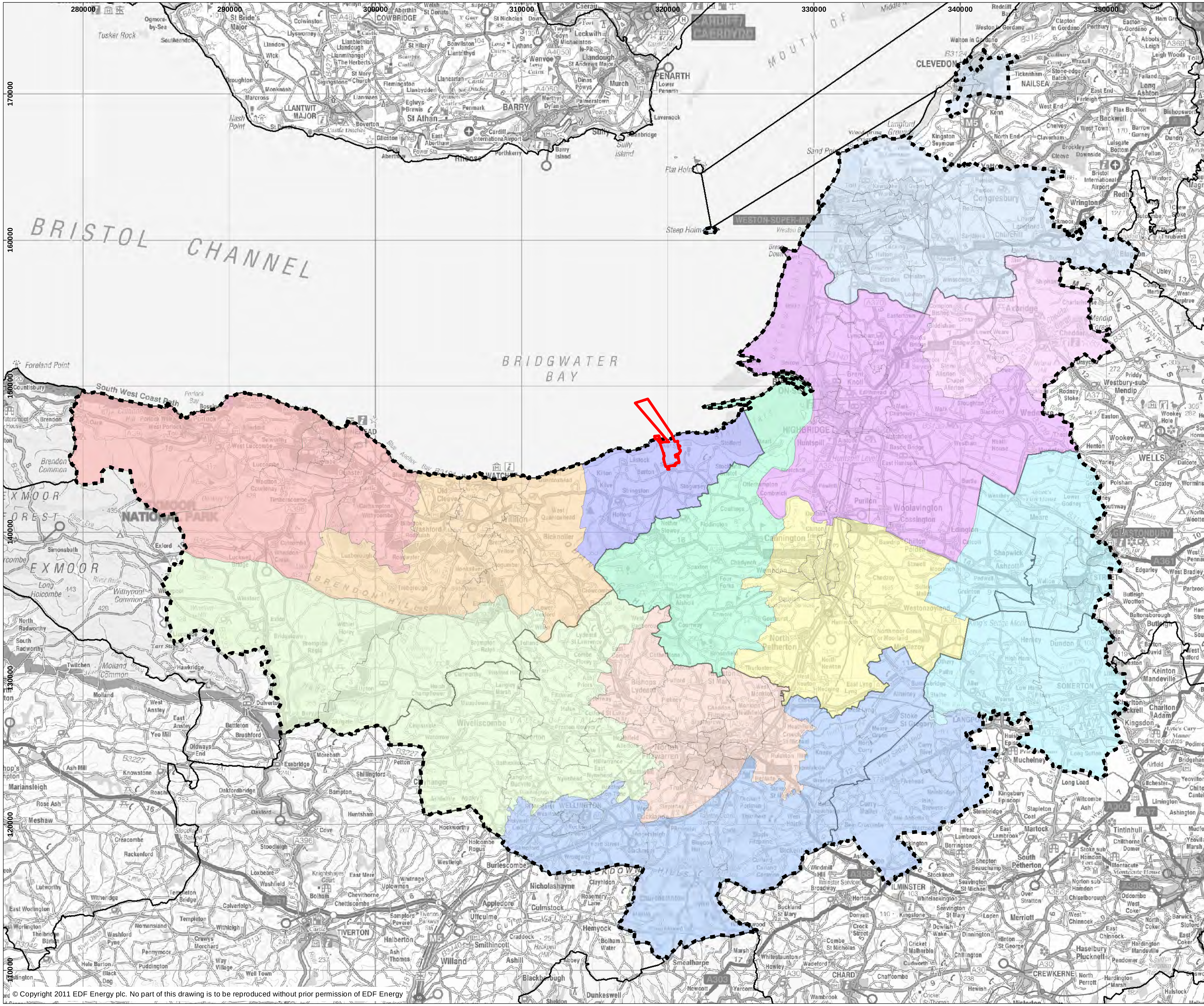

KEY

- HINKLEY POINT C DEVELOPMENT SITE
- 60-MINUTE TRAVEL ZONE

DISTRIBUTION OF NHB WORKERS

WARD CLUSTERS

- BRIDGWATER
- BURNHAM AND HIGHBRIDGE
- CANNINGTON
- CHEDDAR AND CLEVEDON
- GLASTONBURY
- HINKLEY POINT
- MINEHEAD
- SOMERSET SOUTH
- SOMERSET WEST
- TAUNTON
- WATCHET AND WILLITON
- WESTON-SUPER-MARE
- LOCAL AUTHORITIES

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:

WARD CLUSTERS

FIGURE NO:		REVISION:
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FIGURE 27A.2: STOGURSEY PARISH AND MAIN HPC DEVELOPMENT SITE

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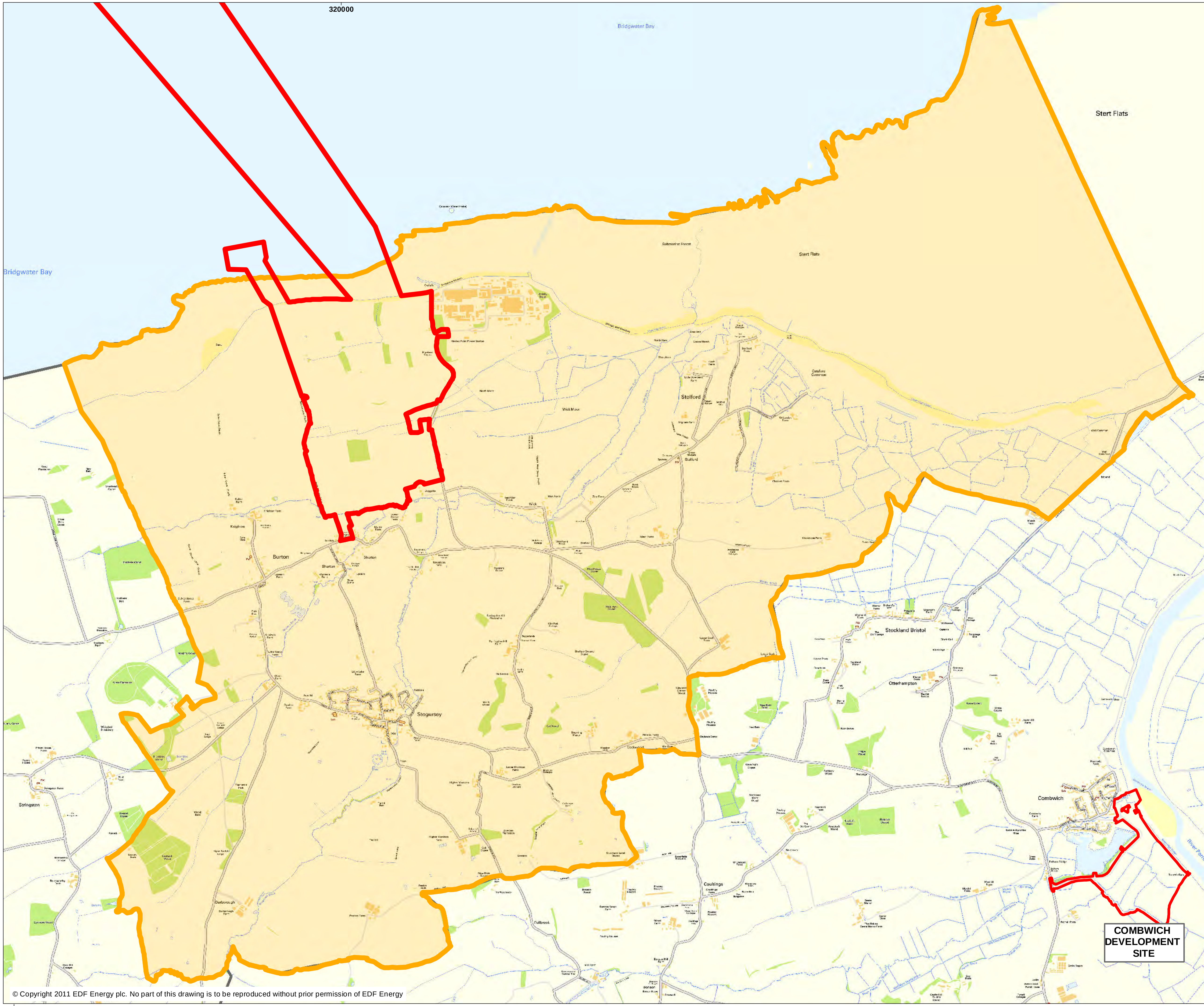

KEY

STOGURSEY PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT ASSESSMENT

FIGURE TITLE:

STOGURSEY PARISH AND
MAIN HPC DEVELOPMENT SITE

FIGURE NO:	REVISION:
FIGURE : 27A.2	01

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FIGURE 27A.3: BRIDGWATER PARISH AND PROPOSED DEVELOPMENT SITES

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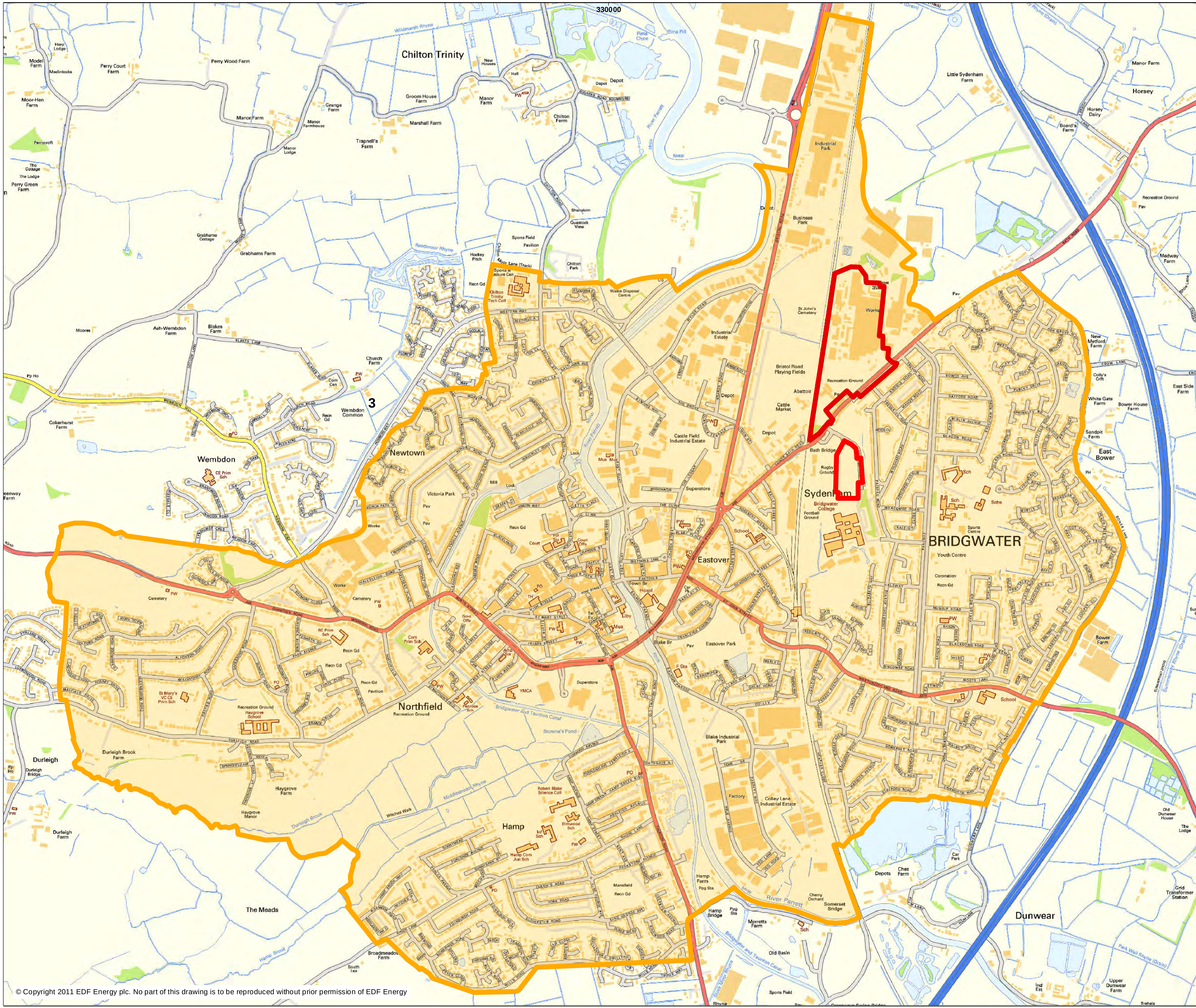

KEY

BRIDGWATER PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:

BRIDGWATER PARISH
AND PROPOSED DEVELOPMENT SITES

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FIGURE 27A.4: CANNINGTON PARISH AND PROPOSED DEVELOPMENT SITES

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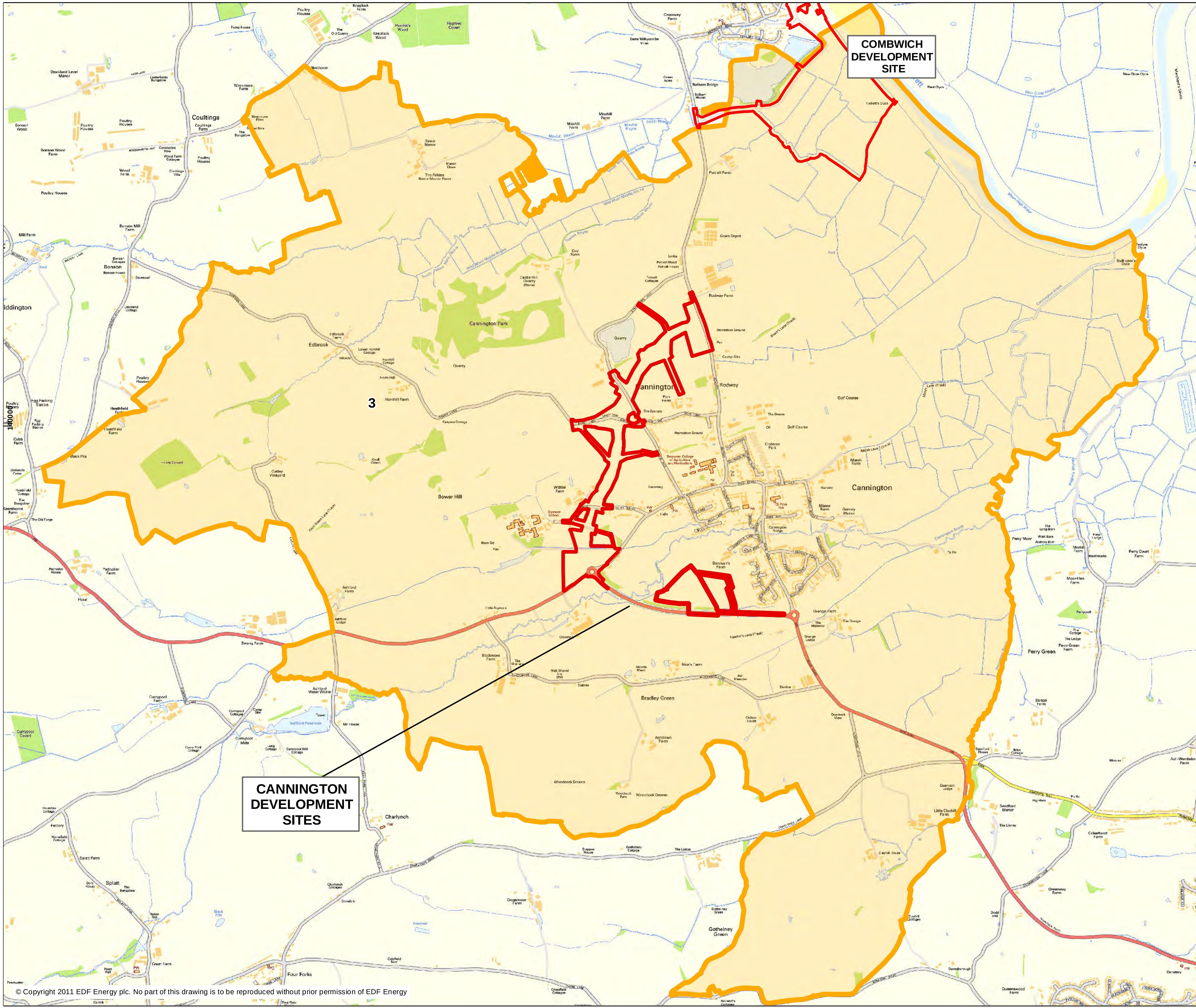

KEY

CANNINGTON PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:
CANNINGTON PARISH
AND PROPOSED
DEVELOPMENT SITES

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FIGURE 27A.5: OTTERHAMPTON PARISH AND PROPOSED DEVELOPMENT SITE

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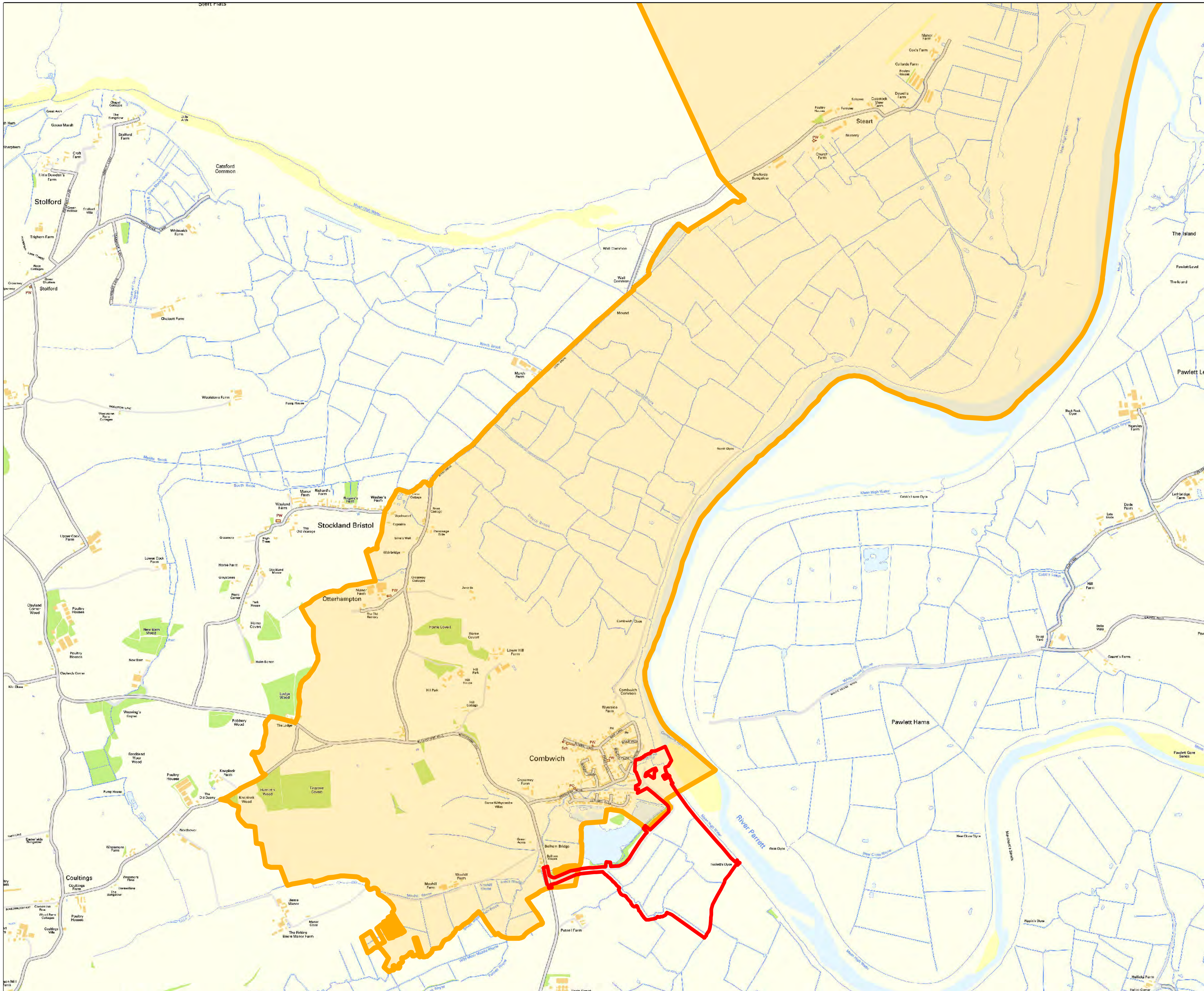

KEY

OTTERHAMPTON PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:

OTTERHAMPTON PARISH AND PROPOSED DEVELOPMENT SITE

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FIGURE 27A.6: WILLITON PARISH AND PROPOSED DEVELOPMENT SITE

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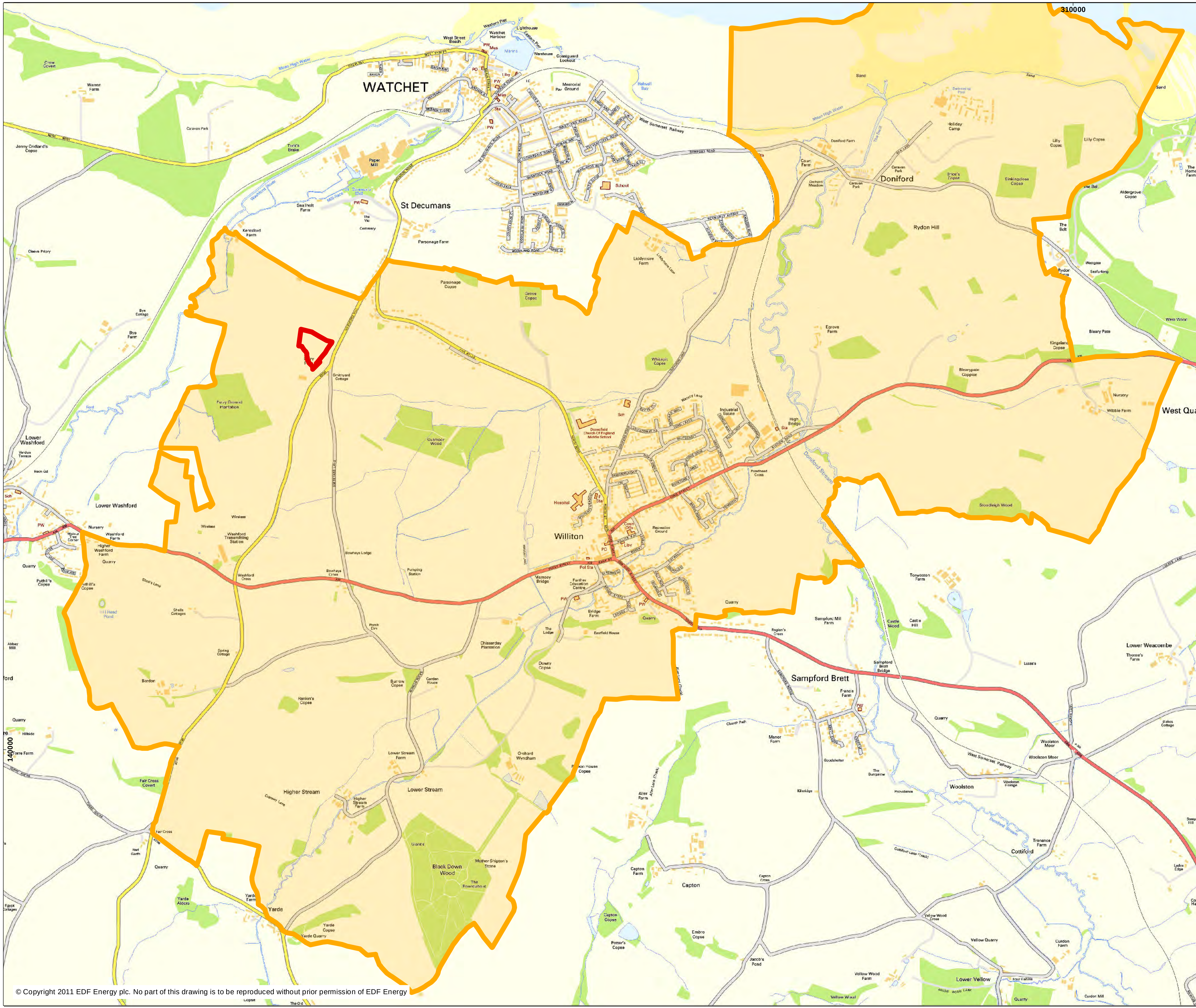

KEY

WILLITON PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:

WILLITON PARISH AND
PROPOSED DEVELOPMENT SITE

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FIGURE 27A.7: PURITON PARISH AND PROPOSED DEVELOPMENT SITE

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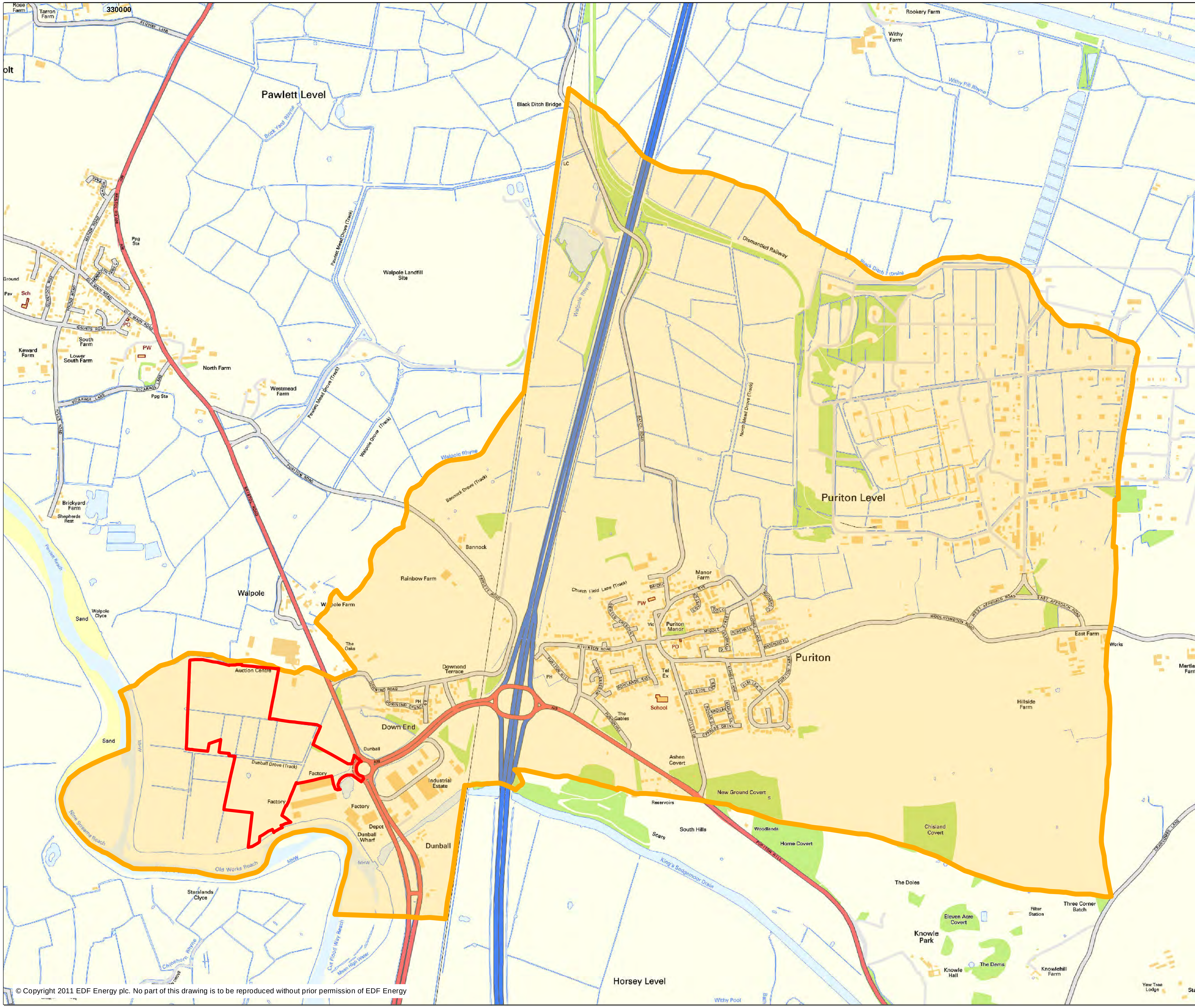

KEY

PURITON PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:

PURITON PARISH AND
PROPOSED DEVELOPMENT SITE

FIGURE NO:		REVISION:
FIGURE 27A.7		01
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FIGURE 27A.8: NORTH PETHERTON PARISH AND PROPOSED DEVELOPMENT SITE

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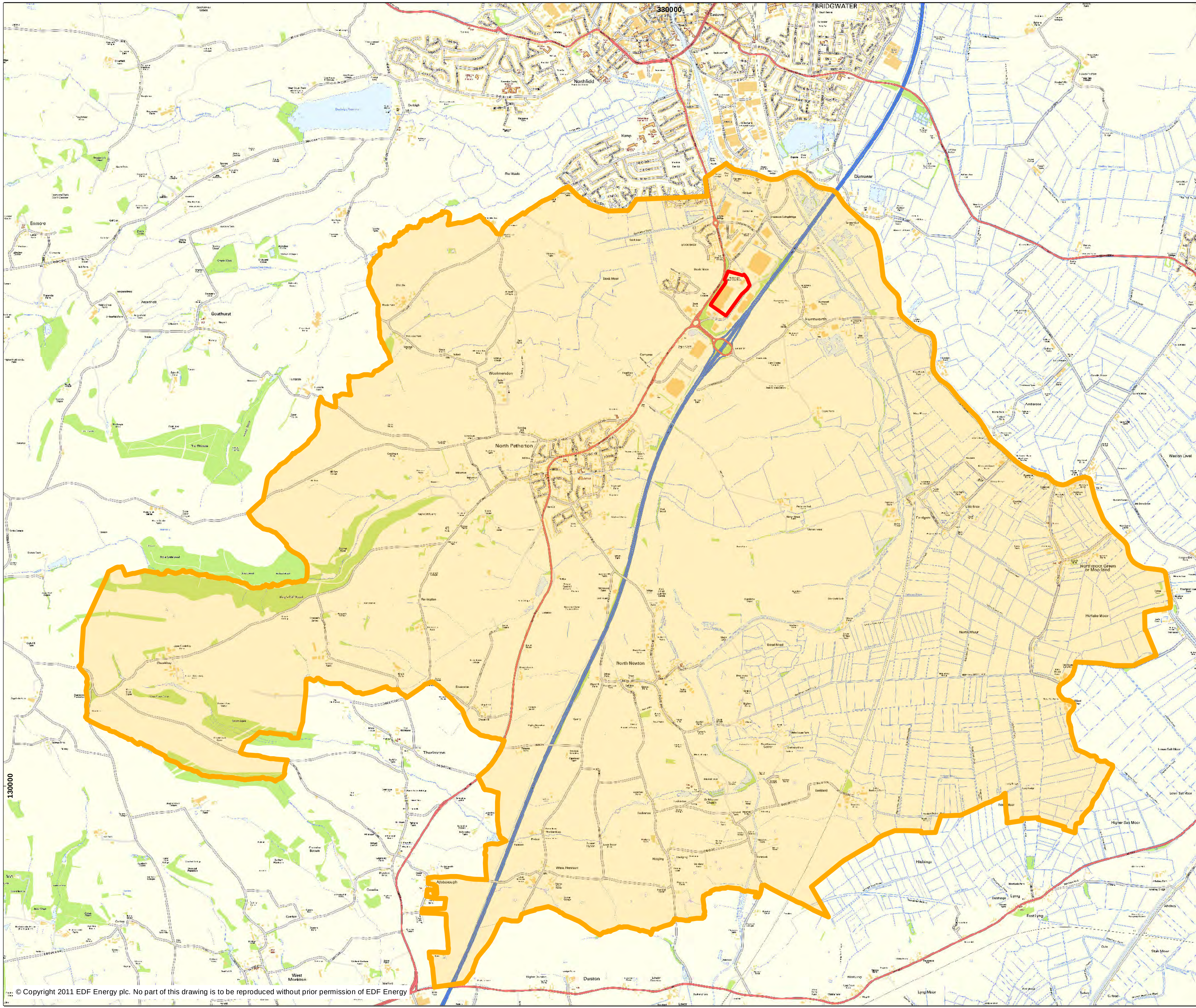

KEY

NORTH PETHERTON PARISH

PROPOSED DEVELOPMENT SITE BOUNDARY

N S E W

EDF ENERGY

DOCUMENT:

HINKLEY POINT C PROJECT
COMMUNITY IMPACT REPORT

FIGURE TITLE:

NORTH PETHERTON PARISH
AND PROPOSED DEVELOPMENT SITE

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FIGURE 27A.8		01
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APPENDIX A: CONTEXT OF HPC PROJECT (SECTION 3 OF THE PLANNING STATEMENT)

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CONTENTS

TABLES

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A. CONTEXT OF HPC PROJECT (SECTION 3 OF THE PLANNING STATEMENT)

A.1 Introduction

The principal events in the main site's planning history are as follows:

- The 1988-1989 Hinkley Point C planning inquiry;
- Site nomination in National Policy Statement EN-6; and
- The site preparation planning application submitted on behalf of EDF Energy to West Somerset Council in 2010.

A.1.1 There has been at least one nuclear power station at Hinkley Point since 1965 when Hinkley Point A was commissioned. Whilst the A station is no longer operating and is the subject of a programme of decommissioning, Hinkley Point B was commissioned in 1976 and will continue to operate at least until 2016. The suitability of the general location for the development of a C station has been established in principle through the extensive studies which support up to date policy set out in the National Policy Statement on nuclear power (EN-6 *National Policy Statement for Nuclear Power Generation, June 2011)* (NPS EN-6) and through the site's own planning history.

A.2 The 1988-1989 Hinkley Point C Planning Inquiry

A.2.2 A previous proposal for a nuclear power station in approximately the same location as the current proposal was considered at a planning inquiry spanning 1988-89. Permission was granted but never implemented. The Inspector's report and Secretary of State's decision letters provide some helpful context for the consideration of the current HPC project, although a number of matters have moved on significantly since that time.

A.2.3 In 1987 the Central Electricity Generating Board (CEGB) applied to the Secretary of State for Energy for deemed planning permission for an additional generating station at Hinkley, to be known as Hinkley Point C. A separate application was made in September 1987 to realign overhead transmission lines at Hinkley and in June 1988 the CEGB applied for the confirmation of a compulsory purchase order in respect of land required in connection with the development.

A.2.4 Three public inquiries were held jointly between October 1988 and December 1989. The Inspector's report into the principal application and the CPO was published on 4th June 1990 recommending approval of the deemed planning application. The Inspector recommended that the "*benefits substantially outweigh the disadvantages*". In letters dated 6th September 1990, the

Secretary of State for Energy accepted the Inspector's recommendations, granted deemed planning permission for the power station but refused to confirm the CPO because of uncertainty about the implementation of the development.

A.2.5 A substantial amount of the inquiry was taken up with issues relating to energy policy, need etc as the project did not benefit from a clear statement of national policy, as is currently provided by the designated National Policy Statements. There were a number of site specific considerations, however, which may contain some lessons for the current project. Many of the issues relevant at that time are also relevant today, as is amplified in the following paragraphs.

a) Ecology

A.2.6 The Inspector recognised that the construction and operation of a PWR at Hinkley Point was certain to have some adverse effects on the ecology of the site and the surrounding area: for example, the effect on grass land on the cliff top, the disturbance of nightingale habitats on the construction site and the possible need for dredging in the River Parrett. However, the Inspector also concluded that there was "*no obvious or special ecological importance in the area"* which would be immediately affected by the proposed development (Inspector's report paragraph 58.42). In particular:-

- the bird breeding community of the area appeared to be typical of lowland England;
- there was no evidence that the process would have lasting adverse effects on fisheries or fish life or other marine life;
- there was no hard evidence that the A and B stations have had a major adverse effect;
- the presence of a regionally uncommon bee orchid on ground used during the construction of Hinkley A demonstrated that the species could survive in the area restored after construction;
- nightingales have survived the disturbance of construction of the A and B stations and now nest close to the main gate;
- the Inspector did not accept that up to 80 vessels coming to Combwich Wharf over 2 years would have great effect on the ecology of the river or the estuary; and
- the Nature Conservancy Council (now Natural England) raised no objection to the development or its effect on the SSSI and were satisfied with the proposed Ramsar land exchange, which would be a net benefit to the Ramsar (58.46).

A.2.7 The exchange land was known as the Island Saltings on the east of the River Parrett, which was offered in exchange for that part of the foreshore affected at Hinkley Point (58.8). The Inspector concluded that the adverse ecological effects would not be of a major or serious nature.

b) Visual Impact

A.2.8 The Inspector identified that Hinkley Point lies close to the transition zone between the upland areas to the west and the low lying area to the east (55.5). The Inspector concluded that claims for the attractiveness of the area around Hinkley Point were justified. Whilst it was not a grand landscape, it had a restrained beauty of its own which grows on the visitor. One of its main characteristics was its variety, ie the variety of different landscapes which appear within a small area (55.41).

A.2.9 The Inspector considered that the present A and B stations do have a substantial visual impact on the area – an impact which is greatest on the coast to the west and on the low lying area to the east. He considered that there was a noticeable but lesser impact on views from the Quantocks because of the "largeness" of the views available (55.43). When viewed from the Quantocks and from the moors, Hinkley C would have doubled the apparent length of the existing power station site. From the coast, however, the C station would either help to hide or would be partly hidden by the A and B stations. In the Inspector's opinion, the effect of a C station would be less than the gross and unacceptable additional visual intrusion which some people alleged particularly because:-

- it is a very different thing to propose the extension of an existing site than to propose its initial establishment. If new nuclear power stations are to be built on the coast they should, where possible, be built alongside existing stations – this is a powerful argument when it comes to questions of visual impact;
- the Inspector did not find the appearance of a PWR as unattractive as many industrial installations. There would be none of the smoke, grime or noise associated with heavy industry and the cold, scientific, some what futuristic aura of a PWR would be much less out of place in a coastal setting than many other forms of development;
- the visual improvement in the appearance of a C station over the existing stations would be more than the slight improvement alleged by some witnesses;
- some of the concern expressed by objectors appeared to relate to their deep dislike of anything nuclear, rather than visual impact; and
- *"the views from the Quantocks are of great importance, but here I believe the additional length of the Hinkley Point site would be muted in its effect by the very extent of the panoramic views available." (55.45)*

A.2.10 The Inspector found that the greatest impact of a C station would be on views from the coast to the west and from the low lying moors to the east and south-east. It was here that landscaping proposals would be of most importance and could do much to obscure the clutter of lower buildings on the site. The Inspector considered that the adverse effects of the existing stations are least damaging when seen from the west because of the undulating landscape which reduces their visual clutter (56.76). Nevertheless, the Inspector identified that all that can reasonably and properly be done to restrict adverse effects should be done.

A.2.11 The Inspector did conclude that the C station would have an adverse visual effect on a local area which has a substantial and varied visual beauty (55.46). Nevertheless, he did not regard the visual impact "*as being so gross and serious*" that the project became unacceptable in principle, although landscaping would be important.

A.2.12 However, the Inspector was not content with the CEGB's proposed landscaping approach. In particular, the Inspector expressed concern about the loss of nearly 0.5km of cliff and nearly 3 ha of foreshore which CEGB had failed to properly justify. The evidence showed that a shorter sea wall could protect the station just as effectively (56.72).

A.2.13 The Inspector considered that the aim of landscaping was to mask and improve the visual impact of the proposed development, including its construction (56.94) in particular. There was genuine merit in hiding the clutter at the lower levels of the development and this was more important than being able to visually establish the base of the dome.

A.2.14 The Inspector concluded, however, that the CEGB proposals could be materially improved in 7 ways including reduced impact on the sea wall, planting of the northern ridge, raising the crest of the southern ridge, improving planting on the western screen ridge, providing a temporary mound to the west of the contractors' area and increased efforts in relation to off-site landscaping (56.100). Accordingly, the Inspector concluded that a condition should be proposed requiring the submission of a revised landscaping proposal before the commencement of the development.

c) Accommodation and Housing Issues

A.2.15 The evidence indicated a construction workers' peak of 3,500 in year 4 and an estimate that the number of in-migrants seeking accommodation in the area would be around 1,700 (61.4). The Inspector concluded that the districts of Sedgemoor, West Somerset and Taunton Deane were a reasonable area for assessment when considering accommodation impact. An on-site hostel containing 400 spaces, which could be increased to 700 spaces was proposed. By way of background it was explained that:-

- in March 1989 WSC had refused planning consent for a mobile home site near Watchet;

- during the construction of the A and B stations, caravan sites were established near Stogursey but were not properly managed and caused considerable disturbance; and
- it was agreed that a site to accommodate 80 caravans should be provided by CEGB, although a specific site was not identified – it would need to be established in good time.

A.2.16 There was dispute over the best location for the hostel. WSC considered that, if there were to be a hostel, it should be on site. Local residents, however, favoured a location well away from the site because of fears of disturbance from workers.

A.2.17 The Inspector did not find the issue easy to decide. He had no doubt that a hostel was desirable and there were obvious common sense advantages in it being located adjacent to the construction site. It would be considerably more convenient for the occupants and the site operator and would reduce traffic on roads. Local concerns could not be lightly dismissed but, to some extent, this concern was a legacy of the previous experience and a balanced judgement had to be struck. The Inspector concluded that the obvious advantages of an on-site hostel, combined with the fact that some of the causes of the disturbance in earlier years could be removed through better management, tipped the balance in favour of the hostel being on the site.

A.2.18 Concern was also expressed about pressure on the local housing market and the increased burden that would fall on WSC as the local housing authority. WSC sought a commitment from CEGB that they would be reimbursed any additional expenditure on housing services but the Inspector did not consider this to be reasonable (61.41). The Inspector did not think that the additional burden would be significant and reminded the authority of their statutory duties.

d) Transport

A.2.19 The construction of Hinkley Point C was anticipated to involve the transport to the site of about 1.5 million tonnes of material and plant, with a peak labour force estimated at 3,500 workers, on top of about 330 operational staff who would also be present in the peak construction year. Long term operational staff would number approximately 470. Use was to be made of Combwich Wharf for abnormal loads but the Inspector agreed that access by rail was not feasible and that access by sea could not be achieved because the construction of a new harbour or dock would have adverse environmental effects. All traffic, therefore was expected to drive direct to the site, which offered 1,400 on-site parking spaces. HGVs and lighter commercial vehicles were likely to generate over 1,000 movements per day in the peak construction year.

A.2.20 CEGB's case was that all traffic generated, with the exception of a few abnormal loads which would use the wharf at Combwich, would be carried entirely by road and that the existing road network would be adequate to carry the additional traffic. The coalition of local authorities (COLA) disagreed and their case was that the extent of additional traffic warranted the construction of bypasses for Bridgwater and Cannington.

A.2.21 An agreement was reached between CEGB and COLA in relation to the bypass. In July 1988, CEGB offered to contribute £10 million towards the construction of the bypasses and other minor road works, conditional on the County Council withdrawing objections to the construction of Hinkley Point C on transport grounds. As a result, no detailed transport evidence was heard at the inquiry and, in the light of the commitment given by CEGB towards the bypass, the Inspector did not think it reasonable to impose a condition requested by SDC that the bypass should be in place before construction could commence (62.13).

A.2.22 The proposed bypass would run from the A38 near Dunball, crossing the River Parrett by an opening bridge and proceed for 3.37 miles to join the A39 to the south-east of Cannington. It would continue around the south of Cannington to rejoin the A39 near Brymore School and connect from there around the north west of Cannington to join the C182 at Rodway.

A.2.23 CEGB had obtained planning permission to construct a new road to the south of Combwich to bypass the village when using the wharf (62.54). This road has since been constructed, as has the southern section of the Cannington Bypass.

A.2.24 Because the Inspector had no detailed transportation evidence, he concluded that, in the event that the Secretary of State failed to confirm the necessary orders for the Bridgwater and Cannington Bypasses, the inquiry would need to be re-opened (62.68).

A.2.25 The Secretary of State for Transport subsequently confirmed the Side Road Orders and Bridge scheme necessary for the construction of the proposed Cannington and Bridgwater bypasses.

e) Overall Conclusions

A.2.26 The Inspector's overall conclusions contain substantial discussion about need and policy. In these respects the Inspector concluded that there was a likely capacity need, that there were benefits in adding a degree of diversity to sources of generation supply and to provide security against volatile movement in the price of fossil fuels, as well as security against long term uncertainties. The Inspector also identified that the grant of consent would mean that

> *"a plant could be constructed which would have major environmental benefits compared to some other forms of generating plant….It is too early to reach a general conclusion on the scale or the imminence of the threat which may be posed by global warming, but there appears*

> *to be an increasing likelihood that international action, perhaps on a drastic scale, will be needed to meet the threat. It seems to me that there is a major benefit in granting consent for a large electricity generating plant which will in its normal operation create no pollution of the types just mentioned or indeed no significant atmospheric or environmental pollution." (para 15).*

A.2.27 Against this finding of significant benefit, the Inspector identified disadvantages, including the costly generation of electricity and the creation of any risk to safety or health. In relation to environmental effects, the Inspector concluded the following:-

> *"22. Thirdly, the effect of the proposed plant in the local area would in my opinion be generally be disadvantageous. The main adverse impact would be visual since the plant would be set in an attractive coastal and rural area. There would be local benefits such as the provision of employment and a contribution to road improvements and the development in visual terms must be seen in the physical context of the existing site with its two power stations, but the overall effect would be clearly disadvantageous. I can state this element of disadvantage briefly but it is one in my judgment that would figure substantially in any overall weighing.....the adverse local effects thus weigh heavily in my mind when considering the disadvantages side of the balance."*

A.2.28 The Inspector identified adverse effects of the development on the locality as disadvantages to which he would attach particular weight (para 27). However, when considering the benefits of granting consent, the Inspector was "*clear that the benefits substantially outweigh the disadvantages".*

A.2.29 The Secretary of State's decision letter identified as a principal issue "*whether there are any local or environmental considerations which prevent the grant of this consent*". Under that heading, the Secretary of State:-

- accepted the Inspector's conclusion that, although the visual and other disadvantages outweigh the local benefits, they were not such as to prevent the grant of consent, although they do need to be considered in the final balance of benefits and disadvantages;
- accepted the Inspector's outline conclusions for the shortening and realigning of the sea wall which would have preserved more of the existing cliff line and allow for further improvements to CEGB's landscaping proposal;
- agreed that the land sought to be acquired by compulsory purchase would not be excessive except that part which would not be needed if the sea wall were shortened;
- accepted that a temporary hostel should be provided on site for construction workers; and

- accepted that the construction of a rail link would not be practical.

A.2.30 Accordingly, the Secretary of State agreed that the local impact was on balance negative but had to be considered in the context of an existing site with two nuclear stations which are unlikely to be dismantled for many years. The Secretary of State concluded that strong importance should be attached to greater diversity of fuel supply and in particular – for global environmental reasons – greater diversification away from fossil fuels.

A.2.31 Accordingly, on 6th September 1990, the Secretary of State granted consent for HPC and its temporary workers hostel.

A.2.32 In relation to the compulsory purchase, however, the Secretary of State noted the uncertainty of Hinkley Point C proceeding having regard to viability and other issues. In the light of that uncertainty, the Secretary of State decided not to confirm the CPO (page 15).

A.2.33 There are, of course, many differences between the nature of the previous Hinkley Point C proposals and the current project and also between the policy and other circumstances which prevail then and now. However, the following conclusions remain relevant to the current proposals:-

- in principle, land which forms part of the main development site was found suitable for the development of a nuclear power station;
- if new nuclear power stations are to be constructed, it makes sense for them to be located in remote coastal locations but, particularly, for them to be located adjacent to existing nuclear power stations rather than generating fresh impacts;
- the development of Hinkley Point C provides the opportunity to improve the screening and visual appearance of the existing power stations. Landscaping is important, however, and a careful and comprehensive approach is required which respects the natural features of the site and screens, particularly, the 'clutter' of lower level development and activity;
- views of the development from the Quantocks are important but are not, in principle, unacceptable because of the scale of panorama available from the Quantocks and the presence of the existing power stations; and
- there is benefit in providing accommodation for construction workers on site, as long as it is properly managed.

A.3 Site Nomination and Selection

a) Policy Background

A.3.34 In the period 2005-2008, the Government undertook a comprehensive review of national energy policy, within the context of its policies for climate change. As part of that review, a series of consultation documents and subsequent policy statements were published relating to the UK's energy needs and the strategy for meeting those needs. These included the following:

- '*The Energy Challenge'* Energy Review Report, July 2006 (Ref.4.28);
- '*Meeting the Energy Challenge'*: A White Paper on Energy, May 2007 (Ref.4.29);
- Consultation paper 'The Future of Nuclear Power: The Role of Nuclear Power in a Low Carbon Economy', May 2007 (Ref.4.30);
- '*Meeting the Energy Challenge'*: A White Paper on Nuclear Power, January 2008 (Ref. 4.31);

A.3.35 The Energy White Paper, May 2007 and the Nuclear Power White Paper, January 2008 established that new nuclear power stations should have a role to play in this country's future energy mix, alongside other low-carbon sources. In particular, the White Paper on Nuclear Power included a foreword from the then Prime Minister which advised:

> *"More than ever before, nuclear power has a key role to play as part of the UK's energy mix. I am confident that nuclear power can and will make a real contribution to meeting our commitments to damaging climate change."*

A.3.36 And the separate foreword from the then Energy Minister advised:

> *"Against the challenges of climate change and security of supply, I believe that the evidence in support of nuclear power is compelling and that we should positively embrace the opportunity of delivering this important part of our energy policy."*

A.3.37 The White Paper itself established what the Government will do to implement its policy, ie:-

> *"3.1 The Government has reached the conclusion that new nuclear power stations can help the UK to meet its objectives on climate change and energy security. We conclude, therefore, that it would be in the public interest to allow energy companies the option to invest in new nuclear power stations. The Government will take a number of facilitative actions to reduce regulatory and planning risks associated with investing in new nuclear power stations and to ensure that owners and operators of new nuclear power stations set aside funds over the operating life of the power stations to cover the full costs of decommissioning and their full share of long-term waste management and disposal costs. These facilitative steps…..will reduce uncertainties in the pre-construction period through improvements in the regulatory and planning processes."*

A.3.38 In relation to planning, the White Paper referred directly to reforms promoted in the then Planning Bill for a fundamental reform of the planning system for nationally significant major infrastructure projects. These included proposals to establish the Infrastructure Planning Commission (the IPC) to determine applications for major infrastructure proposals within the context of new National Policy Statements (NPS). The Nuclear White Paper then explained:-

> *"3.4 The Government's intention is that the inquiry phase of any application for a new nuclear power station should examine the proposals in the context of the national strategic or regulatory material considerations, which will already have been established through our facilitative action. It should examine the local benefits of the development and how local impacts of the construction and operation of the plant can be minimised. The purpose of our facilitative action is, therefore, to handle these national strategic and regulatory material considerations and enable the consideration of the proposal to progress effectively and efficiently."*

A.3.39 For nuclear power stations at least, this new approach to planning for infrastructure was to involve the identification of specific sites.

A.3.40 The White Paper, therefore, put in train a series of actions for this purpose. Those steps taken in accordance with the White Paper have included the following:-

- consultation on draft criteria for a Strategic Siting Assessment (SSA) of potential sites for new nuclear power stations;
- undertaking a Strategic Environmental Assessment (SEA) as part of the SSA process and a Habitat Regulations Screening Report;
- inviting nominations for potential sites to be considered in the SSA and consulting on a draft list of nominated sites, followed by the assessment of appropriate nominated sites against the SSA criteria and a further public consultation exercise inviting views on those nominated sites judged by the Government to meet the criteria;
- undertaking an Alternative Sites Study (a Government – commissioned strategic level screening exercise to identify whether there are any other sites in England and Wales that are potentially suitable for the deployment of new nuclear power stations before the end of 2025 and which had not been nominated);
- preparing an Appraisal of Sustainability and a Habitat Regulation Assessment conducted at a strategic level for each site and for an emerging National Policy Statement on nuclear power;
- consultation on draft National Policy Statements (NPS);
- taking advice from specialists such as the Nuclear Regulators, including the assessment of sites against specific criteria;

- parliamentary scrutiny of the NPS; and
- designation of the NPS listing potential suitable sites for new nuclear development.

b) Site Selection

A.3.41 The sites listed in the NPS, therefore, have been assessed by the Government by way of a Strategic Siting Assessment (SSA) and an Appraisal of Sustainability (AoS), which has assessed the sustainability of the NPS on nuclear power generation, taking account of potential alternative strategies and the potential impacts of nominated sites.

A.3.42 The SSA criteria for site assessment were based upon selected exclusionary and discretionary criteria. Exclusionary criteria were those which, if breached, would categorically exclude all or part of a site from further consideration (for example demographic risk or proximity to certain military activities). Discretionary criteria were those criteria that the Government considered, for various reasons, could, either singly or in combination, make all or part of a site unsuitable for a new nuclear power station but which needed to be carefully considered in order to come to a conclusion as to the site's strategic suitability (for example, flood risk and proximity to hazardous facilities).

A.3.43 The outcome of the AoS was published in November 2009 *(Appraisal of Sustainability of the draft nuclear National Policy Statement: Main Report).* The AoS concluded that the preferred approach should be the preparation of a Nuclear NPS, based on the case for nuclear in relation to other alternatives (para. S.8.7). The AoS reviewed the sustainability characteristics of the potentially suitable new nuclear sites then proposed to be identified in the draft NPS and identified key issues that were recommended to be identified for the IPC to consider when determining individual applications for nuclear power stations. For Hinkley Point C, its findings were consistent with those of the SSA. Of particular relevance to Hinkley, the AoS identified (para. S.12.7):

- that there is some potential for adverse effects on the settings of four national and internationally protected sites, on water quality and on fish/shellfish populations;
- potential adverse effects on views from the Quantocks AoNB, which would be difficult to mitigate; and
- likely positive long term economic and employment effects in the region.

Annex C to NPS EN-6 contains the outcomes of the individual site assessments referred to above. The Annex provides the results of the assessment of the nominated Hinkley Point C proposal against the SSA criteria which reflects advice from specialists and the regulators [1].

Table A.1: Strategic Siting Assessment

SSA Criteria	Summary of Assessment
Deployment by end of 2025	Passes
Demographics – "semi-urban" criteria	Passes. Support from HSE.
Proximity to military activities	Passes. Notes possible effects on Bridgwater Bay Firing Area.
Flooding, storm surge and tsunami	Passes. Low risk of flooding, including allowances for climate change, storm surge, and tsunami.
Coastal processes	Passes
Proximity to hazardous facilities	Passes
Proximity to civil aircraft movements	Passes
Internationally designated sites of ecological importance	Passes – noting possible effects on Severn Estuary SAC, SPA, Ramsar, and to a lesser extent the River Wye SAC and the River Usk SAC
Nationally designated sites of ecological importance	Passes – noting possible effects on Bridgwater Bay NNR, Bridgwater Bay SSSI, Seven Estuary SSSI, and to a lesser extent the River Wye SSSI, River Usk SSSI
Areas of amenity, cultural heritage and landscape value	Passes – noting possible effects on Quantock Hills AONB and public footpaths on and around HPC Development Site
Size of site to accommodate operation	Passes
Access to suitable sources of cooling	Passes
Health impacts	Passes
Meteorological conditions	Passes
Cumulative Effects (with Oldbury)	Passes – subject to detailed cumulative assessment of proposals that elsewhere emerge.

Source: Summarised from NPS EN-6, June 2011, Annex C

A.3.44 The SSA process involved a strategic level review of the suitability of the Hinkley Point C site against a number of criteria. Fundamentally the process was influential in confirming the potential suitability of the Hinkley Point C site in principle for the development of a new nuclear power station.

A.3.45 The process also produced useful information which can be used in the spatial development of the project. Lessons learned from the SSA which help inform the project's development and acceptability include:

[1] Health and Safety Executive including the Nuclear Installations Inspectorate and Office for Civil Nuclear Security, Environment Agency, Civil Aviation Authority, Ministry of Defence, Department of Transport, Atkins Ltd, MWH Enfusion

- A Flood Risk Assessment (FRA), of course, will be necessary to support any application. In principle, the AoS established that mitigation against flooding may be possible through appropriate design and construction of defences and suitable management (C.5.22), whilst the Environment Agency advised that any new flood mitigation measures are unlikely to have a detrimental effect on the flood risk to the surrounding area (C.5.29). Nevertheless, as part of any site licensing conditions, the licensee must review their safety case at regular intervals (typically on a 10 yearly basis) taking account of the most recent climate change projections and allow any necessary modifications to flood defences and operating arrangements to be undertaken (C.5.26).
- The effects of coastal erosion should be mitigated through appropriate design and construction of defences, taking into account the potential effects of ‘coastal squeeze’ (paragraph C.5.35).
- The Habitats Regulations Assessment concluded that, at a strategic level, it could not rule out the potential for adverse effects on the integrity of European Sites. The HRA proposed a suite of avoidance and mitigation measures to be considered as part of any project level HRA (C.5.49). Similar conclusions are identified in relation to nationally designated sites of ecological importance (C.5.57).
- The Appraisal of Sustainability identified potential adverse effects on the surrounding elevated local landscape and associated distant views with potentially lasting adverse effects on the setting and views from the Quantock Area of Outstanding Beauty to the West (C.5.60). Whilst some mitigation may be put in place, the Appraisal of Sustainability considered that the main form of mitigation potential may be the clustering of new and proposed reactor buildings to avoid broadening the potential visual impact – even so, the Appraisal of Sustainability noted that a new nuclear power station at Hinkley Point C is likely to lead to perceptible deterioration in some of these views (C.5.62).
- Potential effects on local rights of way and, particularly, the coastal path were identified along with possible mitigation measures which may include siting certain elements of the development away from public footpaths, as well as the provision of realignments to existing or planned rights of way (C.5.63).
- Any nuclear reactor must not be sited east of longitude grid reference 32128 as the area is of inadequate size to provide defence-in-depth for a reactor and its associated turbine hall, spent fuel and intermediate level waste stores (paragraph C.5.70).
- Cumulative impacts, if the proposed site at Oldbury is developed for nuclear power generation, should be assessed, particularly with regard to effects on European Sites (paragraph C.5.83).
- Development at Hinkley Point was appraised as having positive effects of regional economic significance on employment and community viability and

indirect positive health effects associated with enhanced prosperity and long term employment opportunities, although this will only be significant for local communities if employment is secured for local people (C.5.85).

A.3.46 As a result of these and other assessments, NPS EN-6 confirms:-

> *"2.3.2 The Strategic Siting Assessment was designed to identify sites in England and Wales that are potentially suitable for deployment of new nuclear power stations by the end of 2025.*
>
> *2.3.2 Having considered all of the sites nominated as well as those identified by the Alternative Site Study, the Government believes that only those sites listed in part 4 of this NPS are potentially suitable for the deployment of new nuclear power stations in England and Wales by the end of 2025.*
>
> *2.4.3 As a result of the SSA and the Alternative Site Study, the Government does not believe that there are any alternatives to the listed sites…"*

A.3.47 Accordingly, Hinkley Point is listed as one of 8 "potentially suitable sites" in Part 4 of NPS EN-6. The NPS explains (page 9) that the SSA could only conclude that sites are "potentially" suitable as it is a strategic level assessment based on the information available to the Government at the time. In accordance with the Planning Act 2008, the IPC will assess the details of each application for new nuclear development in accordance with NPS EN-1, EN-6 and any other matters which it considers relevant and important, in order to determine whether or not to grant development consent at any of the listed sites.

A.3.48 Not all sites nominated were accepted into the NPS. As a result of the SSA and AoS exercises, sites at Braystones, Kirksanton and Dungeness were not found to be potentially suitable and were not considered to be feasible alternatives.

A.3.49 It is significant that national policy has identified the potential suitability of Hinkley Point C for new nuclear development notwithstanding the SSA findings that its development could generate some significant adverse effects. Of these, perhaps the most significant is a recognition that the development of a new nuclear power station at Hinkley (and indeed at the other 7 potentially suitable sites) could have adverse effects on European designated sites. Paragraph 1.8.2 of NPS EN-6 explains that, as a result, the Government has considered potential alternatives that would better respect the integrity of European protected sites but concluded that there are none. Accordingly, the Government has presented a case for Imperative Reasons of Overriding Public Interest (IROPI) which sets out why the NPS should proceed. This is set out at Annex A of the NPS, which confirms that:

> *"A.3.7 There are IROPI in providing new nuclear generating capacity in order to provide our future energy security in a way which minimises carbon emissions, thus securing public safety, public health and combating climate change, which is a beneficial consequence of primary importance to the environment."*

A.4 The Site Preparation Application

A.4.50 The planning history of the main site is also important as a result of recent applications. In particular, planning permission has been granted for initial enabling works, including the removal of a soil mound and the relocation of a helipad in order to facilitate the construction of Hinkley Point C. More significantly, two substantial **preliminary works applications** have been submitted :-

- an application for the necessary consents and powers to construct and operate a Temporary Jetty and associated works (the Jetty applications) which have been made to the Marine Management Organisation (MMO) and the Department of Energy and Climate Change (DECC); and
- a planning application submitted to West Somerset Council (WSC) on 26th November 2010 for **site preparation works** (application reference 3/32/10/037).

A.4.51 **The jetty applications** are to be the subject of a public inquiry in November 2011 and, if approved, would permit its early construction and operation. The jetty would be used to bring at least 80% of aggregates for concrete to the site and has the facility to bring additional construction material, thereby saving approximately 250,000 lorry movements on local roads.

A.4.52 Whilst the jetty is the subject of these separate applications, at the time of submitting the draft DCO application, the outcome of that process is not known. Accordingly, EDF Energy is also seeking consent for a temporary jetty and associated conveyor and pipeline as part of the DCO, with the offshore works included in Part 2 of the draft Order. In the event that EDF Energy's HEO and TWAO jetty applications are granted and safe from legal challenge, EDF Energy will withdraw its request for the IPC to grant Part 2 of the draft DCO. EDF Energy will, however, continue to seek the power to close the temporary jetty via the DCO if this power is not granted in the HEO.

A.4.53 The purpose of the **site preparation works** is to clear the application site and undertake the earthworks necessary to create the development platforms required for the subsequent construction of Hinkley Point C power station. In addition, works would commence on the deeper excavations for building foundations. The site preparation works also involve substantial drainage works, including culverting Holford stream, which runs through the centre of the site, and the construction of a network of spine drains for the collection of surface water and ground water In addition to the earthworks and site drainage, the application includes a number of supplementary packages of work including:-

- demolition of existing barns;
- vegetation clearance;
- erection of boundary and construction fencing;
- construction of a temporary retaining wall along a low point in the cliff fronting the application site (to enable land raising of the site during platform development);
- construction of two new access points on the C182, each with its own roundabout, and internal site haulage routes;
- construction of two concrete batching plants;
- installation of services infrastructure, including a temporary 11kV sub station;
- local switch rooms and other utilities; and
- mobilisation of the civil works contractor, ie the contractor that would undertake the civil works upon grant of the DCO for Hinkley Point C.

A.4.54 In other words, the application seeks permission for those aspects of site clearance and preparation that can reasonably be undertaken before development consent is obtained for the construction of the nuclear power station itself.

A.4.55 In principle, the early approval of preparatory works for nuclear power stations was endorsed in a letter issued jointly by DECC and DCLG dated 16 July 2009. That letter encouraged local authorities to have confidence in considering such applications on their merits but recognised that authorities may decide that consent for such development should potentially be granted on the basis that any preliminary works carried out will be removed if the subsequent application to the IPC is turned down or not pursued for other reasons. That is the basis on which the site preparation works application was made to West Somerset Council, ie that the land would be reinstated in accordance with a Landscape Mitigation and Reinstatement Strategy in the event that development consent for the construction and operation of a nuclear power station at Hinkley Point is not granted within 5 years of the date of the site preparation planning permission.

A.4.56 The site preparation application was considered by the Planning Committee of WSC on 28 July 2011 when Members resolved to approve the application in accordance with the officer's report subject to a series of conditions and Section 106 obligations. At the time of drafting this Planning Statement, the Section 106 agreement had not yet been signed.

A.4.57 The officer's report on the application recognised that:-

- the national imperative of timely delivery of new nuclear power stations (page 327) and that a significant material consideration in the determination of the application is the identified need for new nuclear generating capacity to be operating as quickly as possible (page 348);
- there will be a loss of best and most versatile land but it is considered that other material considerations would outweigh the effects of this loss (page 173);
- local footpaths, which are an important part of the local recreation resource, will be adversely affected by the proposals but, through the provision of mitigation and financial contributions secured by Section 106 obligations and conditions, the proposals can be considered to be generally compliant with development plan policy (page 195);
- in relation to landscape and visual impacts, the approach taken by the applicant will assist in managing and minimising some of the individual and cumulative visual impacts associated with the site preparation works, although great reliance is placed on the ability of a tree screen and shrub planting to provide an effective visual screen across an extensive area and to mitigate lighting intrusion. Nevertheless, given the major changes to the landscape, not all the effects can be satisfactorily mitigated through design, siting or through visual screening of the site. For instance, the Council concurs with the views of the Quantock Hills AONB Service that the visual impacts on the elevated areas of the AONBs cannot be sufficiently mitigated through screening and design and with the views of the Fairfield Estate that the impacts on the Area of Outstanding Scenic Interest cannot be fully mitigated. Therefore, it is necessary to secure contributions to off site landscape improvements and enhancements as set out in the recommended Heads of Terms for the Section 106. On this basis, the proposal could be regarded as complying with some development plan landscape and visual policies but where conflicts exist, the Council has concluded that there are other material considerations including national policy which outweigh the conflict (page 241); and
- in relation to heritage issues, irreversible harm will be caused to buried archaeological remains in conflict with national and local policy and there may be impacts on the sensitive historic environment of the area. Planning conditions and mitigation will assist to some extent in compensating for the loss of heritage assets. Nevertheless, it will be difficult to mitigate against all of the harm on the historic environment and there will be residual impacts that could result in conflict with development plan policies. Where these conflicts exist, the Council has concluded that there are other material considerations which outweigh the conflict (page 241).

A.4.58 Other conclusions were reached on specific topics and the overall conclusion was to recommend approval subject to detailed conditions and Section 106 obligations.

A.4.59 In addition, through negotiation, EDF Energy and the Local Planning Authorities took the opportunity to include within the Section 106 agreement a number of matters which could be usefully put in place early to help the local area accommodate more easily the development of Hinkley Point C itself. More detail is provided in Section 9 of this Statement but, in principle, implementation of the site preparation planning consent would put in place obligations on EDF Energy to provide:

- advance highway improvement works;
- advance investment in new education and training facilities;
- the establishment of a Housing Fund to provide advance mitigation from any adverse effects on the local housing market from the rapid influx of construction workers in the early years of construction;
- investment in leisure facilities to anticipate the impacts and demands of the main DCO proposals;
- off site landscape and ecological enhancements to mitigation the visual and nature conservation impact of both the site preparation and main power station works; and
- a series of economic development initiatives to help prepare local companies and the local workforce for business and employment opportunities at Hinkley Point C.

A.4.60 There are at least three important consequences of the site preparation application which can be identified now that it has been supported by WSC ie:-

- up to date local endorsement that the principle of the development of the main site is acceptable in planning terms because of the national importance of Hinkley Point C;
- site preparation provides the ability to accelerate the development of Hinkley Point C; and
- the site preparation Section 106 agreement would put in place measures which, if implemented, would reduce the impact of the main DCO proposals.

A.5 Conclusions

A.5.61 Whilst all impacts and effects of the DCO proposals fall to be considered on their merits against relevant policy tests, the planning history includes relevant considerations which support the principle of the current proposals. In particular, not only has the principle of a nuclear power station at Hinkley Point C been endorsed in a previous planning decision, a more recent and up to date planning resolution has endorsed the in-principle acceptability of the development of the site for preparatory works, in view of the national imperative to deliver the nuclear power station.

A.5.62 The effect of the resolution to approve site preparation works is also to establish the acceptability of the principal land based impacts of the development, including impacts on archaeology, ecology, agricultural land, public rights of way and, if permission is granted, to allow EDF Energy to put in place relevant mitigation to address those impacts and to prepare for the power station development itself.

A.5.63 Even more significantly, the potential suitability of the site for the development of a new nuclear power station has been endorsed in Government policy as a result of a systematic assessment process.

A.5.64 None of this background predetermines the acceptability of the DCO application. Government policy has, however, established the potential suitability of the site for a new nuclear power station, in full recognition of the likelihood that its development may generate some adverse impacts. The site preparation planning application and the support for that application from the local authority reinforces that in-principle suitability and also demonstrates that the impacts at least of the site preparation works are acceptable, subject to the provision of appropriate mitigation.

A.5.65 This background provides a strong foundation against which to consider the DCO proposals themselves.

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APPENDIX B: SUMMARY OF THE PRINCIPAL MITIGATION OBLIGATIONS PROPOSED AS PART OF THE DCO APPLICATION (SECTIONS 7-9 OF PLANNING STATEMENT)

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B. SUMMARY OF THE PRINCIPAL MITIGATION OBLIGATIONS PROPOSED AS PART OF THE DCO APPLICATION (SECTIONS 7-9 OF PLANNING STATEMENT)

B.1 Planning Analysis: Project-Wide Considerations

B.1.1 NPS EN-1 and EN-6 identify "*Generic Impacts*" and "*flags for local consideration*". Whilst these are not exhaustive, they provide a helpful guide to the principal issues which the IPC is expected to take into account when determining the acceptability of a DCO application for a nuclear NSIP. The majority of the impact headings relate to site-specific considerations – such as landscape and visual impact, heritage impact etc but others are related to project-wide effects and are considered in this section of the Planning Statement. Section 8 considers site specific environmental and other effects and reviews the planning issues raised by the individual sites which collectively make up the HPC project.

B.1.2 In particular, the NPSs identify the need to consider impacts relating to the following:

- socio-economic effects;
- human health and well-being;
- traffic and transport.

B.1.3 Each of these topics is the subject of its own detailed assessment. The purpose of this Planning Statement, therefore, is to draw from those assessments and to put their conclusions into the context of the policy tests set by the NPSs. In each case, it is important to identify whether there are adverse impacts which it is relevant to take into account when considering the overall planning balance. In other words, whether there is a combination of adverse effects which is sufficient to overcome the strong presumption in favour of granting consent set out in NPS EN-1 (para. 4.1.2).

a) Socio-Economic Effects

B.1.4 The HPC DCO application meets the requirement of NPS EN-1 (para. 5.12.2) that the applicant should undertake and include in their application an assessment of socio-economic effects. Chapter 9 of each volume of the **Environmental Statement** addresses the socio-economic effects of the development in comprehensive terms – and, particularly, in the main development site volume. In addition, the application is supported by a number of relevant strategies and by an **Economic Strategy,** which are all relevant under this heading.

B.1.5 NPS EN-1 and EN-6 advise that the socio-economic topic should consider issues relating to:

- the creation of jobs and training opportunities;

- the provision of additional local services and improvements to local infrastructure;
- effects on tourism;
- the impact of a changing influx of workers during the different construction, operation and decommissioning phases on the demand for services and facilities in nearby settlements, including effects on social cohesion;
- economic benefits; and
- cumulative effects.

B.1.6 These matters are addressed in detail in the Social Economic Chapters of the **Environmental Statement**, based on a thorough evidence base. Sound evidence is important for these purposes because NPS EN-1 advises:

> *"5.12.7 The IPC may conclude that limited weight is to be given to assertions of socio-economic impacts that are not supported by evidence….."*

B.1.7 The Site Assessment contained at Annex C of NPS EN-6 identifies that development at Hinkley Point C has been appraised in the preparation of the NPS as having positive effects of regional economic significance on employment and community viability (para.C.5.85). Nevertheless, consultees including the local planning authorities have expressed concerns about some of the potential effects of the HPC project including, for instance, its impact on local housing, community cohesion and tourism.

B.1.8 EDF Energy has taken comprehensive steps to understand and assess these issues. In particular, a formal Socio-Economic Working Group was established in October 2010, incorporating representatives from SDC, WSC, SCC and EDF Energy. The Working Group has met on multiple occasions to commission and share data. A series of six detailed technical notes have been prepared by EDF Energy for consideration by the Working Group and are appended to the Socio-Economic chapter of the **Environmental Statement.** They are as follows:

- Technical Note 1: Workforce Profile;
- Technical Note 2: Demographic Benchmarks;
- Technical Note 3: Spatial Distribution;
- Technical Note 4: Accommodation Datasets;
- Technical Note 5: Leisure Audit and Estimated Demand;
- Technical Note 6: Community Cohesion.

i. Employment and Economic Effects

B.1.9 The socio-economic assessment considers the potential effects of the project at a number of geographic scales including:

B.1.10 Construction Daily Commuter Zone (CDCZ) – a 90 minute commute time within which home-based workers would be drawn to employment at Hinkley Point C without moving house;

B.1.11 60-minute travel time – the estimated extent of daily travel time to HPC by non-home based workers who may move into the area to work on the project.

B.1.12 In addition, a study area is formed from the administrative areas of West Somerset, Sedgemoor and Taunton Deane, whilst other effects are considered at a more local level.

B.1.13 The baseline demonstrates that recent years up to 2008 saw a relatively strong growth in employment in Somerset and in Sedgemoor in particular but with significant local variation, including less strong growth in West Somerset and a decline in Bridgwater. The County Council's Local Economic Assessment notes that Somerset performs poorly in terms of employment in knowledge intensive industries and has an over-dependency on sectors that are at risk of decline, including sectors such as food and drink, tourism, manufacturing and sectors that are based on public spending. Forecast declines in agriculture and fishing will have an impact on rural areas in Somerset, whilst the forecast decline in manufacturing is likely to impact larger centres such Yeovil and also Bridgwater.

B.1.14 A major issue threatening the economy, especially in the short to medium term is the effect of public sector expenditure cuts. Sedgemoor and Taunton Deane have a significant reliance on the public sector, with 31.1% and 29.8% of all residents employed in public sector positions. Independent reports by the South West Observatory[1] and by Experian[2] both identify concerns for the resilience of the local economy.

B.1.15 One of the strengths of the regional economy has been its contribution to the UK's nuclear work force, with the south west hosting approximately 35% of the country's employees in the sector. However, the decommissioning of Oldbury and of Hinkley B will result in a 45% reduction in work force employed in the sector in the south west by 2025. Against this background, it is unsurprising that local strategies recognise the importance of the Hinkley Point C inward investment. Endorsement for the importance of the investment has come from a range of sources including the following:

B.1.16 the recently formed Heart of the South West Local Enterprise Partnership published a Partnership Prospectus in March 2011 which identified a number of key priorities, including encouraging investment in potential growth sectors such as low carbon energy generation that can create and sustain new private sector jobs, rebalancing the economy away from an over-reliance on the public sector (Socio-Economic Assessment para 9.1.80);

B.1.17 the non-statutory Somerset County Plan – (2010-13) sets out the County Council's priorities. On *prosperity* the plan notes that Somerset has historically under performed economically, so it aims to help existing businesses grow and to attract

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[1] South West Observatory (August 2010) Impact of public sector spending cuts – Emerging evidence base for the South West August 2010

[2] http://www.bbc.co.uk/news/business-11233799

new ones. It identifies the development of HPC as a "*huge opportunity*" (Socio-Economic Assessment para 9.1.91);

B.1.18 SDC's recently updated Economic Development Strategy 2011 – 2026 confirms that:

> *"the proposed multi-billion pound investment by EDF Energy in a new nuclear power station at Hinkley Point C represents a substantial potential benefit on the local economy and area. This provides the local authority and public sector with the opportunity to work with the local community and businesses to mitigate any adverse impacts during construction and to capitalise upon the investment to embed lasting economic benefits in Sedgemoor." (Socio-Economic Chapter para 9.1.02).*

B.1.19 Against this background, it is unsurprising that the Socio-Economic Assessment identifies a number of beneficial impacts of Hinkley Point C – both during construction and operation. The headline impacts include the following:

- **During Construction** – 25,000 person years work, which is expected to result in 20,000-25,000 different individual posts in the main 108 month construction period, with a peak headcount of 5,600.
- Opportunities for the local supply chain are expected to be at least £45m per annum, wages and multipliers are estimated at £85m per annum or just under £800m over the construction period (Economic Strategy para 4.1.4).
- **Operation –** 700 direct EDF employees and up to 200 contract staff – totalling 900. The contractor support will also increase significantly to over 1,000 for two months periods during each unit's refuelling outage (every 18 months). (Socio-Economic Assessment para 9.1.226).
- Long-term wages of £30m per annum and additional supply chain benefits of £40m per annum (Economic Strategy para 4.1.4).

B.1.20 The scale of these benefits represents a major opportunity to support local communities and stimulate the local economy. It also offers real opportunities to tackle worklessness which has increased in recent years to the point where there are more than 19,000 unemployed or economically inactive residents in Somerset, of whom 7,000 live in Sedgemoor (Economic Strategy Table 5).

B.1.21 EDF Energy's Vision for the HPC project includes a determination to ensure that the inherent benefits of its investment in Hinkley Point C are captured in a way which maximises its practical contributions to the local and regional economy. Accordingly, EDF Energy is committed to a number of strategies to ensure that maximum local benefit is gained from its investment at Hinkley Point. In particular, EDF Energy has committed to a **Construction Workforce Development Strategy** (CWDS) which comprises seven key projects:

- **Employment Brokerage**: The project has been developed with JobCentre Plus and will match vacancies with contractors to residents. This will include people who already have appropriate skills, and also identify and address skills needs and barriers to work for target groups including the unemployed and young people not in education, employment or training (NEETs). Partners will seek to lever in external funding to support customised training to address identified needs. EDF

Energy and Jobcentre Plus are committed to providing staffing resources for this project.

- **Employment Outreach**: Employment outreach projects will engage with local communities, particularly hard to reach groups, so that they are aware of opportunities at HPC and supported in gaining the necessary motivation and skills to access jobs. EDF Energy is funding community outreach workers in Sedgemoor and West Somerset who will liaise with their own outreach co-ordinator. They will identify specific interventions relating to clients' needs and will link with the brokerage service.
- **Construction Skills Centre**: EDF Energy has been working in partnership with Bridgwater College to enable local, demand led training to be delivered at a Construction Skills Centre in Cannington. The centre will be able offer courses ranging from basic health and safety and card schemes through to advanced training in specific skills. This will include a dedicated Civil Engineering site designed to accommodate state of the art training in all types of plant being used at HPC, OSAT NVQs, Building Services/Utilities, Formwork, Steel Fixing, Steel Erecting, New Roads and Street Works.
- **Constructionarium**: This is a hands-on construction experience for students following civil engineering and built environment courses. It allows the students to learn practically from industry - their future employers. It is designed to be part of a 21st Century engineering education which links academic theory with contractors and consultants from the construction industry. It will be established in partnership with education providers and based at the Construction Skills Centre.
- **Hinkley Skills Ready Project**: This will enable residents of West Somerset to get the skills they need to work at HPC. It has been developed in partnership with West Somerset Community College, and will combine physical investment in buildings at the college with a curriculum designed to meet the needs of HPC contractors.
- **Apprenticeships**: EDF Energy aims to at least meet the national benchmark for construction apprenticeships. EDF Energy will produce a specific Apprenticeship Strategy and work with its supply chain and other agencies to maximise apprenticeships for local residents.
- **The Enterprise Centre Project**: EDF Energy is working with West Somerset Community College and West Somerset Council on a feasibility study for an enterprise centre project, to support Somerset residents and businesses in providing services to the incoming workforce and prepare for other new markets (eg. visitors and tourists) that may arise as a result of the HPC development.

B.1.22 The commitment is defined in the **Heads of Terms for the Section 106 Agreement** which is discussed in Chapter 9 of this Planning Statement. The implementation of the strategy is being overseen by a governance structure that includes key partners. It includes Key Performance Indicators that will be regularly monitored, so that the effectiveness of projects can be assessed and reviewed over the lifetime of the development.

B.1.23 The potential to secure benefits locally is also enhanced by the HPC **Local Business Engagement Strategy**, which is annexed to the **Economic Strategy**. The Strategy confirms that EDF Energy has been working with the Somerset

Chamber to Commerce for some time now in order to ensure that not only the UK supply chain but also the local supply chain benefit from involvement in the project. The strategy includes:

- building a database of Somerset suppliers, certificated as meeting the necessary quality standards for engagement on the project;
- undertaking a series of visits to local suppliers in order to explain the project requirements and ensure that they are "Hinkley ready";
- hosting a series of "meet the buyer" events, introducing local suppliers to potential principal contractors;
- engaging with local business organisations to raise the profile and the opportunities generated by the Hinkley Point C project; and
- adopting Key Performance Indicators aimed at maximising benefits for local companies.

B.1.24 These comprehensive measures secure EDF Energy's Vision to maximise the inherent benefits of the project locally. The potential benefit of the project, however, is even greater because of its capacity to act as a catalyst for change. Chapter 5 of the **Economic Strategy** explains how the Government has identified new nuclear investment as an opportunity to bring about structural change in the national, regional and local economies.

B.1.25 The particular additional benefit which the HPC project may be able to facilitate is the potential to establish a Low Carbon Business Cluster in Somerset. As early as June 2009, the South West Regional Development Agency (SWRDA) identified the potential for Hinkley to become *"a source of international expertise and create a strong high value business cluster in Somerset*"(ES **Volume 2, Chapter 9 Socio-Economic Assessment** para 9.1.79). This ambition is now a central objective of Somerset's Local Economic Assessment (p.5) and of Sedgemoor's Economic Development Strategy (Section 5.5 and **Table 7**). SDC is bringing forward employment land which could benefit from the opportunity and EDF Energy is working with the Councils, funding research to support the Somerset Low Carbon Economic Delivery Plan. In addition, EDF Energy has committed itself to a £3m investment in the new Energy Skills Centre at Bridgwater College which could become a regional or even national centre for excellence for the teaching of sustainable energy techniques and alternative energy innovations.

B.1.26 Against this background, the potential adverse economic and employment effects are extremely limited. In fact, the only potential adverse effects which have been raised through consultation areas follows:

- displacement effects, ie the loss of labour from existing local companies to Hinkley Point C;
- congestion impacts on the agricultural and logistics sectors; and
- adverse effects on the tourism economy.

B.1.27 These issues are addressed in detail in the **Socio Economic Assessment** and potential transport effects are addressed in the **Transport Assessment**; no adverse impacts on these issues are identified. Experience at Sizewell B was that around

30% of employees recruited in the peak recruitment year had come from other local employers but a survey of 160 local companies found that less than 10% of those companies thought that the power station project had made it more difficult to retain or recruit staff (para 9.1.386). If similar proportions arose at Hinkley this would account for 3% of the construction workforce in Somerset and 1% in the CDCZ, which would be negligible in the context of the overall "churn" within the construction and the overall labour market in the area.

B.1.28 There is no evidence that the construction and operation of a nuclear power station has adverse impacts on tourism. During the construction period, the incoming construction workforce is expected to make a major contribution to the tourist accommodation sector, particularly by taking up substantial spare capacity available in the off peak seasons. Expenditure in tourist accommodation over the lifetime of the project is estimated at around £15m.

B.1.29 A new Public Information Centre is proposed as part of the HPC project. It is the intention of EDF Energy that this will be open to the public with a mix of local, tourist and educational visitors. The centre would provide information not only on the HPC project but also wider Somerset attractions. EDF Energy intend to have an initial cap of around 250,000 annual visits per year with capacity for up to 1,000 a day in the August peak. The centre would provide an important additional indoor attraction for the area. If it is as successful as expected, it would be the most popular visitor attraction in Somerset and would have a major beneficial effect at a local and county level.

B.1.30 In reality, the investment in Hinkley Point C provides an important opportunity to rebalance the local economy and to tie the sub-regional economy into two of the few genuine growth sectors – infrastructure construction and low carbon energy. The investment and activity planned in construction workforce and local procurement initiatives would ensure that these opportunities are captured locally.

B.1.31 EDF Energy's assessments confirm the expectation in the NPS that the development of Hinkley Point C would have positive employment and economic effects of regional economic significance.

ii. Education

B.1.32 Education issues arise in two ways: EDF Energy has an education strategy which seeks to maximise the opportunities for young people created by the HPC project. In addition, however, it is also important to ensure that there is no adverse effect on local education facilities from the influx of HPC workers.

Education Strategy

B.1.33 The *Inspire* Education Strategy forms an appendix to the **Economic Strategy**. It sets out a comprehensive commitment to work in and with schools in Somerset to engage and inspire young people to follow a pathway in Science, Technology, Engineering and Mathematics, with a primary aim of raising aspiration and attracting school leavers into careers in construction or engineering. The *Inspire* strategy is fully funded through the **Section 106 Heads of Terms** and EDF Energy has recruited a specialist team to implement it. Activities will include the production of information packs, curriculum and teacher support, site visits, classroom support, careers events, an online environmental education tool, specific training and support, expert visits to schools and virtual work experience. The strategy can be seen as the first part of a comprehensive education and training programme aimed at maximising local opportunity and it complements the activities explained above in the **Construction Workforce Development Strategy**. Over a fifteen year period, the HPC project is expected to generate 700 apprentice and 150 graduate opportunities per annum and it holds the potential to transform the lives of hundreds of young people in the local area.

Education Impacts

B.1.34 In order to ensure that there are no adverse impacts on education capacity in the local area, the socio-economic assessment considers in detail the potential scale of demand from Hinkley Point C construction worker's children relative to capacity in local schools (**Socio-Economic Assessment** para 9.1.484 onwards). The **Heads of Terms for the Section 106 Agreement** propose advanced mitigation through early investment funded by EDF Energy in primary school capacity in Bridgwater and Cannington and a formula for payment towards increasing education capacity if monitoring identifies further impacts beyond existing capacity. The proposals would more than mitigate the assessed minor impact which has been assessed from the central assumptions set out in the Socio-Economic Assessment.

iii. Accommodation

B.1.35 Whilst NPS EN-1 and EN-6 do not specifically flag the need for the IPC to consider potential effects on the local housing market, effects relating to the influx of workers during the construction and operational phases are identified as relevant. In addition, the local authorities have continued to express concern about the potential impact of Hinkley Point construction workers on the local housing market. In particular, concerns have been expressed that the demand for workers could adversely affect the tourism accommodation sector and that the influx could raise prices and rents, which could in turn make access to accommodation more difficult for those on the lowest incomes. Accordingly, these considerations have been the subject of extensive engagement with the local authorities.

B.1.36 Again, a detailed evidence base is available, which is reported in the Socio-Economic Chapters of the **Environmental Statement**. As listed in paragraph 7.2.4, Technical Notes 1 and 2 (appended to the Socio-economic assessment Volume 2 Chapter 9 of the ES) relating to workforce profile and demographics have been prepared by EDF Energy and have been agreed by the Local Authorities. This provides a helpful basis against which to consider the potential for adverse effects.

B.1.37 The Technical Notes explain the agreed assumptions that the construction workforce will peak at 5,600 workers and that the best central estimate is that 34% of these would be home based workers, with 66% or 3,700 workers coming to the area and requiring accommodation (non home based workers or NHB) at peak. Those workers are expected to seek accommodation within a 60 minute drive time. Detailed research has been undertaken to estimate the capacity of accommodation within that 60 minute drive time.

B.1.38 The evidence also demonstrates that the area has a relatively mobile population. On average, 7% of households move home each year and the figure rises to 20% within the private rented sector (PRS). This may be partly due to the nature of the local economy, which relies in part on traditionally seasonal sectors such as tourism and agriculture.

B.1.39 In relation to tourism, it is estimated that the area has approximately 35,000 tourist bed spaces excluding accommodation in holiday villages which is unlikely to be available to HPC workers. EDF Energy's estimates of available capacity have been cautiously made in order to ensure no adverse effect on the tourist sector. In particular vacancy rates have been examined. August is the peak month and vacancy rates show only 6,500 vacancies. At other times of the year, capacity is much greater with typically 24,500 vacant bed spaces in March (see the **Accommodation Strategy Table 4.3**). EDF Energy's capacity estimates are further reduced to discount accommodation which may not be affordable to workers, leaving an estimate of 2,070 spare bed spaces in the peak month of August in the 60 minute drive time.

B.1.40 This is the extent of tourist accommodation which EDF Energy believes can be available for take up by HPC workers without any risk of adverse impacts.

B.1.41 Similar estimates have been made of the private rental sector. Within the 60 minute study area, there are 22,000 PRS units. Many of these have capacity for more than one bed space, so that the PRS sector is expected to have a capacity of 51,000 bed spaces in the 60 minute travel time. Based on an analysis of vacancy rates, it is estimated that at least 1,270 bed spaces are surplus within the study area. This is a particularly conservative estimate which relies only on spare capacity above normal vacancy rates. (see the **Accommodation Strategy Table 4.6**).

B.1.42 Other sources of accommodation are the owner occupied sector and latent accommodation. These have the following characteristics:

- The demand for owner occupied accommodation is expected to be limited, principally to managerial and professional grades who move to longer term construction jobs at Hinkley, a number of whom may be expected to bring their families. The **Socio-Economic Assessment** estimates that these would account for approximately 500 workers with families. No issue appears to be alleged in relation to the impact of those workers on the owner occupied market. Their impact on the market would equate to a maximum of 3% of all property sales, benchmarked against sales in 2009, which was a relatively low year for house sales. This demand may provide a small stimulus for the market but is not alleged or expected to have adverse impacts.
- The latent sector represents potential capacity that is not being currently or previously rented. This comprises rooms which local homeowners are willing to rent out to Hinkley construction workers. To test the market, EDF Energy has placed adverts locally seeking interest from homeowners and received a strong response. The most recent advert resulted in 750 responses of which over 400 were genuinely "additional" to existing supply. Interest has continued to grow and the HPC Accommodation Office database accounted for 1,500 properties at September 2011 of which 400 are rooms within peoples houses.

B.1.43 In addition to this supply, EDF Energy proposes the construction of 1,510 bed spaces in three workers accommodation campuses – at the HPC development site, at Bridgwater A and at Bridgwater C. Any planning issues related to the campuses themselves are discussed further in Section 8 of this Planning Statement but, taken together with the estimates of supply in the existing accommodation market, the availability of the campus accommodation brings the potential supply of accommodation available to workers to at least 5,740 spaces. Comparing this to the likely take up of different accommodation types, the **Accommodation Strategy** estimates the relative supply and demand of accommodation to be broadly as follows:

Table B.1: Hinkley Point C Accommodation Capacity and Expected Take-Up

Type	%	Number	Capacity
Campus	39%	1,450	1,500
Tourist Accommodation	16%	600	2,070
Private Rented	20%	750	1,270
Owner Occupied	14%	500	500+
Latent Accommodation	11%	400	400+
TOTAL NHB		3,700	5,740

B.1.44 The take up of campus, owner occupied and latent accommodation would have no adverse impacts on the housing market, although the overall demand is expected to stimulate the market and, for instance, generate investment in new building, bed and breakfast and latent accommodation.

B.1.45 Concerns for potential impacts, therefore, should be limited to tourist accommodation and the PRS.

Tourist Accommodation

B.1.46 The available information, however, suggests that there are no likely adverse impacts in the tourism sector for the following principal reasons:-

- the estimated take up of tourist accommodation (600 bed spaces) compares to a very cautious estimate of capacity of 2,070 spaces. It should be remembered that this estimate is a sub-set of a total vacancy of more than 6,500 bed spaces and that this is the vacancy rate in the peak summer month of August. In the lower seasons, available accommodation peaks at over 20,000 bed spaces;
- the take up estimate represents the peak of the HPC construction workforce. Figure 2.2 in the **Accommodation Strategy** shows that the number of non-home based workers exceeds 3,000 for only an 18 month period and that the peak itself is short-lived; and
- there is no evidence, therefore, that there would be any adverse effect even in the Summer peak on tourist accommodation. Instead, a more realistic assessment would be that HPC construction workers would bring significant benefit to the tourist accommodation sector by providing year round demand in an industry which is subject to extreme seasonal variation.

Private Rental Sector

B.1.47 Similar conclusions can be draw for PRS accommodation, for the following reasons:

- an estimated demand of 750 bed spaces is unlikely to have any significant impact on an overall market of more than 50,000 bed spaces;
- the scale of demand falls well below the estimate of available capacity, even when that estimate is drawn from a series of conservative assumptions; and
- the demand on the PRS sector in the peak construction year of 750 bed spaces can be seen as small compared to the annual "churn" of approximately 10,000 bed spaces (20% of 50,000). In other words, this is a dynamic sector which sees seasonal and other workers entering, moving and leaving the sector on a regular, short-term basis in response to seasonal employment and other factors.

B.1.48 The evidence suggests, therefore, that it is unlikely that the influx of NHB workers, which would build up to a peak over a 4 or 5 year period, would have adverse impacts on the supply of either tourist or PRS accommodation within the local area.

B.1.49 In any event, EDF Energy has proposed a number of measures to ensure the absence of adverse impacts and to mitigate any impacts that do arise. These measures are detailed in the **Accommodation Strategy** but may be summarised as follows:

- the establishment of an Accommodation Office which would provide a service both to local accommodation providers but also to incoming HPC workers, matching their respective requirements;
- monitoring the home location of HPC workers and providing liaison and other facilities through the Accommodation Office to identify any adverse impacts that may arise;
- a flexible bus strategy which will allow routes to be varied and additional buses that run directly to the site to be provided. This could be used to make areas that have spare accommodation more attractive to workers. This would then reduce pressure on areas that have attracted large numbers of workers and where there may be pressure on accommodation capacity;
- applying an Accommodation Management Strategy to direct incoming HPC workers away from any areas of identified housing stress;
- a commitment to a Housing Fund of £5 million to be spent on a range of specified measures, each of which would stimulate supply in the private rented stock or provide financial assistance to local households seeking PRS accommodation; and
- committing to additional mitigation in the event that monitoring identified clustering of incoming workers beyond the capacity of local settlements.

B.1.50 Details of these mitigation measures are set out in the **Accommodation Strategy** and are discussed further in Section 9 of this Planning Statement, which considers necessary Section 106 obligations and requirements. As a package of measures, however, the **Accommodation Strategy** would, if implemented, ensure that there would be no adverse impact on the housing sector, whilst the accommodation proposals overall provide significant benefit for the owner occupied, tourist and latent accommodation sectors, as well as stimulating supply in the private rented, tourist and owner-occupied sectors and providing financial assistance for local households suffering hardship.

B.1.51 The proposals to construct three workers campuses also raise site specific planning issues but these are discussed in relation to specific sites in Section 8 of this Planning Statement.

B.1.52 Based on the above analysis, and the more detailed analysis set out in the Socio-Economic chapters of the Environmental Statement and the **Accommodation Strategy**, it can be confidently concluded that the HPC project would not generate adverse impacts on the local housing market.

iv. Leisure and Recreation

B.1.53 The influx of new workers into the area could generate additional demand for leisure facilities. In addition, the construction and operations of the associated development sites will impact on some existing facilities. In particular:

- The Bridgwater C campus would displace a rugby club training pitch;
- The development of Bridgwater A would result in the loss of the former Innovia playing field and social club;
- Enhanced wharf facilities at Combwich would disrupt facilities used by the local sailing club.

B.1.54 It is necessary to assess and to mitigate these impacts. Before assessing the details, however, it is relevant to note two important considerations, as follows:

- the DCO application proposals include leisure facilities. In particular, the description of the associated development proposals at Section 4.6 of this Planning Statement records the inclusion of sports pitches and changing facilities at Bridgwater A, similar facilities at the HPC development site accommodation campus and a sports pitch at Bridgwater C. Whilst these facilities are also to be made available to the public, they will make a significant contribution to meeting the leisure needs of construction workers; and
- the majority of indoor leisure facilities in West Somerset and Sedgemoor charge for entry, so that demand from HPC workers will help contribute to the viability and running of those facilities.

B.1.55 The potential for adverse impacts is directly addressed in the Socio-Economic Chapters of the **Environmental Statement**. The approach is founded upon a clear evidence base and Technical Note 5; “Leisure Audit and Estimated Demand” sets out the existing provision of sports facilities in Sedgemoor, West Somerset and Taunton and estimates the incremental demand that would be generated by HPC workers. The Technical Note uses the “Sport England Facilities Calculator” to identify the likely demand for provision. The assessment demonstrates that demand for sports facilities is very modest and is likely to be able to be met from existing provision and the campus proposals. The exception to this is where there is already a significant deficiency in sports provision, for example swimming pools, although the increased demand for these facilities is assessed to be small. Taking account of the facilities directly provided at the associated development sites, the assessment concludes that the level of non-home based workforce would need to more than double to generate a net impact on provision greater than that already being provided through the campus facilities. Impacts on other sports provision are likely to remain negligible in any plausible scenario (**Socio-Economic Assessment** para 9.1.506).

B.1.56 Consideration has, however, been given to the impact of the associated developments on existing leisure facilities. EDF Energy will be obliged to replace the rugby training ground as part of its land agreement for the Bridgwater C campus, so that the principal physical impacts of the associated developments relate to the loss of the facilities at Bridgwater A and to any disturbance to the activities of the sailing club at Combwich. Section 8 of this Planning Statement considers site specific impacts directly with the benefit of Appendices 7-14 which review each site in more detail. That analysis shows, for instance, that full provision is being made in the design of the Combwich Wharf facilities to replace and enhance the facilities available to the sailing club.

B.1.57 At Bridgwater A, as Appendix 7 explains, planning permission has been granted which accepts the principle of the loss of the social club and playing field at the former Innovia site, as part of the North East Bridgwater Masterplan consent. Nevertheless, as part of the work undertaken in the preparation of the Site Preparation Section 106 Agreement, estimates were made based on the SDC Infrastructure Delivery Strategy of the cost of reproviding in full the sports pitch and the social club. The estimated cost of reprovision was £435,000. Estimates were also made of the total cost of meeting the leisure needs of the HPC construction workforce and mitigating in advance all of the leisure impacts of the HPC project. Through the Site Preparation Section 106, therefore, a substantial commitment is proposed to safeguard against the risk of impact, with the following characteristics:-

- £250,000 towards the provision of new or improved sports and leisure facilities within West Somerset;
- £500,000 towards providing new or improved sports and leisure facilities within the parish of Stogursey;
- £250,000 as a contribution towards the new swimming pool under construction at Chilton Trinity Technical College in Bridgwater;
- £500,000 to provide new or improved sports and leisure facilities within Bridgwater; and
- £500,000 to provide new or improved sports and leisure facilities within Cannington.

B.1.58 The purpose of this commitment was to provide advanced mitigation for the impacts of the DCO project. Based on the analysis set out in the **Socio-Economic Assessment**, it is apparent that these contributions fully mitigate impacts that might arise from the construction workforce, even at the peak of construction activity.

B.1.59 The commitment to provide £500,000 towards sports facilities in Bridgwater meets the calculated cost of reproviding the sports club and playing field that would be lost as a consequence of the Bridgwater A accommodation campus development. This commitment was deliberately made as part of the Site Preparation Section 106 Agreement in order to put in place early mitigation so that the development of the campus could proceed as soon as the DCO is granted. EDF Energy has been working with Somerset Leisure and SDC to target the most effective use of the commitment and the current expectation is that the funds would be applied to enhance and extend leisure facilities in East Bridgwater.

B.1.60 Potential recreation and amenity impacts are also addressed in detail in the Environmental Statement. In particular, the assessment identifies the commitment made as part of the Site Preparation Section 106 Agreement to fund substantial enhancements to the network of Public Rights of Way in the vicinity of the main development site and the coastal areas, principally to the west. These plans have been developed and agreed with Somerset County Council. As part of the Heads of Terms for the Section 106 Agreement for the DCO (see Section 9), EDF Energy intends to extend these commitments to include further enhancements, particularly to the Parrett Trail and to the coastal footpath network to the east of Hinkley Point. The net effect of these commitments would be an enhancement of the rights of way network. The commitments made through the Section 106 Agreements will leave a legacy of enhanced facilities.

v. Public Services and Community Cohesion

B.1.61 EDF Energy has been consulting with key public service providers through a formally established group, the Emergency Services and Local Authorities Group, since September 2010 in order to increase its depth of understanding of the current roles of the providers and potential community safety issues arising from the construction and subsequent operation of Hinkley Point C. Meetings have been held on a monthly basis and attended by the local authorities (SCC, WSC and SDC), Avon and Somerset Constabulary, Devon and Somerset Fire and Rescue Service, South Western Ambulance Service Trust and Her Majesty's Coast Guard.

B.1.62 In addition to monthly meetings attended by all stakeholders, regular bilateral meetings have been held in order to progress points of detail. Service relationship protocols have been discussed with providers and workshops have been held with the Group at key stages in order to establish potential impacts, to review construction proposals, to assess the approach to traffic incident management and to establish governance arrangements for the group through the construction period.

B.1.63 The output for the purposes of the DCO application is a **Community Safety Management Plan** appended to which are:

- a worker code of conduct; and
- the Outline Contingency Response Arrangements (OCRA).

B.1.64 In addition, the principles of a **Traffic Incident Management Plan** have been agreed and these are reported in the **Transport Assessment**.

B.1.65 It is proposed that the group will continue to meet in order to work together to deliver key objectives of the above strategies, to monitor impacts on community safety arising as a consequence of the HPC project and to make recommendations for action. The **Heads of Terms for the Section 106 Agreement** set out a framework of funding in order to facilitate the ongoing working of the Group. Through this constructive, comprehensive engagement, EDF Energy has worked successfully with the service providers in order to ensure that the impacts arising from the HPC project on key local services can be fully addressed.

B.1.66 In this respect, EDF Energy recognises that the influx of non home based workers, along with the scale of activity which the HPC project will generate will result in change in the local economy and local communities. The measures described above and other commitments described below (and set out in **the Heads of Terms for the Section 106 Agreement**) combine to ensure that any adverse impacts on community cohesion will be appropriately addressed. In particular:

- community safety issues have been comprehensively addressed through the measures outlined above, including the funding of a Community Safety Beat Team within the police service, as well as additional funding for community safety resources in the three local authorities;
- incident management and contingent response arrangements are in place to address unexpected events;
- investment by EDF Energy in comprehensive education, training and local recruitment initiatives in order to maximise the opportunity for local people to achieve employment and training and to become part of the HPC project;
- EDF Energy has worked hard to ensure that the project does not marginalise sectors of the local communities – in particular, investment is proposed in community outreach and youth worker programmes to ensure that traditionally "hard to reach" groups can be given every opportunity to benefit from the project;
- the worker Code of Conduct will be rigorously enforced if necessary and EDF Energy will have additional oversight of worker behaviour through its **Accommodation Management Strategy** and through the provision and management of accommodation campuses; and
- worker induction will include extensive information about local services in order to enable workers to engage with the local community.

B.1.67 The HPC project, therefore, is fully mitigating its potential impacts on sectors of the local community including housing, leisure, recreation and other services. In fact, through the extensive investment in local services and facilities, together particularly with the education, employment and training initiatives set out above, the HPC project is expected to provide a major boost to the local economy and a major opportunity for local communities.

vi. Health Effects

B.1.68 NPS EN-1 and EN-6 provide clear guidance to the IPC on the approach that is appropriate to the potential health impacts of an NSIP. In particular, NPS EN-1 is careful to ensure that those matters which are subject to separate regulation are appropriately considered through those other regimes (see earlier paragraph 6.2.8 and Appendix 6). This includes issues to do with nuclear safety, as well as Health & Safety, so that para 4.13.5 advises:

> *"… so that it is unlikely that health concerns will either constitute a reason to refuse consents or require specific mitigation under the Planning Act 2008."*

B.1.69 The same paragraph goes on to explain that the IPC will want to take account of health concerns when setting requirements relating to a range of impacts, such as noise. Health does not appear, however, in Section 5 of NPS EN-1 which sets out the Generic Impacts for the IPC to consider, although that list is not exhaustive.

B.1.70 NPS EN-6 is consistent with this approach. In relation to radioactive waste management, for instance, paragraph 2.11.6 states that the IPC should act on the basis that the relevant licensing and permitting regimes will be properly applied and enforced.

B.1.71 Human health and well-being, however, is a heading in Part 3 of NPS EN-6, ie matters for the IPC to consider when assessing potential impacts and siting considerations of new nuclear power stations. Human health and well-being, therefore, is a "Flag for Local Consideration". The guidance provided, however, puts that issue into context in the following way:

- the operation of a new nuclear power station is unlikely to be associated with significant noise, vibration or air quality impacts (although there may be local impacts from transport and associated activities during construction). With appropriate mitigation, the subsequent effect of these potential impacts on human health is unlikely to be significant (para 3.12.3);
- the process of construction, operation and decommissioning, however, could affect healthcare provision (para 3.12.5); and
- the Nuclear AoS identified that there could be positive effects for health and well-being resulting from the positive socio-economic benefits of new nuclear power stations (para 3.12.6) and the IPC is asked to consider the positive effect of employment and other socio-economic impacts on human health and well-being (para 3.12.8).

B.1.72 The NPS, therefore, identifies the potential need for mitigation, particularly during construction and the need to consider the possible effect on healthcare provision. Other matters particularly the risk of adverse effects resulting from exposure to radiation are not matters for the IPC, who are asked to act on the basis that such risks will be adequately mitigated through other regimes (para 3.12.11).

B.1.73 Further context for Hinkley Point C is provided by the Site Assessment set out at Annex C of NPS EN-6, which confirms that the development at Hinkley Point is appraised as having positive economic effects, including positive effects on community viability (para C.5.85). The Assessment is aware that the presence of a nuclear power station may lead to increased stress levels in certain individuals but advises:

> *"C.5.99….Overall, the Appraisal of Sustainability finds that likely enhancement in employment, community wealth, housing stock and other associated neighbourhood infrastructure should improve community well-being and health generally."*

B.1.74 Against that background, EDF Energy has sought to engage with the community and relevant stakeholders and it has taken a number of measures which are brought together in the **Health Impact Assessment** (the HIA). The HIA explains its own objective as follows:

> *"1.3.1 The primary aim of the HIA is to build on and complement the outputs of the Environmental Statement to further integrate health and well-being within the HPC project, identify and assess potential health outcomes*

and put forward recommendations to maximise health gains whilst minimising potential negative impacts".

B.1.75 It would not be appropriate in this Planning Statement to review in detail the terms of the HIA or of its associated **Health Action Plan** (HAP). Nevertheless, those documents demonstrate that EDF Energy has adopted a comprehensive approach to all relevant health related matters, including community well-being.

B.1.76 As with other topic areas, there has been extensive engagement with relevant stakeholders. This is related in Section 4 of the HIA, whilst Section 7 also identifies that a Health Task and Finish Group (HTFG) was formed in November 2010 to support the development and refinement of the HAP and to monitor its delivery. The HTFG includes representation from the local authorities but also from the principal health service providers, including the PCT and the South West Ambulance Trust. EDF Energy has funded the operation of that group and the Site Preparation Section 106 Agreement proposes a payment of £60,000 to the group to enable it to undertake its own studies to ensure readiness for the HPC project.

B.1.77 To address the health and well-being of its own workforce, EDF Energy is committed to a number of initiatives including:

B.1.78 the engagement of Duradiamond Healthcare as the provider of occupational healthcare services to the workforce during construction. Duradiamond provide extensive healthcare services to workers including:

- screening and preventative healthcare;
- regular health reviews;
- a programme of health promotion;
- the application of a Drug and Alcohol Policy (which includes testing but also confidential advice);
- on-site treatment for accidents or illness; and
- emergency response.

B.1.79 Not only does this provide a high level of healthcare service to HPC workers, it also significantly reduces pressure on local healthcare services;

- close working with the Ambulance Trust and an agreed funding formula to pay for any necessary ambulance and health services when workers have health issues which exceed the expertise of capacity of the on-site facilities; and
- funding to cover the NHS costs of referrals for both construction workers and their families and dependents.

B.1.80 This combination of measures fully addresses the NPS requirement to have regard to the impact of the workforce on local health services.

B.1.81 Potential health impacts on the community are more difficult to identify and address. As the HIA makes clear, EDF Energy's principal approach has been to design the HPC Project in order to limit its potential effects and then to comprehensively mitigate any residual effects which may, for instance, give rise to significant health or well-being impacts. Drawing on the **Environmental Statement**, this Planning Statement identifies in Section 7, 8 and 9 how strategies are in place to avoid, reduce or mitigate significant effects arising from transport, noise, air quality, visual impacts, community safety and other environmental effects..

B.1.82 If these overall strategies are successful, impacts will have been reduced as far as practical and outstanding health impacts may relate to less easily addressed matters such as the stress and anxiety that can be caused by an intervention in local community life on the scale of a project like Hinkley Point C. The HIA seeks to address these issues as far as practical, informed by extensive engagement and, for instance, by a Community Well-Being Survey undertaken in smaller settlements local to the main development site at Hinkley. To address those concerns it identifies a range of proposals including:

- **Communication and Openness:** is important in reducing unwarranted fears and in helping to integrate the project into the community. The HAP sets out proposals for newsletters, local forums and for the ready availability of monitoring information to be provided to the community.
- **Main Site Neighbourhood Support Scheme:** EDF Energy has consulted upon and published a neighbourhood support scheme that would apply in the hamlets close to the main development site, ie Burton, Shurton, Wick and Stolford. The scheme is conditional only on implementation of the HPC project and it would provide assistance with noise insulation for properties and a Property Price Support Scheme which would underwrite any loss in value of property which might arise from the HPC project. The scheme is a voluntary scheme and it has been received well by the local communities. It is not strictly a planning scheme because the anticipated noise measurements do not generate a necessity for mitigation and because property value is not strictly a planning consideration. Nevertheless, this initiative should be helpful in addressing some elements of local community concern.
- **Noise Insulation:** a scheme is proposed to provide noise insulation from construction traffic in Cannington and from activities at the wharf at Combwich as part of the **Heads of Terms for the Section 106 Agreement** for the DCO (see Section 9).
- **Maximising Local benefits:** consistently with EDF Energy's Vision for the HPC project, this Planning Statement has already identified a series of measures aimed directly at maximising local opportunity and benefit for residents and communities – particularly in relation to education, training, employment, housing and leisure facilities. The ability for local people to gain employment at Hinkley Point C or to benefit from training associated with the project will not only aid integration of the project into the community but also directly enhance the quality of life for local residents.

B.1.83 In addition, EDF Energy has proposed a Community Impact Fund. The fund is explained in more detail in Section 9 but its principal purpose is to mitigate residual impacts on the quality of life caused by the HPC project. EDF Energy's vision for the Fund is that it would be spent in the community by the community on projects which the community considers would maintain and enhance the quality of life locally.

B.1.84 In combination with the full range of requirements and obligations proposed as part of the DCO application, in addition to those agreed as part of the Site Preparation

Section 106 Agreement, these measures responsibly address those health impacts that have been identified as arising from the HPC project.

b) Transport

B.1.85 The transport effects of the HPC project during its construction (including the noise effects of traffic) are amongst the more significant and contentious effects of the project as a whole. They are the subject of detailed consideration in the **Transport Assessment** and in the Transport and Noise chapters of the **Environmental Statement**. It is not intended to review them in detail in the Planning Statement.

B.1.86 Nevertheless, it is important to identify the scale of adverse effects in order that these can be weighed in the overall planning balance within the context of national policy.

B.1.87 NPS EN-1 and EN-6 provide short but helpful guidance on the approach to be taken to the transport effects of a NSIP. NPS EN-1 explains at para 5.1.2 that it is for the NPSs to define the level of weight that should be given to any impacts of a relevant project.

B.1.88 The most significant elements of the NPS EN-1 guidance are as follows:

- a recognition that a new energy NSIP may give rise to substantial impacts on the surrounding transport infrastructure including during the construction phase of the development (para 5.13.6);
- mitigation is expected to "*reduce the impact on the transport infrastructure to acceptable levels*" (para 5.13.6); and
- provided that the applicant is willing to enter into planning obligations or requirements to mitigate transport impacts (to acceptable levels), development consent should not be withheld and "*appropriately limited weight should be applied to residual effects on the surrounding transport infrastructure*." (para 5.13.7).

B.1.89 It follows that there is no obligation to mitigate all transport effects and that it is always likely that there will be some residual transport effects arising from large infrastructure projects. The relevant question, therefore, is to address how transport effects might be reduced to "*acceptable levels*" and what those acceptable levels might be.

B.1.90 Specifically in relation to nuclear power generation, NPS EN-6 provides as a Flag for local consideration the question of "*impact on significant infrastructure and resources*" (para 3.15). Those resources are identified as including motorways and major highways and paragraph 3.15.2 requires that applications should demonstrate that the proposed development would not have an unacceptable adverse impact on such infrastructure. The following paragraph (3.15.3) confirms that the Nuclear AoS identified that there may be adverse effects during the construction and decommissioning phases on regional transport networks which may already be under stress, particularly where there are clusters of potential sites for new nuclear power stations. This Flag provides some helpful context in determining the scale of what adverse effects may need to be in order to carry significant weight in IPC decision making on an application for a nuclear power station.

B.1.91 Whilst some residual impacts, therefore, may be acceptable, particularly on the local highway network, the NPSs are clear that promoters should prepare a Transport Assessment and a Travel Plan and that transport strategies should seek to reduce and mitigate impact. In particular, the following suggestions are relevant:

- where mitigation is needed, possible demand management measures must be considered if feasible and operationally reasonable before considering requirements for the provision of new inland transport infrastructure (para 5.13.8);
- the IPC should consider the cost effectiveness of demand management measures compared to new transport infrastructure as well as the aim to secure more sustainable patterns of transport (para 5.13.9);
- water borne or rail transport is preferred over road transport at all stages, where cost effective (para 5.13.10);
- the IPC should consider requirements to control the number of HGV vehicle movements on particular routes and at particular times and make sufficient provision for HGV parking to avoid overspill parking on public roads or prolonged queuing (para 5.13.11); and
- satisfactory arrangements need to be made for reasonably foreseeable abnormal disruption (para 5.13.11).

B.1.92 These helpful elements of advice correlate closely with the Transport Strategy which EDF Energy has adopted for the HPC project and which was outlined in Section 4 of this Planning Statement. In particular:

- EDF Energy proposes a bus based strategy for the transport of workers, and this is enabled by the use of four park and ride car parks, as well as by direct buses from principal settlements;
- two freight management sites are proposed in order to limit overspill HGV parking or queuing and to control HGV movements so that they occur in a steady flow and can be reduced during peak traffic periods;
- defined traffic routes are identified and monitoring arrangements proposed to enforce their use and this is complemented by proposed requirements which would restrict HGV vehicle movements on key routes and by shift patterns which are also designed to avoid peak periods;
- substantial investment is proposed in the new temporary jetty and the improvements to Combwich Wharf in order to maximise the potential to bring materials by sea – directly in accord with the NPS guidance;
- highway improvements at important junctions, noise mitigation in Cannington and public realm enhancements on transport routes in Cannington and Bridgwater are all proposed in order to mitigate the impacts of construction traffic;
- the Cannington Bypass is proposed in recognition of the fact that Cannington would see the biggest change in traffic conditions, with all construction traffic otherwise routed through the village; but
- a Bridgwater Bypass is not proposed because the transport assessment demonstrates that the demand management measures and highway improvements proposed bring traffic impacts within acceptable levels in

Bridgwater and that the construction of a ByPpass would not be cost effective nor would it be consistent with the sustainability objectives of the NPS.

B.1.93 The HPC Transport Strategy, therefore, is considered to be directly consistent with the advice and requirements of the NPSs. Nevertheless, there are residual transport impacts and related planning issues to take into account.

B.1.94 The detail of the Transport Assessment is too complex to report within the Planning Statement but there are some high level outcomes that can usefully be recorded. The detailed transport analysis is contained within the Transport Assessment whilst the Transport Volume of the **Environmental Statement** assesses the significance of transport impacts against five principal criteria:-

- severance;
- pedestrian delay;
- pedestrian amenity;
- driver delay; and
- accidents and safety.

B.1.95 Impacts are assessed at 2013, 2016 and 2021, i.e. at the beginning, middle and the end of the construction period. The assessment uses a Paramics Transport Model which has been validated and agreed with the Highway Authorities.

B.1.96 The assessment at each year compares the 'without' and 'with' development scenarios and takes account of a number of highway improvement works which are proposed by EDF Energy across the network to address anticipated impacts. At 2016 and 2021 the model shows the net effect of the HPC traffic with the proposed highway improvements in place. At 2013, not all of the highway improvements would be in place and not all of the associated development sites would be available to use. The 2013 assessment, therefore, shows an "*early years*" assessment, which is different in some important respects from the later assessments.

B.1.97 As part of the draft DCO application for Hinkley Point C, a package of highway improvements is proposed for the urban areas of Bridgwater and Cannington and elsewhere on the local highway network to provide mitigation for the transportation impacts of the HPC Project. These improvements are proposed at points on the highway network where they are considered necessary for highway safety and/or highway capacity reasons. The off-site highway works are described in detail in the Transport Assessment and comprise:

- A38 Bristol Road/The Drove Junction – increase in width of highway to improve operation of the junction;
- A39 Broadway/A38 Taunton Road Junction – changes to signal arrangements, minor carriageway realignment to improve operation of the junction;
- A38 Bristol Road/Wylds Road Junction – increase in width of carriageway and right turn lane to assist right turns and reduce queuing;
- Wylds Road/The Drove Junction - provision of a left-turn slip road from Western Way into Wylds Road to improve operation of the junction;

- A39 New Road/B3339 Sandford Hill Roundabout – new roundabout to improve safety of junction;
- M5 Junction 23 Roundabout – changes to signal arrangements and minor carriageway widening on slip road to improve operation of roundabout;
- Washford Cross Roundabout – new roundabout to improve safety of junction;
- Claylands Corner Junction – minor carriageway widening to improve operation of the junction;
- C182 Farringdon Hill Lane, Horse Crossing – provision of horse crossing to improve safety for horses and riders;
- Cannington Traffic Calming Measures – traffic management measures;
- Huntworth Roundabout – increase in width of eastern arm of roundabout to reduce queuing; and
- Bath Road – minor works within the highway to facilitate access to Bridgwater A.

i. Effects in Bridgwater

B.1.98 One of the important preliminary points to note is that the model has taken the maximum or peak traffic flows anticipated for the project and, therefore, represents a worst case assessment. As the Transport Assessment explains, limits are proposed on quarterly movements but there is flexibility for these to be exceeded on individual days, so long as the overall quarterly average is respected. It is these higher daily limits that have been used in the assessment. Timing requirements are also proposed to ensure that the majority of HGV traffic does not coincide with peak periods. Against this background, there are some important headline outputs from the assessment, including:

- Overall, the highway improvements package increases capacity in Bridgwater by more than the scale of the additional traffic (Transport Chapter of the ES Section 10);
- As a result, overall journey speeds are maintained. At 2016, for instance, the output shows that the average vehicle speed across the model network of 29.1 miles per hour changes only to 29.0 miles per hour even when allowance is made for the HPC construction traffic and other growth on the transport network; and
- Consequently, the impact on journey times across the network is also broadly neutral.

B.1.99 These headline outputs, of course, are an inadequate summary of detailed impacts which occur across the network. In principle, however, they suggest that the combination of the Transport Strategy and the highway improvement works is sufficient to broadly maintain the performance of the highway network during the construction period.

B.1.100 It also follows from this high level review that the local highway network will be left significantly improved after the construction of Hinkley Point C, when traffic levels will return to a lower level but the highway improvements will remain in place. The HPC project, therefore, creates a legacy of highway improvements across the network in exchange for some short-term impacts.

B.1.101 In terms of the matters assessed within the **Environmental Statement** at 2016, the Transport Volume reports some moderate adverse severance impacts on some routes through Bridgwater and corresponding impacts on pedestrian amenity. For Bridgwater routes, however, it identifies that all of the routes in question are A roads which are expected to take HGV traffic and that, in general, these roads only have a modest number of residential properties fronting on to them. The commitment to specific traffic routes prevents adverse impacts arising elsewhere. In terms of Accidents and Safety, the assessment identifies that the planned highway improvements address principal issues, so that the overall assessment under this heading for 2016 is "*minor adverse*".

B.1.102 These are not a scale of adverse effects that could justify rejection of the DCO application.

B.1.103 The NPSs provide guidance also on the consideration of noise, although the majority of the guidance is concerned with long term operational noise from NSIPs. Paragraph 5.11.5 of NPS EN-1 does also expect, however, that the noise impact of activities associated with development, such as increased road and rail traffic movements should be considered.

B.1.104 In relation to noise from road traffic, the impact assessment during construction has been conducted for the years of 2013 and 2016. These are the years that have been assessed in the transport assessment and represent the peak periods of traffic generation during HPC construction. The 2013 assessment includes the peak period of HGV movements and the 2016 assessment includes the peak period in terms of workforce numbers.

B.1.105 The principal potential adverse impacts which have been considered essentially fall into two categories. The first of these is daytime noise impacts which arise principally from the HGV movements to and from the HPC Development Site. These movements will be limited to the two authorised HGV Routes which are the principal roads through Bridgwater. HGV movements on these routes will be restricted to between the hours of 7am and 10pm. Robust assumptions have been made on HGV movements in the transport modelling which has been used for the noise impact assessment.

B.1.106 The second area of impacts is noise which arises early in the morning or late in the evening from bus movements to bring the HPC construction workforce to and from the HPC Development site. These movements will not occur through the night but will align with the beginning of the first construction shift and the end of the second construction shift and will be limited to a window of approximately 1.5-2 hours. As with HGV movements, the modelling of bus movements has been made on robust assumptions which assume that very regular timetables operate on all direct, campus and park & ride bus routes associated with the beginning and end of each construction shift. These timetables are not fixed at this stage and will be finalised once a bus operator has been appointed to provide the bus services. In practice bus provision and timetables will be regularly adjusted to match the changing patterns of demand and the actual number of buses on many routes is likely to be significantly less than has been modelled at many points in the construction programme. However, at this stage and for the purpose of providing a very robust assessment of transport and noise impacts, fixed timetables on all routes have been used in the modelling.

B.1.107 Noise impacts arising from daytime HGV movements in Bridgwater are assessed as minor adverse in either 2013 or 2016. Moderate or major adverse impacts have been assessed in Bridgwater for the shorter periods of time associated with early morning and late evening bus movements which, have, as noted above, been modelled on a robust basis. These impacts are also limited to the two existing A roads which are recognised as the main corridors for traffic through Bridgwater. Nevertheless, there are noise impacts for the affected properties.

B.1.108 It is not possible to undertake a construction project of the scale of Hinkley Point C without some adverse impacts arsing somewhere on the network from construction vehicles. In the case of Hinkley Point C the potential impacts have been reduced by the sea based strategy for concrete making materials, other construction materials and AILs and by the use of the Freight Management sites, restrictions on hours of operation and by confining the impact to the most suitable routes. The scale of residual impacts is modest in the context of the scale of the construction project.

ii. Effects in Cannington

B.1.109 In Cannington at 2016, the assessment assumes that the Cannington Western By-Pass will be in place. The bypass would result in a reduction in traffic flows relative to existing levels. The position in 2013, however, is different and the Transport Volume identifies that daily vehicle flows on Cannington High Street will increase by 1,391 vehicles or 64% of the existing flow before the by-pass is in place – which is expected to be open to traffic in Q4 2014. For approximately a 15 month period, therefore, Cannington would experience significantly increased flows through the village whilst the bypass is being constructed. In these circumstances, the Transport Chapters of the **Environmental Statement** Volume identify substantial adverse effects on severance and pedestrian amenity, although there are no significant highway capacity issues that would generate driver delay. In addition, the noise chapters identify major adverse effects on the C182 (Rodway) and High Street in Cannington. This temporary, early years impact in Cannington is one of the most significant impacts of the HPC project.

B.1.110 The scale of adverse road traffic noise impacts is greatest in Cannington prior to the construction of the Cannington bypass. Properties adjacent to the road in Cannington on the HGV route to Hinkley Point will experience both daytime noise impacts from HGV movements which are assessed as major adverse and early morning/late evening noise impacts from bus movements which are also assessed as major adverse. The absolute change in noise levels arising from HPC related traffic is also significantly higher in Cannington prior to the construction of the bypass than would be the case in Bridgwater.

B.1.111 The principle of HPC construction traffic routing through Cannington village in the absence of a bypass has been accepted by the local planning and highway authorities through the grant of planning permission for the enabling works and the resolution to approve the site preparation works. The enabling works consent, the construction of the jetty and the site preparation works would all generate construction and worker traffic through Cannington and no by-pass has been said by the planning or highway authorities to be required as a part of any of those planning consents or resolutions. Instead, the draft planning consent for site preparation works proposes a limit on HGV vehicle movements through Cannington and the

WSC committee resolution to approve the application was based on the following approach:

- vehicle movements are to be limited to those assessed in the Site Preparation Transport Assessment. HGV movements are relatively small in the first quarter, (ie 28 movements per day) but they rise over the fifteen month construction period reaching over 200 movements per day for quarters 2-5, peaking at 290 movements per day in quarter 3;
- HGV movements would not be permitted between 18:00-07:00;
- maximum flows in the highway peak hour will be restricted to 24 movements and restricted to 30 movements per hour at other times;
- a series of traffic calming and safety improvements are were proposed in Cannington including a Parking Traffic Regulation Order and minor changes to Memorial Junction (the junction of High Street and Rodway), as well as enhanced pedestrian crossing facilities. In addition, safety improvements and speed restrictions are proposed on the C182 between Cannington and Hinkley Point; and
- approximately £200,000 is to be committed to public realm heritage improvements in Cannington to offset the impact on the Conservation Area of the increased traffic levels.

B.1.112 Against this background, a requirement is proposed within the draft DCO application which would limit average daily HGV movements over a quarter to 250 each way, i.e. 500 movements. Flexibility is required, however, to cater for daily variations up to 750 movements per day. HGV operating hours would be extended to 22:00 but, again, there would be no movements after that time and until 07:00 in the morning.

B.1.113 Upon approval of the DCO, EDF Energy intends to let the principal civils works contracts and to commence construction as quickly as possible. A continuation of the site preparation HGV limits would severely inhibit the construction of the NSIP. Consequently, EDF Energy has considered the acceptability of the early years flows and what further mitigation could be proposed to mitigate the short-term impacts on Cannington during this early construction period. The **Heads of Terms for the Section 106 Agreement** propose the introduction of a noise mitigation scheme, with noise insulation being offered to properties along High Street and Rodway. Properties which take up the noise insulation scheme and install double or secondary glazing would be provided with the lasting benefit in exchange for a short-term impact. That impact arises from traffic but it is relevant to identify that there is no traffic capacity issues through Cannington – rather, the issues relate to noise and amenity.

B.1.114 Cannington would be a long term beneficiary of the bypass which would relieve it of construction, operational and outage traffic after Q4 2014. The Transport Assessment shows that there would be significant reductions in traffic flows through Cannington once the bypass is open. The village would also benefit from other investments set out in the **Heads of Terms of the Section 106 Agreement** including significantly improved leisure facilities, improvements to the village school, public realm, parking and pedestrian crossing enhancements. None of these directly mitigate the short-term impact from elevated levels of construction traffic but they do demonstrate that EDF Energy has sought to comprehensively address the impact of the project on the village.

B.1.115 Against this background, the short-term impact on Cannington is not considered to be so adverse that restrictions should be imposed which would severely inhibit the construction of the power station, particularly given the urgency with which the need is expressed in national policy.

B.1.116 Whilst the draft DCO application does propose a Cannington Bypass, it does not propose a bypass for Bridgwater. The need or otherwise for a Bridgwater Bypass has been a regular theme arising from engagement and consultation and it is the policy of SCC, WSC and SDC that EDF Energy should assess the need for a Bridgwater Bypass as part of the Hinkley Point C DCO application. In order to explain EDF Energy's position in relation to a Bridgwater Bypass in more detail, the **Bridgwater Bypass Study** has been prepared as part of the DCO application documents. EDF Energy also published the *HPC Bypass Report* in July 2010 as part of its Stage 2 consultation. That Bypass Report concluded that:-

- a Bridgwater Northern Bypass would be within the floodplain and pass close to sensitive environmental areas;
- it would take four years to build and waiting for the bypass would substantially delay the operation and the carbon-saving benefits of the HPC power station; and
- a Bridgwater Bypass is not necessary because the transport effects of the HPC project through Bridgwater can be accommodated with improvements to the existing highway network.

B.1.117 Some parties making representations on the emerging HPC proposals have drawn a parallel with the 1988-1989 Hinkley Point C planning inquiry where the promoter (the CEGB) proposed funding for a Bridgwater Bypass. The representations suggest that this establishes a principle that a Hinkley Point C Nuclear Power Station should provide a bypass. As set out in Section 3, a number of matters have moved on significantly since that time. In particular:

- the CEGB proposals did not include a temporary jetty for the delivery of bulk aggregate and other construction materials;
- The CEGB proposals did not include park and ride sites or a bus based strategy for employees and visitors – instead, a car based strategy was proposed with 1,400 on site car parking spaces;
- the CEGB proposal did not include investment in a Delivery Management System or in freight management sites, such as those proposed by EDF Energy at junctions 23 and 24 which would have the effect of holding back HGV traffic so that it principally serves the site outside peak hours; and
- National policy has moved on significantly since the late 1980s/early 1990s to the extent that policy now emphasises a priority to manage traffic, to achieve modal shift and to optimise the use of existing infrastructure: new road building is discouraged as a mitigation measure.

B.1.118 The **Bridgwater Bypass Study** confirms this analysis. It also reviews the policy background to the need for a Bridgwater Bypass. That review identifies that a Bypass for Bridgwater has never been proposed within a statutory planning policy document and that even the more recent informal planning policy documents such as the draft Hinkley SPD or the County Council's Future Transport Plan do not set out a requirement for the bypass – rather, they set out a requirement for the need for the bypass to be assessed by EDF Energy. The review also identifies that the local planning and highway authorities have permitted the substantial growth of Bridgwater and have planned considerable continuing growth through the Core Strategy, without any expressed requirement for a bypass. Similarly, major planning applications such as the North East Bridgwater Masterplan, which generate more peak hour traffic than the HPC project have been consented without a requirement for a Bridgwater bypass.

B.1.119 The principal relevant evidence, of course, is the **Transport Assessment** submitted as part of the DCO application. As explained above, the **Transport Assessment** confirms that the temporary construction transport impact of the project can be accommodated within the existing highway network thanks to the operation of the Hinkley Transport Strategy which reduces the need to travel, achieves modal shift away from the use of the car and controls lorry movements outside peak periods. That approach is directly consistent with the advice provided in NPS EN-1, as follows:-

> *"5.13.18 Where mitigation is needed, possible demand management measures must be considered and if feasible and operationally reasonable, required, before considering requirements for the provision of new inland transport infrastructure to deal with remaining transport impacts."*

B.1.120 In conclusion, EDF Energy has adopted an approach to managing the temporary impacts of construction traffic which is directly consistent with national policy. As a result, the **Transport Assessment** demonstrates that the principal adverse impacts can be mitigated and that the residual impacts fall within acceptable levels. Short term noise impacts do arise, particularly when assessed on a worst case basis, but short term impacts on principal routes for limited hours of the day cannot justify the provision of a bypass.

B.1.121 Operational traffic is also assessed but, inevitably, is much less than the construction traffic. The analysis demonstrates that the transport interventions at the park and ride and freight management sites can be removed at the end of the construction period, whilst the transport effects of operational traffic would fall within acceptable levels. Overall, the highway network would be improved through the highway works proposed as part of the DCO application, including the Cannington Bypass.

c) Conclusions in Relation to Project-Wide Effects

B.1.122 This section of the Planning Statement has demonstrated that the HPC project would not have impacts on the local or the wider area which are of such a scale as to warrant refusal of the DCO application. Mitigation and controls, however, do need to be in place and these are explained in Section 9 of the Planning Statement.

B.2 Planning Analysis: Site Specific Considerations

B.2.1 The HPC Project is a single NSIP, spread over 9 principal sites. In addition to the main development site at Hinkley Point, there are 8 principal off site developments together with a number of smaller off-site highway improvement works. The principle of seeking development consent in a single application is central to the regime established for nationally important infrastructure under the Planning Act 2008. As the Planning White Paper, *Planning for a Sustainable Future* (May 2007) which preceded the 2008 Act explained, a core principle of the White Paper was that the planning system should be "*streamlined, efficient and predictable"* para (1.37). Accordingly, one of the key principles in relation to NSIPs was to streamline the procedures to create a single application process. As paragraph 5.18 of the White Paper explained, in order to ensure that the IPC is able to grant the authorisations necessary to construct these projects it is proposed to:

> *"rationalise the different development consent regimes and create, as far as possible, a unified, single consent regime with a harmonised set of requirements and procedures."*

B.2.2 NPS EN-1 at paragraph 1.4.3 makes clear that it is the NPSs which will be the primary basis for IPC decision-making on associated development (as well as for the NSIP itself). This Planning Statement has sought to explain the distinction in legal terms between the "generating station" and its "associated development" (see earlier paragraph 2.1.28) but it is apparent that the HPC project should be considered as a whole and it is clear from the NPS that the same planning principles apply to each element of the project.

B.2.3 The weight to be attached to local policy, for instance, is the same for the associated development as it is for the main development site.

B.2.4 Whilst the draft Hinkley SPD draws attention to the relative lack of guidance with the NSIPs for associate development sites (draft Hinkley SPD para 2.7), there is no expectation or requirement in the NPS for this lack of detail to be filled by local policy. The associated development is part of the NSIP and the delivery of nationally important infrastructure could potentially be put at risk if its different elements were subject to different policy regimes or if local policy sought to duplicate, confuse or compete with the primary national policy guidance.

B.2.5 The approach taken to policy is explained in Section 6 of this Planning Statement which recognises that the principal test to be applied to the DCO application is that set by Section 104 (7) of the Planning Act 2008, ie whether the IPC "*is satisfied that the adverse impact of the proposed development, would outweigh its benefits."* It is important to identify, therefore, whether there are adverse impacts of the proposed development, rather than whether there may be any conflicts arising with local policy either from the project as a whole or from the development of individual sites. Local policy may be helpful, however, in identifying where adverse effects might arise.

B.2.6 Against that background, **Appendices 7-14** review the planning issues arising from the proposed development of the individual sites, which collectively make up the HPC project. That analysis is not repeated in this section, nor does it seek to replicate the very extensive information available on the individual sites provided in the **Environmental Statement**, the **Alternative Sites Assessment** (Appendix 3) or the individual **Design and Access Statement** documents which relate to the individual sites. Instead, this section seeks to draw out the principal issues that arise from the Appendices in order that they may help to inform the overall planning balance. This section deals first with associated development sites and then with the main development site.

a) Associated Development Sites

i. Issues of Principle

B.2.7 Section 115 (1) of the Planning Act 2008 provides that development consent may be granted for development for which development consent is required or for associated development. Associated development is defined within the same Section to mean development which is associated with an NSIP and "*is not the construction or extension of one or more dwellings*". The CLG *Guidance on associated development,* September 2009 explains that it is a matter for the decision maker to decide on a case by case basis whether or not development should be treated as associated development having regard to a number of principles which include:-

> *"Associated development should not be an aim in itself, it should be subordinate to and* ***necessary for the development and effective operation to its design capacity of the NSIP*** *that is the subject of the application". (paragraph 10)*

B.2.8 The guidance in paragraph 10 also explains that associated development is expected in most cases to be of a type normally brought forward with that sort of primary development and, for clarification, it could include "*measures necessary to mitigate the impacts of the primary development".*

B.2.9 Applying these principles to the HPC project, it is apparent that none of the proposed associated development is promoted as an aim in itself. All of the associated development is only promoted because it is necessary for the development and operation of the power station. Each of the associated development sites is the subject of development which is proposed at substantial costs to EDF Energy and which, in the majority is proposed to be removed at the end of the construction period. There is no other benefit to be derived from that development for the promoter than its use to serve the development of the power station.

B.2.10 The **Post Operational Strategy** (Appendix 4) sets out a framework for controlling the future of the individual associated development sites. With the exception of the permanent development of the Cannington Bypass and the improvements to the wharf facilities at Combwich, the Strategy identifies that the authorised use of the associated development facilities would fall away once their role in association with the construction of the HPC project is complete. Post Operational Schemes would determine closer to that time the extent to which it was sensible to remove all of the physical associated development from the individual site but the DCO application does not seek consent for their long term use. They are not proposed in the DCO application for any other purpose than to be subordinate to the NSIP. Apart from those facilities which are proposed to be permanent (the Cannington Bypass, the wharf improvements at Combwich) and the highway improvement works, there are no exceptions to this principle.

B.2.11 Whilst it is widely recognised that it may well be sensible and sustainable to retain the Bridgwater C campus buildings for future student accommodation, that proposal is not to be consented through the DCO. Instead, the **Post Operational Strategy** makes clear that any future use unassociated with the NSIP would need to be the subject of a planning application.

B.2.12 The only principal associated development sites where it is proposed to retain and use the development for the long term operation of Hinkley Point C are the Cannington Bypass and the improved wharf facilities at Combwich, although the lay down area would be removed and restored to open countryside. Both the bypass and the wharf have a continuing purpose in serving Hinkley Point C. The bypass would provide the primary route for daily operational traffic, whilst the wharf would continue to be important for the delivery of abnormal invisible loads during regular maintenance outages.

B.2.13 Whilst each of the associated development sites raises its own planning issues, the principle of providing associated development has not been controversial, with the exception of campus development, particularly at Bridgwater A. Otherwise, the response to consultation has generally welcomed the transport, freight and accommodation strategies which have sought to limit the impact of the HPC project on the local highway network and, for instance, on local housing resources.

B.2.14 The purpose of each element of the associated development is explained in Section 4 of this Planning Statement. The owners of the Bridgwater A site, however, have challenged the extent to which the accommodation campus can be promoted on the former Innovia site, *inter alia*, because it is suggested that the proposal may amount to the development of “dwellings” and may, therefore, be inconsistent with Section 115 of the 2008 Act. That assertion is the subject of on-going legal proceedings which will determine its merit. From a planning perspective, however, it may be helpful to briefly observe:

- case law clearly establishes important differences between dwelling houses and temporary accommodation which is more akin to barracks, hostels or holiday camps and the Town and Country Planning (Use Classes) Order 1987 makes a clear distinction between dwelling-houses, which fall under Class C3, and hostels which are not so categorised and, therefore, have been treated as being *sui generis*;
- the campuses are very different from other types of accommodation in the local area, particularly permanent family housing. They would be run by a Facilities Management Company using a centralised computer-based reservation system to provide temporary, short stay accommodation for construction workers and their operation in this respect would be similar to hotel accommodation with meals and communal facilities available to workers who would be able to book in for short or extended and sometimes intermittent periods;
- experience at Sizewell demonstrated that the campus accommodation was particularly popular with workers and its availability is known to be important to contractors who need the ability to attract a skilled and mobile workforce in large numbers at short notice; and
- because of their specific function, the accommodation campuses will be laid out in a very different form from traditional residential development. In particular each campus will be laid out in accommodation blocks, with around 35 workers living in individual rooms in each block, with shared amenities in a separate building. At Bridgwater A, for instance, this amounts to 25 separate accommodation blocks. This type of accommodation is not suitable for permanent residential accommodation.

B.2.15 Each element of the associated development proposals, therefore, can properly be considered as a part of the DCO application. Each element is necessary for the efficient and acceptable development of Hinkley Point C.

ii. Adverse Effects

B.2.16 Appendices 7-13 review the planning issues generated by development on the proposed associated development sites. In each case, the principal planning issues are identified and addressed and the principal residual issues are also identified and balanced against the benefits provided by the development of each site. The principal planning issues raised in the assessments are:

- conflict with local policy which aspires to the provision of permanent residential accommodation, rather than accommodation campuses;
- development on open countryside outside defined development boundaries; and
- detailed site specific issues.

B.2.17 The principle of providing temporary worker accommodation in campuses has been addressed above. It has been established through the Sedgemoor Core Strategy examination that the Core Strategy (and, therefore, also the draft Hinkley SPD) do not set policies or requirements for the HPC project. Instead, they express aspirations of the local authorities which carry no weight as planning policies. For the purposes of the consideration of the DCO application, it is more relevant to consider whether adverse impacts arise from the fact that the associated development proposals propose temporary rather than permanent residential accommodation. The analysis carried out within the appendices and that which is also set out in the **Accommodation Strategy** confirms that no adverse impacts are generated by the decision not to provide permanent residential accommodation as part of the DCO application.

B.2.18 Following the Stage 2 consultation, the local authorities asked EDF Energy to investigate whether it might be possible to construct family-style housing that could be used to accommodate construction workers and be left as a legacy for the local area. However, this investigation reinforced to EDF Energy the benefits of campus accommodation, which could not be delivered in permanent dwellings. Campus accommodation is specifically targeted at workers who want serviced accommodation, and feedback from contractors, suggests that this is what many workers would want. Those who want to stay in individual houses and do their own catering, laundry etc. would choose to stay in existing private rented sector stock. The full rationale for the use of accommodation campuses, rather than dwellings, to accommodate the workers during the construction phase is detailed in the **Accommodation Strategy**.

B.2.19 Turning to the question of development outside the established development boundaries, four of the sites (and the HPC development site itself) promote development on greenfield land, ie in countryside outside the designated boundaries for development within existing policy documents. This much is not surprising as the policy documents did not anticipate the development of Hinkley Point C or its designation in the NPS and did not set out to allocate land to meet its requirements. In fact, it would have been surprising if the project's development requirements could be satisfied within existing designated boundaries. If development is necessary for the development and effective operation of the NSIP, it will need to be provided and the relevant issues are not conformity with local policy but the extent to which actual harm arises from the development of the sites proposed.

B.2.20 The **Alternative Sites Assessment** (ASA) sets out in detail the considerable care which has been taken to select the proposed sites. It is clear from the ASA that a determined intention to limit adverse impacts has been one of the primary drivers of site selection. The other primary driver, however, has been the need to meet the functional requirements of the NSIP. As the ASA observes, there is no purpose in meeting a project specific need in the wrong location. The Cannington park and ride, for instance, has to be at Cannington, adjacent to the A39 and south of the village if it is to perform the function required of it by the Transport Strategy. Exactly the same principles apply to the other greenfield site proposals, ie junction 23, the Cannington bypass and the Combwich laydown area; they each respond to a specific requirement.

B.2.21 Opportunities have been taken where practical to correlate the functional need for the associated development with local planning policy designations. For instance, the Williton park and ride achieves both the functional need for a park and ride site to the west of Hinkley and the local policy aspirations to prefer brownfield land. The same principle arises in relation to the Somerfield site at Junction 24. Both sites were changed as a result of public consultation and their selection demonstrates the responsible and rigorous approach which has been taken to site selection.

B.2.22 As the ASA and the individual **Design and Access Statement** documents demonstrate, another feature of the project has been the careful evolution of site development in response to consultation and to the emerging outcomes of the **Environmental Statement**. The appendices record the changes made to all sites in response to these issues in order to refine the development proposals and to ensure where practical that their design avoids, limits and mitigates the potential impacts of each development. As a result of this approach, the appendices are able to record that there are relatively few significant adverse effects arising from the development of the associated development sites.

B.2.23 Of the associated development sites, perhaps the most sensitive in planning and environmental terms is the land at Combwich. As **Appendix 13** establishes, however, the site is required to meet a very specific and locationally inflexible requirement. Significant impacts do arise in relation to the visual impact of development in open countryside of the lay down area and significant noise impacts are likely to arise from the operation of the wharf. As the Appendix also explains, care has been taken to minimise these impacts through design and to mitigate them through screening, operational controls and through the provision of a noise insulation scheme. After the construction of HPC, the lay down area would be restored to open countryside. Whilst the proposed development of the land has generated concerns from local residents and the planning authorities, no better alternative sites have been proposed to meet the function which the land needs to perform in order to facilitate the construction of the power station.

B.2.24 Each of the appendices concludes that the benefit of the individual development outweighs its mitigated adverse effects. It is also necessary, however, to consider the contribution which each of the associated development sites makes to the HPC project as a whole. In particular, the following points are directly relevant:

- Each associated development site performs an essential function in mitigating greater impacts that would arise if the land was not developed. The absence of park and ride sites, for instance, would cause either extensive fly-parking across the travel to work area or the need for unsustainable and unsatisfactory car travel through urban and rural areas to the Hinkley Point C main development site, which would inevitably need to be expanded to provide a large car park (itself in open countryside).
- Similar considerations apply to the accommodation campuses – not only do they provide essential accommodation for the construction workforce, their development limits impacts on the local housing sector and brings direct advantages in terms of the ability to provide sustainable travel and to regulate worker behaviour.
- Without the associated development sites, there would be no HPC project – the impacts of the development would be substantially greater and the operational need to provide worker accommodation and to regulate freight deliveries and transport to the HPC development site could not be provided.

B.2.25 For all of these reasons, the collective impact of the associate development sites does not generate substantial adverse impacts to weigh in the overall planning balance.

b) HPC Development Site

B.2.26 Appendix 14 provides a review of the planning issues affecting the main development site. A detailed assessment of the likely significant effects of the construction, operation and decommissioning of the main development site is set out in the **Environmental Statement**, whilst the evolution and details of the design for the HPC development site is explained in the **Hinkley Point C Development Site Design and Access Statement** document.

B.2.27 The selection of the HPC development site is explained in Section 3 of this Planning Statement which reviews the site selection process undertaken by the Government in the preparation of NPS EN-6. That process also identified the potential for some significant environmental effects to arise from the development of the site with a nuclear power station but these potential effects were not considered a sufficient reason not to identify the site as potentially suitable within the NPS.

B.2.28 Confirmation that the main development site should be suitable in principle for the development of a nuclear power station is also provided by the fact that planning permission was granted in 1990 by the Secretary of State for a previous Hinkley Point C development following an extensive public inquiry.

B.2.29 More recently, WSC resolved to grant planning permission for extensive site preparation works in order to facilitate and bring forward the construction of the power station. That resolution, together with the intended grant and implementation of the permission would establish at least two relevant and important considerations for the IPC, namely:

- an acceptance by the local planning authority that the national imperative to provide a nuclear power station at Hinkley Point C is compelling; and

- the principal land – based impacts of the HPC development are already committed – ie impacts on archaeology and terrestrial ecology.

B.2.30 In fact, the consequences of a site preparation planning permission are even more significant. In particular, the resolution to grant permission for the site preparation works is a clear local acknowledgement of the likely overall acceptability of the HPC project as a whole. For instance, in relation to the landscape and visual impact of the future HPC project, WSC's resolution anticipates its effect and seeks to put in place preparatory mitigation to reduce its impact. Similar considerations arise in relation to other potential impacts of the HPC project. As part of the proposed Section 106 Agreement for the site preparation works, EDF Energy, WSC, SDC and SCC agreed to put in place a range of preparatory mitigation to address leisure, education, amenity, socio economic and accommodation impacts that would principally arise from the DCO project itself. There would be no purpose in those measures or in supporting the site preparation works if the HPC project was thought, in principle, to be unacceptable.

B.2.31 As with other elements of the HPC project, the relevant **Design and Access Statement** document identifies a meticulous approach to the evolution of the development proposals themselves in response to consultation and to the emerging learning generated by environmental and other assessments. As with each of the HPC sites, the emphasis has been to avoid, limit and mitigate impacts through scheme design.

B.2.32 The development of the HPC development site is necessarily a large-scale project which is subject to a high degree of technical specification and regulation. To a large extent, these requirements predetermine substantial elements of the scale and layout of the development. Perhaps for this reason, the local planning authorities have generated relatively little by way of informal policy for the main development site; concentrating instead on the associated development sites. The need to meet technical specifications, safety requirements and to ensure security are overriding considerations.

B.2.33 The inclusion of a 510 bedspace accommodation campus at the main development site has been the subject of controversy. The principal issues are addressed in the **Accommodation Strategy**, in the previous sections of this Planning Statement and in Appendix 14. The appendix identifies the obvious benefits of providing worker accommodation on site. Local residents have expressed concern about the potential implications of 510 workers being accommodated on site and this is understood to relate to fears for worker behaviour and/or a lack of integration between the workers and local residents. Appendix 14 explains the measures being put in place to ensure high quality management of the workforce. The concerns expressed are undoubtedly genuine but they do not translate into tangible planning objections, particularly compared with the alternative which would be to disperse the workforce in less controlled and co-ordinated accommodation throughout the local villages.

B.2.34 The **Habitats Regulations Assessment** considers in detail the potential for the HPC project to adversely impact upon the integrity of European protected sites. No such impact is predicted to arise.

B.2.35 The **Environmental Statement** reviews all other potential environmental effects and the principal identified impacts are reviewed in Appendix 14. Because of the care taken with scheme design and proposed mitigation, the residual environmental effects identified are relatively limited for the scale and importance of the project.

B.2.36 As anticipated in the assessment summarised in Annex C of NPS EN-6, there are landscape and visual impacts which cannot be entirely mitigated. As Appendix 14 explains, however, the early implementation of landscape and screening particularly to the south of the site and on its western boundary limit construction impacts.

B.2.37 Once the HPC development is complete the majority of landscape and visual impacts would decrease due to removal of construction machinery and the restoration of the landscape, although some significant adverse impacts would remain in the local area due to the large scale of the completed HPC development which cannot be completely screened by landform or vegetation, particularly when viewed from elevated areas.

B.2.38 The landscape impacts during operation would be predominantly minor adverse due to the landscape restoration scheme which would introduce a number of valuable landscape features within the site.

B.2.39 In the residential areas closest to the application site, where landscaping including landform and vegetation has the highest screening potential, the majority of visual impacts would be adverse and of moderate significance. However, due to the proximity of the HPC, localised major adverse impacts would remain for users of PRoW along the coastline adjacent to the site. Some of these impacts would slightly decrease in the long term, when the planting proposals, including off-site mitigation measures, mature.

B.2.40 The majority of permanent visual impacts on viewers from within the Quantock Hills AONB would be minor adverse, although a localised area of moderate adverse visual impact would exist in the north-eastern part of the AONB due to its high elevation and the angle of view. The visual impacts on viewers located approximately 8km and beyond would not be significant.

B.2.41 In principle, this scale of impact is not different from that anticipated in the NPS, although local impacts may be less than may have been expected due to the proposals to bring forward early screening in the south of the site.

B.2.42 Screening, operational controls and distance ensure that the noise and air quality effects on local communities are likely to be acceptable. In any event, EDF Energy has proposed a **Main Site Neighbourhood Support Scheme** to provide noise insulation and a Property Price Support Scheme for residents in Shurton, Burton, Knighton, Wick and Stolford in recognition of the fundamental change which the project will bring to the immediate vicinity of the site, even if that change does not generate direct adverse amenity impacts.

B.2.43 Mitigation proposed as part of the Site Preparation Works Section 106 Agreement already addresses the need to divert affected rights of way and to mitigate the impact on local recreation by upgrading public rights of way nearby. The extensive programme of PROW improvements proposed as part of the site preparation works is intended to be extended in the **Heads of Terms for the DCO Section 106 Agreement** (Appendix 15), so that the HPC project should bring a net benefit in the quality of local rights of way. In addition, in excess of 100 ha of land in the southern part of the development site would be landscaped and enhanced as a nature reserve with public access, making a significant contribution to enhanced local biodiversity and amenity.

B.2.44 As with all aspects of the HPC project, therefore, the careful approach to design and mitigation does mean that the residual impacts of even the development of the development site are relatively limited given the scale and importance of the project.

B.3 REQUIREMENTS AND OBLIGATIONS

B.3.1 EDF Energy consulted on a suggested approach to the principal Requirements and Obligations that may be relevant to Hinkley Point C as part of its Stage 2 consultation in summer 2010 and on further suggested changes as part of its Stage 2A update consultation in spring 2011. Since that time, EDF Energy has continued to develop its proposals for development consent obligations. These considerations have been particularly informed by:-

- feedback from its consultation exercises and from continuing engagement with communities and stakeholders;
- the detailed discussions that have taken place around the now agreed terms for planning obligations to be associated with the Site Preparation works on the HPC development site; and
- the results of the environmental impact assessment and other assessments undertaken for the DCO application, which have been referred to in the previous two Sections of this Planning Statement on a project wide and site-specific basis.

B.3.2 As a result, the proposed **Heads of Terms for the Section 106 Agreement** have been drawn up and are explained in this Section of the Planning Statement.

B.3.3 In addition, requirements have been drawn up to form part of the draft DCO. Draft requirements were circulated to statutory consultees for comment and have been developed further with the benefit of that exercise but also to capture the mitigation required to secure the robustness of the environmental and other assessments which accompany the DCO application.

a) Relationship to the Site Preparation and Jetty applications

B.3.4 The draft requirements and obligations for the DCO application have been prepared with the benefit of the discussions that have taken place with stakeholders over the terms of conditions and obligations for the two preliminary works applications – ie. for the Site Preparation application to WSC and the jetty applications. Against that background it is relevant to confirm the following:

- the draft DCO includes both the Site Preparation and the Jetty developments for the reasons explained in Section 4 of this Planning Statement. Conditions that might be applied to those permissions, therefore, need to be included in the DCO where appropriate;
- whilst both may have been consented and implemented before the DCO itself may be granted, EDF Energy proposes that all land–based construction activity should be carried out and regulated under a single consent; namely, under the DCO. It is proposed, therefore, that the conditions imposed on the Site

Preparation and the land-based Jetty works would fall away in the event that the DCO is consented and that all works would then be regulated under the DCO instead;

- in most cases EDF Energy has carried forward the drafting of conditions for the Site Preparation and the Jetty works into the DCO requirements; but in some instances changes have been made. Those changes either result from the need to codify a clear set of requirements so that they are appropriate to a single project, or they arise from matters which EDF Energy considers necessary change from the previous consents. An example of the latter category is the requirement relating to hours of working where EDF Energy has consulted on more extensive working hours in the event that the DCO application is consented;
- EDF Energy has committed itself, however, to observe the terms of the Site Preparation Section 106 Agreement for the duration of the Site Preparation Works in the event that the Site Preparation works application is granted and implemented. The Section 106 obligations proposed for the draft DCO, therefore, assume the grant of the Site Preparation permission and its implementation, so that the draft Heads of Terms for the DCO Section 106 Agreement are additional and complementary to the Site Preparation obligations; and
- the one exception to this relates to the provisions for reinstatement, where EDF Energy proposes a different approach – see further below.

B.3.5 This means that, in some topic areas, further obligations to be entered into in relation to the DCO are relatively limited because much of the mitigation will already have been secured in the event that the site preparation planning permission is granted and implemented.

i. Relevant Guidance: Obligations

B.3.6 National policy in respect of planning obligations and the approach to the mitigation of impacts for Energy NSIPs is set out in NPS EN-1. As the NPS makes clear (para. 1.7.2), the development of new energy infrastructure is likely to have some negative effects, not all of which it will be possible to mitigate. Guidance is provided on a topic specific basic on the approach to be taken to the assessment and mitigation of impacts, but the overriding policy principles are set out paragraph 4.1.8 which provides:

> *“The IPC may take into account any development consent obligations that the applicant agrees with local authorities. These must be* ***relevant to planning, necessary to make the proposed development acceptable in planning terms, directly related to the proposed development, fairly and reasonably related in scale and kind to the proposed development and reasonable in all other respects****.” (emphasis added)*

B.3.7 Interestingly, the NPS does not defer or refer to any other guidance, law or policy in this respect – this is the statement of policy for NSIP development consent obligations.

B.3.8 The appropriate approach has been the subject of some debate with the Local Planning Authorities – particularly in relation to the draft text and policies of the Sedgemoor Core Strategy and the Hinkley SPD (see earlier para. 6.3.6). In particular, EDF Energy resisted the general expectation in the submitted draft Core

Strategy that "compensation" should be provided to offset any adverse impacts of the project. Following the Core Strategy examination, SDC made changes to the draft Core Strategy to remove such references.

B.3.9 For the purposes of this application, the terms of NPS provide the primary policy guidance. The NPS ENV-1 provides at paragraphs 4.2.2-3:

> *"The (EIA) Directive requires an assessment of the likely significant effects of the proposed project on the environment, covering the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects at all stages of the project, and also of the measures envisaged for avoiding or mitigating significant adverse effects.*
>
> *To consider the potential effects, including benefits, of a proposal for a project, the IPC will find it helpful if the applicant sets out information on the likely significant social and economic effects of the development, and shows how any likely significant negative effects would be avoided or mitigated."*

B.3.10 Two matters to be drawn from these paragraphs are i) that it is only "*significant*" effects which are expected to be addressed (where they can be) and ii) that such effects are to be avoided or mitigated; there is no generalised requirement to compensate unmitigated impacts. Similar guidance is provided throughout the NPS. Part 5 of the NPS provides advice to the IPC on "*Generic Impacts*". In each case, the NPS sets out expectations for the applicant's assessment, for IPC decision making and for mitigation. The list is not exhaustive but paragraph 5.1.2 provides that the IPC should consider other impacts and means of mitigation where it determines that the impact is relevant and important to its decision.

B.3.11 Specific reference to "compensation" is provided at paragraph 5.3.7; in a context where significant harm to biodiversity cannot be avoided through alternatives or mitigation, compensation measures should be sought. This principle of compensatory habitat is familiar through PPS 9 and through Habitats Assessments and has been observed where required in the HPC project. Otherwise, however, EDF Energy's approach has been to seek to limit adverse effects through project design and to mitigate those significant effects that cannot be avoided. Any residual impacts fall to be considered in drawing the overall balanced judgement required by Section 104 of the Planning Act 2008, i.e. whether the adverse effects outweigh the benefits of the project.

ii. Draft DCO Section 106 Heads of Terms

B.3.12 The draft Heads of Terms for the development consent obligations have been drawn up on the basis of the principles set out above, having regard to the assessed impacts of the development and they are explained below under a series of headings, in alphabetical order.

B.3.13 Before doing that, however, there are three important matters to explain in relation to the Site Preparation works Section 106 Agreement:

- the site preparation works themselves required mitigation principally in relation to their land based impacts – ie. impacts generated by the clearing and preparation of the main development site itself – for example in relation to archaeology or ecology. The scale of transport or socio-effects was assessed to be relatively limited

- the opportunity was taken, however, for EDF Energy to commit to other obligations which would assist in the mitigation of the impacts of the HPC project itself and, in particular, to put in place measures which would assist in mitigating impacts that might arise early in the construction of the HPC project. These measures related, for instance, to early highway improvements or early investment in local housing initiatives. In the same way that the application proposed preparatory works to bring forward the project, the opportunity was taken to bring forward some elements of mitigation for the project as well;
- EDF Energy has been open about the purpose of the preparatory mitigation and its purpose was advised in the officer's report to committee, with appropriate weight being given to those aspects which did not relate directly to the impacts of the site preparation works themselves.

B.3.14 EDF Energy did not propose the terms of some of the obligations required by WSC but the Section 106 Agreement was drawn up based on the terms resolved by the Planning Committee. EDF Energy's alternative course of action would have been to appeal the application for non-determination and to argue for different terms at a planning inquiry. The urgency of the project, however, including the need to undertake some works within the appropriate season (to respect relevant bird and bat seasons), militated against further delay of an application which had originally been submitted in November 2010.

B.3.15 Notwithstanding the above, EDF Energy has undertaken not to seek to use the DCO process to alter the Site Preparation obligations, the majority of which are limited in duration to a two-year period following commencement of the site preparation works, as long as planning permission for Site Preparation is granted and implemented.

B.3.16 There is, however, one exception to this which relates to the obligations for site reinstatement, which EDF Energy has made clear it does not consider should apply to any DCO consent. The position in this respect is explained briefly below:

- The planning application for the site preparation works stated that in the event those works are implemented but not required, because a DCO is not subsequently granted for the project, then EDF Energy would completely remove all installed infrastructure and would reinstate the application site to its previous condition.
- The planning application included a Landscape Reinstatement Strategy, which sets out EDF Energy's proposals for the reinstatement of the site in the event that the DCO is not granted.
- A planning condition dealing with reinstatement was put before the Planning Committee and members resolved to grant planning permission on that basis. Negotiations on the form of planning conditions and planning obligations have continued since the committee meeting. The conditions go beyond the period in which the Site Preparation works will be carried out and provide for the site to be reinstated in full in the event that a DCO is granted and implemented, but neither of the nuclear reactors authorised by that order has been substantially completed and generating electricity by 31 December 2025. It is therefore possible that the

power station could be 90% complete on that date, but EDF Energy would nevertheless be compelled to remove all of the buildings constructed on the site and to reinstate the land.

- The Site Preparation planning obligation provides for EDF Energy to provide security of £63,000,000 for these reinstatement obligations by way of a bond and/or an escrow account. The Council may draw on this sum in the event that EDF Energy is in breach of its reinstatement obligations as set out in the planning conditions. As drafted, this security will need to remain in place throughout the period that the reinstatement obligations are "live" – ie. until potentially 31 December 2025.
- EDF Energy's position is that it should be entitled to vary the reinstatement obligations and security arrangements through the DCO process. Indeed, Informative 25 to the draft Site Preparation planning permission specifically contemplates this possibility. The most recent version of the draft Section 106 agreement for the site preparation works now provides that EDF Energy must comply with the reinstatement obligations set out in the draft planning permission unless they are expressly varied, removed, abrogated, modified or superseded by any lawful means.
- The draft Section 106 Agreement for the site preparation works contains the parties' acknowledgement that EDF Energy may apply to vary, modify or supersede the reinstatement obligations and EDF Energy has given the Council notice of its intention to vary those obligations through the DCO, the draft of which provides for no reinstatement obligations. It is EDF Energy's position that maintaining these obligations once the DCO has been granted and implemented would be inappropriate. The Funding Statement provided with the DCO application provides sufficient protection against the remote prospect of a half completed nuclear power station and that there is no expectation in the NPSs (or other guidance) that projects must guard against the extreme possibility of partial development.

B.3.17 Against this background, the terms of the proposed DCO planning obligations are explained below. A Schedule identifying the proposed **Heads of Terms for the Section 106 Agreement** and recording those already proposed in the draft Site preparation Section 106 Agreement is contained at **Appendix 15**.

i. Accommodation

B.3.18 As part of the Section 106 agreement for the site preparation works application , EDF Energy is to commit to the following:

- a series of local education, training, outreach and recruitment initiatives to maximise the opportunity for local people to gain employment in the construction and operation of Hinkley Point C, i.e. people who are already accommodated in the local area;
- the establishment of an Accommodation Office to provide a service to local people and businesses who wish to offer accommodation to the incoming workforce; to provide details of accommodation available in the local area to the workforce and to try and match the accommodation requirements of the incoming workforce to the available local supply where practical;

- a Housing Fund of £4 million, made available to the planning authorities to stimulate new supply in the private rented sector; to bring empty homes back into beneficial use through improvement grants; to support rent deposit schemes, and equity loans to assist local people in securing accommodation and to provide funding for local new build housing schemes, including subsidising the provision of affordable housing.

B.3.19 As part of the DCO application, EDF Energy is seeking approval for the construction of three construction worker campuses (on site and at Bath Road, Bridgwater) for 1,510 workers' bed spaces. Research into the availability of potentially available local accommodation in the housing and bed and breakfast sectors suggests that this supply, in combination with the proposed campuses will be sufficient to meet the requirements of the incoming workforce without adverse impacts on the local housing market.

B.3.20 Rather than simply trusting that this will be the case, however, the Housing Fund has been proposed as "advance mitigation", i.e. to be used to put in place measures to assist local households and to bring forward additional local accommodation in case an impact does arise when the peak of the construction workforce arrives in the area. EDF Energy's research suggests that a housing fund of £5 million would be sufficient to create at least 1,000 additional bed spaces locally. The down payment of £4 million as part of the Site Preparation Section 106, therefore, allows early assistance to be provided to meet any potential future impacts.

B.3.21 For the DCO Section 106, it is proposed to top up the Housing Fund by an additional £1 million, i.e. to complete the fund at a total of £5 million. EDF Energy will put in place measures to ensure that this additional funding is spent efficiently and in areas where any incremental impact is most likely to arise.

B.3.22 In addition, EDF Energy will undertake monitoring to ensure that the clustering of the new workforce in particular settlements does not generate local housing difficulties. EDF Energy's **Accommodation Strategy** sets out triggers for individual groups of local communities. Where monitoring identifies the clustering of workers beyond those trigger points, additional contributions would be made to the Housing Fund.

ii. Community Impact

B.3.23 EDF Energy consulted on the principle of a Community Impact Fund at Stage 2 and the purpose of the Fund has remained consistent since that time. As explained at Stage 2, every effort has been made to identify, limit and mitigate impacts which can be identified at this stage from the DCO development. EDF Energy accepts, however, that there are likely to be other less easily defined impacts which will be felt by local communities and which may not be addressed by the full range of other mitigation commitments. These less tangible impacts might be described as impacts on the "quality of life" of local communities.

B.3.24 It is far from clear that such impacts will necessarily arise in net terms. Whilst the construction and operation of Hinkley Point C will inevitably bring about changes in some local communities, many of those changes will be very positive – particularly the increased economic prosperity that the investment will bring to the local area, which will be maximised through the commitments to education, training and to local procurement. Other Section 106 obligations will also bring benefits in terms of enhancements to local amenities such as public rights of way, leisure facilities etc.

B.3.25 Nevertheless, other adverse changes cannot be ruled out and EDF Energy has always thought it appropriate to offer a local Community Impact Fund. The intention is that the Fund would be spent on local initiatives which enhance the quality of life in settlements that may be affected by Hinkley Point C. EDF Energy's vision for this fund is very much that it should be spent by and on behalf of local communities. EDF Energy does not wish to direct how the Fund should be spent and believes that the communities themselves would be best placed to determine how the availability of funds can best be used to enhance the local quality of life. Accordingly, the scope for the Fund is widely defined so that it may be spent on a range of initiatives including such things as improvements to local facilities, funding local events, sponsoring local initiatives and assisting local causes.

B.3.26 As part of its Stage 2 A consultation, EDF Energy proposed an increase in the fund to £20 million and this remains in EDF Energy's view the appropriate scale of the fund.

B.3.27 As part of the site preparation planning final draft Section 106 Agreement, a down payment of £4 million from the Fund is to be committed, together with two additional annual payments of £1.6 million, ie a total of £7.2 million out of the total fund of £20 million. Similarly, as part of the terms of resolving to grant the site preparation consent, the local planning authorities determined that the Fund should be controlled by a board of 8 representatives (two each nominated by West Somerset, Sedgemoor, Somerset County Council and EDF). The board would receive bids from local communities and others and determine the apportionment of the Fund, with the decisions of the board being ratified by the cabinet of West Somerset Council.

B.3.28 EDF Energy will review the governance structure of the Fund as part of the DCO process in order to ensure that it is effective in meeting the purpose of the Fund, which is to recognise the particular role of local communities and to ensure that the money is spent as the local communities would decide. For the DCO, therefore, EDF Energy will review the governance structure for the residual £12.8 million of the Funds (which would be made available in annual payments throughout the construction period) in discussion with local communities, the local authorities and other stakeholders.

iii. Community Safety

B.3.29 As part of the site preparation Section 106 Agreement, EDF Energy committed to pay up to £1.82 million to the local authorities and to the Emergency Services to be spent on a range of initiatives including:

- Local Authority Community Safety Officers who would work in the local community to address any issues of integration between Hinkley workers and the community.
- Funds for the local authorities to create plans for the management of any incidents arising at Hinkley, including evacuation plans.
- Funding the Police to provide a Community Safety Beat Team, as well as additional funds for the Police to assist in dealing with any incidents or protests and to prepare detailed plans for incidents which may arise during the DCO construction works.
- Funds for the Fire Service to undertake specialist training, site familiarisation and incident planning.

- Funds for the Ambulance Service to do likewise.

B.3.30 For the DCO obligations, EDF Energy proposes to continue similar initiatives with additional funding of £3.84 million, again spread between the local authorities and the emergency services over the construction period. A spreadsheet indicating the breakdown of these funds is attached with Appendix 15.

iv. Ecology

B.3.31 EDF Energy's principal approach to the ecological impacts of the project is to limit those impacts through the careful design of the project and to mitigate any adverse effects through on site ecological enhancements. This approach is consistent with the guidance provided at paragraph 5.3.6 of NPS EN-1.

B.3.32 As part of the site preparation Section 106 agreement, EDF Energy committed to the following:

- off site habitat enhancement to offset any potential impact on bats which may arise from the loss of habitat on the HPC development site;
- a contribution of £250,000 to West Somerset Council to be spent on additional off site habitat enhancements in the local area such as tree planting and hedgerow improvements; and
- a commitment that EDF Energy would undertake comprehensive tracking of bats in the local area in order to inform the extent of any additional obligations necessary for the DCO.

B.3.33 The environmental impact assessment work for the DCO, including the cumulative impact assessment, has not identified the need for any additional off site enhancements, with the potential exception of bat habitat, the scale of which will be informed by the radar tracking of bats to which commitment is made through the Site preparation Section 106.

v. Economic Development

B.3.34 It cannot seriously be disputed that the investment in Hinkley Point C will bring significant benefit to the local economy. As a result, there are no adverse local economic effects to mitigate.

B.3.35 Nevertheless, EDF Energy is committed to ensuring that local benefit is gained from the Hinkley Point C investment. Accordingly, EDF Energy is committed to a determined Local Business Engagement Strategy. For some time, EDF Energy has been working closely with Somerset Chamber of Commerce and with the local authorities to ensure that local companies have maximum opportunity to bid for contracts at Hinkley Point C. This work is explained in the **Local Project – Supply Chain Engagement Strategy.**

B.3.36 As part of the site preparation Section 106 Agreement, the local authorities have required additional investment in economic development and EDF Energy undertook to provide funds of £617,880 to be spent by the local authorities on engagement of Economic Development Officers and funds for business support initiatives, which are intended to build local business resilience and address barriers to growth. .

B.3.37 As part of the DCO obligations, EDF Energy proposes to continue with its own initiatives and, in addition, to provide funds to the local authorities for the continued engagement of an Economic Development Manager over the construction period to ensure maximum integration between local businesses and the EDF Energy procurement team.

B.3.38 In addition, EDF Energy proposes to provide funds of £320,000 to the local authorities to assist in the continuing work of promoting and developing a Somerset and South West low carbon cluster. Those funds would be available to be spent on studies, bids and engagement with potential partners and relevant stakeholders in order to maximise the inward investment opportunity created by the Hinkley Point C development.

vi. Education

B.3.39 Again, EDF Energy has committed to its own **Education Strategy**, known as "Inspire" – the purpose of which is to work in local schools to inspire interest in science, technology, electronics and mathematics. The principles of the Education Strategy have been agreed with the County Council as part of the site preparation planning application and the Strategy is already being implemented. EDF Energy has appointed an education co-ordinator and has committed expenditure of more than £300,000 in the period 2011-2014. The strategy involves outreach visits to schools in the County but, particularly, in Sedgemoor and West Somerset along with the provision of teaching aids and resources to stimulate student interest. The Inspire strategy is effectively the first part in a comprehensive package of education, training and employment aimed at securing the local benefits of Hinkley Point C.

B.3.40 In the event of consent for the DCO, EDF Energy would commit to continuing the operation of the Inspire strategy at least for a further two years at a cost of £200,000 in addition to the cost of £300,000 committed as part of the site preparation application. The continued roll out of the Strategy would be reviewed after that time.

B.3.41 EDF Energy is also aware of the potential for incoming construction workers to bring families that may place pressures on local schools (see earlier paragraph 7.2.26). Accordingly, EDF Energy proposes:-

- to monitor the home location and school location of Hinkley Point C worker children;
- to work with Somerset County Council to monitor the take up of school places by Hinkley workers children relative to the available supply of school places;
- to commit to a formula consistent with existing County Council policy which allows parents to have the right to nominate up to 3 schools where the local school is at capacity. If capacity is unavailable within that framework, EDF Energy would fund the provision of additional school places. In doing so, the cost multiplier normally used by the County Council for permanent housing would be reduced by 50% to reflect the temporary nature of the Hinkley impacts;
- to protect against any potential for adverse effects arising, EDF Energy would commit to an advance payment of £610,000 to fund new temporary or improved class rooms in Bridgwater and Cannington; and

- in addition, EDF Energy will fund a teacher post at a cost of up to £60,000 per annum for 5 years following the grant of DCO consent whose responsibility would be to oversee the integration of Hinkley workers' children into local education.

B.3.42 This is considered to be a comprehensive package of commitments which would both maximise the education benefit and opportunity provided by the Hinkley Point C investment and would ensure that no adverse impacts on local education arise.

vii. Health

B.3.43 In order to reduce potential impacts on local health services from incoming construction workers, EDF Energy has committed to comprehensive occupational health services for construction workers by engaging the health contractor Duradiamond and by providing on site medical facilities at the main Hinkley Point C site. In this way, potential impacts on local health services should be limited to referrals to the NHS where the on site team is unable to deal with specific incidents or conditions, to ambulance call outs and to the potential impacts arising from the families of workers attracted to the area during the construction period. EDF Energy proposes to comprehensively mitigate these potential impacts.

B.3.44 As part of the site preparation Section 106 Agreement, EDF Energy would commit to fund a Hinkley Readiness Study for £60,000 which would enable the health services to prepare properly for the Hinkley Point C development. As part of the DCO Section 106 Agreement, EDF Energy intends additionally to commit to:-

- a formula to fund ambulance call out costs, estimated to be in the region of £134,000;
- a formula also to cover the potential cost of additional NHS referrals from construction workers, estimated to cost £50,460; and
- a phased payment estimated at £793,450 to the Primary Care Trust to address any additional costs of dealing with the health requirements of workers families – even though those families are expected to take up existing housing accommodation.

B.3.45 In addition, a **Health Impact Assessment** and a **Health Action Plan** have been prepared for the DCO application. EDF Energy will undertake the measures set out in the Health Action Plan, which includes those measures set out above, together with a range of community initiatives aimed at limiting any harm on community well being (see earlier Section 7.3).

viii. Heritage and Archaeology

B.3.46 The principal archaeological impacts of the HPC development arise from the site preparation works. Accordingly, as part of the site preparation Section 106 Agreement, a fund of £450,000 was committed to the County Council to be spent on the following:

- £55,000 to be spent on detailed archaeological monitoring of the site preparation works;

- £160,000 to be spent on archaeological outreach and education, ie on show casing the results of the archaeological excavation and extending learning locally from the information gathered as part of that excavation; and
- £245,000 to be spent on public realm heritage improvements in the local area. In particular, funds are to be spent against a detailed programme of activity agreed with the County Council which would see improvements to public realm heritage assets along road corridors in Cannington and Bridgwater.

B.3.47 The environmental impact assessment for the DCO has not identified any substantial additional adverse effects on archaeology or heritage arising from the DCO proposals themselves. Some limited additional adverse effects do arise, however, for instance from the construction of the Cannington Bypass. As a result, EDF Energy proposes to offset these impacts through a contribution of £300,000 which would be applied towards the restoration of Castle House in Bridgwater which is identified as a significant heritage asset at risk.

ix. Landscape and Visual Impacts

B.3.48 EDF Energy acknowledges that the construction of the power station at Hinkley would have landscape impacts locally as well as impacts in longer range views, for instance, from the Quantocks AoNB. Whilst the Government is aware of these potential impacts, it has identified the site of Hinkley Point C as potentially suitable for a new nuclear power station and it recognises that it is unlikely to be possible to fully mitigate the impacts. In other words, some adverse effects are recognised as a necessary consequence of the development. Nevertheless, EDF Energy has worked hard to limit any local or more distant adverse effects through the detailed design of the power station itself and through the careful design of its landscaping proposals, which include significant ground shaping in order to screen lower level "clutter" of the development to help integrate the development into the surrounding landscape.

B.3.49 As part of the site preparation Section 106 Agreement, EDF Energy has agreed to a range of initiatives in recognition of the potential visual impact of the development and in order to put in place advance mitigation in anticipation of the DCO project. Those commitments include:

- £100,000 to establish a Quantock Hills and Vale Landscape Development Fund – to support projects which restore or develop landscape features within the AONB;
- £250,000 to establish a Landscape Improvement Scheme to deliver area wide landscape improvements that provide landscape corridors;
- £80,000 for public art projects to add to the local landscape; and
- £120,000 for the establishment of a Development of a Land Management and Skills scheme, to fund the learning of traditional landscape and countryside skills.

B.3.50 In addition, EDF Energy is proposing to fund through the site preparation Section 106 a landscape officer whose job it is to oversee the implementation of the various funds.

B.3.51 As part of the DCO application, EDF Energy is committing to a detailed landscaping strategy and also proposes to continue with funding for the landscape officer for a further 5 years and to provide an additional £40,000 per annum to the landscape funds established through the site preparation works consent.

B.3.52 In this way, EDF Energy considers that it is comprehensively addressing the potential visual impacts of the development in the most appropriate way. NPS EN-1 and EN-6 recognise that there would inevitably be some landscape and visual impacts that cannot be fully mitigated (see, for instance, NPS EN-1 paras. 1.7.2, 1.7.11, 5.9.8, 5.9.13, 5.9.15 and C.5.67 as well as NPS EN-6 paras. 3.10.3 and 3.10.8). Nevertheless, EDF Energy is doing what it reasonably can to mitigate those impacts.

x. Leisure

B.3.53 Leisure impacts potentially arise in two ways from the Hinkley Point C project. In principle, some of the elements of the development could result in the loss of existing leisure facilities, whilst the influx of construction workers could also add to the demand for local leisure services and facilities. These issues have been directly addressed in the **Environmental Statement** and summarised earlier at paragraph 7.2.45.

B.3.54 In order to anticipate these impacts and to put in place measures to mitigate them before they arise, EDF Energy committed to a comprehensive set of obligations as part of the site preparation Section 106 Agreement, i.e.:

- £250,000 towards the construction of a new swimming pool in Bridgwater;
- £500,000 to provide new playing fields and social club facilities or to improve existing facilities in Bridgwater to offset the loss of such facilities at the former Innovia site which is to be used for a construction workers' campus as part of the DCO project;
- £250,000 to be spent on improving existing sports facilities or providing new sports facilities in the district of West Somerset; and
- £500,000 to be spent in Cannington and £500,000 to be spent in Stogursey parishes on new or improved sports/leisure facilities.

B.3.55 In total, this commitment of £2 million is considered to be sufficient to offset any potential adverse effects arising from the introduction of construction workers into the local area (see earlier Section 7.2 v). By making the money available through the site preparation Section 106 Agreement, advance mitigation could be put in place before impacts arise.

B.3.56 In addition, EDF Energy is providing sports and leisure facilities on its principal campuses at Hinkley Point and at Bridgwater A in order to provide facilities for workers and is committing to ensure that these facilities are made available to the general public.

xi. Rights of Way

B.3.57 Construction of Hinkley Point C would cause the permanent loss of some public rights of way which cross the HPC development site and the temporary loss of a number of other rights of way which would be affected during the extensive construction period. These impacts arise from the start of the site preparation works. Accordingly, EDF Energy committed has to a substantial package of rights of way improvements as part of the Section 106 Agreement for the site preparation works.

B.3.58 That agreement commits EDF Energy to fund up to £539,000 of public rights of way improvement against an agreed **Rights of Way Restoration and Enhancement Plan** which was originally prepared by Somerset County Council. It is the role of the County Council to implement those improvements drawing on the fund provided by EDF Energy.

B.3.59 Limited additional impacts arise from the DCO itself and few rights of way are directly affected by the associated development works, although one right of way is impacted by the construction of the Cannington Bypass and others may be judged to have their setting affected. Accordingly, EDF Energy proposes to extend the Rights of Way Restoration and Enhancement fund by an additional £199,000 in order to fund:

- further improvements to the coastal path westwards from Hinkley to Kilve, contingent upon agreement with the relevant land owners, using powers available to Natural England;
- further upgrading the coastal path where it extends from Stolford to Steart; and
- upgrading the Parrett Trail which runs on the west bank of the river Parrett, as far as Bridgwater.

B.3.60 In this way, the construction of Hinkley Point C is expected to result in a substantial net improvement to the scale, range and quality of the rights of way network.

xii. Skills and Training

B.3.61 The effects of Hinkley Point C on the local potential workforce are all expected to be positive. As with economic development, there is no adverse impact to mitigate. These issues are revised at 7.2 of this Planning Statement.

B.3.62 Nevertheless, EDF Energy is committed to securing the local economic benefits of Hinkley Point C and to ensuring that every opportunity is given to the local workforce to take advantage of the investment. Accordingly, EDF Energy is committed to its own comprehensive programme of skills and training and has recruited a specialist team to ensure maximum benefit.

B.3.63 As part of the site preparation Section 106 agreement, EDF Energy would commit to a range of self funded activities, together with funds of £4.68 million made available to the local authorities and local education providers to achieve the following:

- construction by Bridgwater College of a new Construction Skills Centre at Cannington;
- investment in the existing Energy Skills Centre at Bridgwater College in order to enhance its capacity;
- physical and curriculum improvements at West Somerset Community College as part of a Hinkley Ready Project in order to enable the college to offer relevant training and apprenticeship courses;
- investment in an Enterprise Project to be undertaken also by West Somerset Community College in order to enable local people to gain the necessary skills to provide services to the construction and operational workforce;
- an Employment and Skills Officer to be employed by the local authorities but seconded into the EDFE Employment and Skills team;

- two Community Outreach Workers to support local people and to overcome difficulties which some people have accessing work – this includes commitment to a Fit to Work programme; and
- a Young Persons' Support Worker to improve the life chances of young people and to improve their ability to access the opportunities at Hinkley Point.

B.3.64 To underline its commitment to these and related initiatives, as part of the DCO Section 106 Agreement, EDF Energy proposes further investment into a range of activities including the measures and projects set out in the **Construction Workforce Development Strategy** and:

- a further £2 million to further enhance the Bridgwater College Energy Skills Centre;
- the establishment of a comprehensive Employment Brokerage;
- the continued engagement of the two Community Outreach Workers and the Young Persons' Support Worker for a further 4 years; and
- the continued engagement of the specialist employment and skills team in order to maximise the activity and benefits of the employment brokerage and to ensure its integration with the other training initiatives.

xiii. Tourism

B.3.65 EDF Energy does not expect the construction of Hinkley Point C to adversely affect the local tourist economy (see earlier para 7.2.20). Indeed, the influx of construction workers throughout the year will bring significant benefits to the local bed and breakfast and catering economy, whilst the construction of the exemplar Public Information Centre at Hinkley Point will provide a substantial new tourist attraction to showcase not only Hinkley Point C but also the wider attractions of the county of Somerset.

B.3.66 As part of the resolved terms for the site preparation Section 106 Agreement, the planning authorities required EDF Energy to invest in payments to the Councils to provide Tourism Management Officers, to fund the preparation of a Tourism Strategy and to fund additional marketing and promotion initiatives which will anticipate the benefits of and any impacts of the Hinkley Point C development.

B.3.67 EDF Energy has also committed to provide a public information centre in Bridgwater throughout the construction period of the site preparation works.

B.3.68 EDF Energy does not propose to fund additional initiatives as part of the DCO Section 106 Agreement although it remains fully committed to:

- an exemplar Public Information Centre at Hinkley Point C; and
- the public information centre in Kings Square, Bridgwater remaining open throughout the construction period of the project, to provide a point of contact for the community and visitors to the area who have an interest in the Hinkley Point C project.

xiv. Transport

B.3.69 EDF Energy recognises that no construction project of the scale of Hinkley Point C can be undertaken without generating significant traffic – traffic both to carry the large quantities of construction materials and traffic generated by the construction workers themselves.

B.3.70 Accordingly, EDF Energy is committed to a comprehensive **Transport Strategy** which seeks to reduce the impact of construction activity with the following principal initiatives:

- maximising where practicable the use of the sea to bring construction materials to Hinkley through the development of a temporary jetty and through the refurbishment and enhancement of Combwich Wharf;
- limiting the amount of car parking at the HPC development site and providing four park and ride sites at strategic locations to intercept traffic;
- a comprehensive bus strategy serving principal settlements and also serving the park and ride sites; and
- two freight management facilities located at junctions 23 and 24 of the M5 to intercept lorry traffic and to hold it so that the volume of freight traffic using the local road network during the peak periods is minimised as far as practicable.

B.3.71 In addition, a series of advanced mitigation improvements are to be committed to as part of the site preparation Section 106 Agreement. Whilst the site preparation works themselves will not generate substantial traffic, the opportunity has been taken to secure improvements to the local road network so that those improvements would be in place in time to reduce the impacts of the DCO project when it commences. Those commitments are to include:

- identification of suitable routes for HGV vehicles and the installation of a camera based monitoring system to ensure that those routes are adhered to;
- a series of traffic management improvements and mitigation schemes in Cannington and along the C182;
- junction improvements in Bridgwater and on the A39;
- the establishment of a Transport Steering Group and the commitment to a Travel Plan, as well as a **Traffic Incident Management Plan**; and
- condition and structural surveys of highways, together with commitments to any appropriate restoration.

B.3.72 As part of the DCO Section 106 Agreement, traffic monitoring, the Travel Plan, the Transport Steering Group etc are to be maintained and funded. In addition, a series of highway improvements are proposed on routes between the freight management facilities and Cannington (see earlier para. 7.4). EDF Energy is also committing to contribute funds towards pedestrian, cycle and safety improvements in Bridgwater.

B.3.73 In addition, the DCO itself proposes the construction of the Cannington Bypass. A schedule of proposals is attached to Appendix 15. The total cost of these works is estimated at £13,850,000.

xv. Other Commitments

B.3.74 In addition to the principal headings set out above, the analysis undertaken in preparation of the DCO application has identified a number of appropriate obligations including the following:

- a contribution of £236,000 towards the Bridgwater Strategic Flood Defence Tariff, which accumulates funds from all consented development in Bridgwater towards long term strategic flood defences;
- a series of detailed obligations are proposed at Combwich in order to mitigate the loss of facilities to the local sailing club and to replace them with enhanced facilities such as slip ways, pontoons and moorings (see **Appendix 13**);
- a contribution of £500,000 will be made towards the implementation of the Cannington Flood Alleviation Channel;
- EDF Energy will monitor sea levels and climate change against the long-term predictions set out in the Flood Risk Assessment throughout the operational life of Hinkley Point C. In the event that sea levels exceed a level to be defined in the Section 106 agreement, EDF Energy will notify the owners of properties who would be affected by a tidal breach or overtopping event in the Wick Moor flood cell and offer to enter into an agreement with those property owners in which it would agree to contribute to the reasonable cost of any repairs necessitated by an actual tidal breach or overtopping event. (The magnitude of impact of such a tidal breach or overtopping event on the affected properties is likely to be increased as a result of the provision of the construction platforms for Hinkley Point C and the proposed land raising in the Holford Stream valley.) The amount of EDF Energy's contribution to the costs of repairs would be proportionate to that part of the flood level caused as a result of Hinkley Point C; and
- proposals for noise insulation at Combwich in the immediate vicinity of the wharf and at Cannington to mitigate the impact of early years construction traffic prior to the completion of the Cannington Bypass.

xvi. Conclusion

B.3.75 The paragraphs above have explained the approach taken to limit, reduce and mitigate the likely significant impacts arising from the Hinkley Point C project against a series of topic headings. They have also explained the relationship between the proposed DCO obligations and those planning obligations already committed as part of the proposed Site Preparation Section 106 Agreement.

B.3.76 In preparing this DCO submission, a systematic and comprehensive approach has been taken to address all potential impacts of the development, to limit them where possible and to mitigate them where significant residual impacts remain. In addition, the opportunity has been taken to propose commitments in the Section 106 Agreement to a series of positive / beneficial measures (such as the commitments to Economic Development, Education and to Skills and Training, as well as Tourism) which are not principally designed to mitigate impacts but which are appropriate to secure EDF Energy's Vision for the HPC project. The IPC will need to decide what weight to attach to those positive commitments, which effectively form part of the HPC project.

B.3.77 The approach taken to mitigation is based on the policy approach set out in NPS EN-1 and has been worked up in an exemplary fashion based upon: a) detailed engagement with local stakeholders which has created a strong understanding of local issues and b) the outcome of all necessary assessments and a detailed approach to avoiding, limiting, assessing and then mitigating likely significant impacts.

b) Relevant Guidance: Requirements

B.3.78 NPS EN-1 provides guidance to the IPC about the approach which should be taken to requirements, as follows:

> *"4.1.7 The IPC should only impose requirements in relation to a development consent that are necessary, relevant to planning, relevant to the development to be consented, enforceable, precise and reasonable in all other respects. The IPC should take into account the guidance in Circular 11/95, as revised, on "The Use of Conditions in Planning Permissions" or any successor to it"*

B.3.79 These principles have guided EDF Energy's approach to the project requirements.

c) Proposed DCO Requirements

B.3.80 A schedule of requirements forms part of the draft DCO. It sets out a systematic framework of control to ensure that the project is designed, constructed and operated in accordance with the principles set out in the DCO application documents and that its effects are consistent with those assessed in the **Environmental Statement**.