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<td>Client name:</td>
<td>SMart Wind Limited</td>
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<td>Client contact(s):</td>
<td>Chris Jenner</td>
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<td>Project manager:</td>
<td>Lance Furniss</td>
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<td>29th March 2012</td>
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<td>Report written by:</td>
<td>Lance Furniss</td>
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<td>29th March 2012</td>
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<td>30th March 2012</td>
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<td>Report authorised by:</td>
<td>Chris Jenner</td>
<td></td>
<td>30th March 2012</td>
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Acronyms

AC  Alternating Current  NG  National Grid
CAA  Civil Aviation Authority  NGET  National Grid Electricity Transmission
DCO  Development Consent Order  NID  National Infrastructure Directorate
EIA  Environmental Impact Assessment  PSR  Primary Surveillance Radar
EMF  Electromagnetic fields  SCADA  Supervisory Control and Data Acquisition
ES  Environmental Statement  SoCC  Statement of Community Consultation
GW  Gigawatt  SSR  Secondary Surveillance Radar
HVAC  High Voltage Alternating Current  THLS  Trinity House Lighthouse Service
HVDC  High Voltage Direct Current  UXO  Unexploded Ordnance
IPC  Infrastructure Planning Commission  VHF  Very High Frequency
kV  Kilovolt  LIRA  Line Resonance Analysis
MCA  Maritime and Coastguard Agency  MCA  Maritime and Coastguard Agency
MVAC  Medium Voltage Alternating Current

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1 INTRODUCTION

1.1 BACKGROUND TO REPORT

1.1.1 In November 2010, SMart Wind Limited (SMart Wind), a consortium of Mainstream Renewable Power Limited (“Mainstream”) and Siemens Project Ventures GmbH (“SPV”) issued the Hornsea Project One Environmental Impact Assessment Scoping Report (hereafter referred to as the ‘Scoping Report’) to the Infrastructure Planning Commission (IPC). The Scoping Report was submitted as required by the Planning Act 2008 and associated Regulations and the Scoping Opinion was received from the IPC in December 2010. Both the Scoping Report for Project One and the IPC’s Scoping Opinion are available on the IPC website and also can be downloaded from the SMart Wind website at [http://www.smartwind.co.uk/](http://www.smartwind.co.uk/).

1.1.2 In December 2011, DONG Energy acquired a 33.3% stake in the first offshore wind farm Project within the Hornsea Round 3 Zone and associated offshore cable route and onshore infrastructure, hereafter referred to as ‘Project One’. DONG Energy requires full technical and economic flexibility to deliver against government targets for offshore wind cost reduction. Therefore, SMart Wind and DONG Energy are now including the option to connect Project One to the National Grid using either High Voltage Alternating Current (HVAC) or High Voltage Direct Current (HVDC) technology. HVAC technology has not been considered to date in the scoping or consultation processes for Project One.

1.1.3 This report forms an addendum to the Scoping Report (hereafter referred to as the ‘Scoping Report Addendum’) and considers the additional project parameters required for the inclusion of HVAC technology in the project design for Project One.

1.2 BACKGROUND TO PROJECT

1.2.1 The Hornsea Round 3 Zone is located in the central region of the North Sea, covering an area of 4735 km² (Figure 1.1). The East Riding of Yorkshire coast lies 31 km to the west of the Zone’s boundary. The Zone’s eastern boundary is 1 km from the median line between UK and Netherlands waters.

1.2.2 Project One will comprise up to three wind farm arrays plus all infrastructure to the onshore grid connection. The wind farm arrays are in the centre of the Hornsea Round 3 Zone and cover an area of 407 km² (Figure 1.1). The East Riding Coast lies 103km to the west of that area and the median line between UK and Netherlands Waters lies 40km to the east.

1.2.3 The area for the cable route corridor immediately south of the Hornsea Zone boundary in figure 1.1 represents a search area for the entry point of the export cable into the turbine array for Project One. This area is within the original Scoping Report boundary.

1.2.4 Project One has a capacity of up to 1.2 GW and has secured a grid connection agreement for 1 GW to connect to Killingholme substation, an existing 400 kV substation in North Lincolnshire owned by National Grid (NG). An application for a Development Consent Order (DCO) will be made for Project One under the Planning Act 2008 (the Planning Act). The DCO application will comprise full details of the development proposal and will be accompanied by an Environmental Statement (ES) prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the ‘EIA Regulations’) and supporting documents.

1.2.5 The Environmental Impact Assessment (EIA) will be informed by responses to both the Scoping Report and Scoping Report Addendum. Specifically, in accordance with Regulation 8 of the EIA Regulations, a further Scoping Opinion is requested from the IPC.
2 POLICY AND LEGISLATIVE CONTEXT

2.1 The legislation relating to the application for DCO has not changed since the Scoping Report was issued (see Scoping Report, Section 2).

2.2 Under the Localism Act 2011, on 1 April 2012 the IPC will be abolished and most of the IPC’s functions will be assumed by a new unit currently known as the National Infrastructure Directorate (NID) which will sit within the Planning Inspectorate. The NID will deal only with major infrastructure applications however Ministers rather than Commissioners will be responsible for applications under the same statutory fast-track timeframe as the current regime. SMart Wind's DCO application will therefore be made to the NID, which will make a recommendation to the Secretary of State who will make the final decision.
3 DESCRIPTION OF THE DEVELOPMENT

3.1 As described in the Scoping Report, Hornsea Project One will comprise up to three windfarm arrays, with a combined capacity of up to 1200MW or 1.2GW, which may be built in phases, plus associated electrical infrastructure needed to connect to the National Grid at Killingholme substation.

3.2 The offshore wind turbines will be located in the centre of the Hornsea Zone, covering an area of approximately 407km². Depending on the rated capacity of the turbines, between 3.6 and 8 MW machines, the estimated number of turbines is between 150 and 332. The nearest turbine will be at least 103km from the East Riding of Yorkshire coast. Turbines used for Project One are likely to be a conventional 3-bladed design and will have a maximum rotor diameter of 178m, maximum hub height of 120m, and maximum rotor tip height of 200m.

3.3 Wind turbines and the offshore electrical stations will be supported on foundations which in turn will be supported on or embedded in the seabed. Three foundation types for turbines are being considered for Project One. More information is required to inform the final foundation choice, i.e., which options are the most cost effective and environmentally appropriate for the project. It is possible that more than one type of foundation may be used across Project One. The final selection of foundation type(s) for Project One will be dependent on the final turbine size, site ground conditions, water depth, environmental considerations and economic & supply chain considerations. The following foundation concepts are being considered, as previously detailed in section 3 of the Scoping Report:

- Steel monopile;
- Steel jackets / space frame structure supported by piles; and
- Gravity base foundation

3.4 During the pre application stage SMart Wind confirmed a 1GW grid connection agreement at Killingholme for Project One. Killingholme substation is an existing 400 kilovolt (kV) National Grid substation located on the south bank of the Humber Estuary. SMart Wind is proposing to transmit power from the offshore turbines to the shore via subsea cables.

3.5 Previously only a HVDC transmission option was proposed for Project One. As described in the Scoping Report, the HVDC option comprises offshore collector stations, inter array cabling, an offshore converter station and export cable route to shore. Onshore works will include a landfall site with transition pit, a cable route from the coast to an onshore converter station, and a short cable connection between the converter station and substation, located in Killingholme. The schematic of the HVDC option can be seen in Figure 3.1.

3.6 For a HVDC system, converter stations will be required at both ends of the transmission circuit. An offshore station is required to convert the High Voltage Alternating Current ("HVAC") generated from the turbines to HVDC for transmission to shore. The onshore converter station then converts power back to HVAC for connection into the National Grid transmission system.

3.7 This Scoping Report Addendum is not seeking any further Scoping Opinion in relation to the infrastructure described above, as this is already addressed in the Scoping Opinion of December 2010.

3.8 The addition of a HVAC transmission option to Project One is required to meet full technical and economic flexibility to deliver against government targets for offshore wind cost reduction. The HVAC option comprises offshore collector stations, inter array cabling, an offshore reactive station and export cable route to shore. Onshore works will include a landfall site with transition pit, a cable route from the coast to an onshore substation, and a short cable connection between the substation and existing substation at Killingholme. The schematic of the HVAC option can be seen in Figure 3.2.

3.9 The inclusion of HVAC technology as an alternative option for the electricity transmission, results in a number of amendments to the Scoping Report design assumptions. The primary differences between the HVDC transmission system (as described in the Scoping Report, Section 3) and an HVAC transmission system include:
- No requirement for an offshore HVDC converter station;
- Requirement for an offshore HVAC reactive substation along the offshore cable route;
- HVAC transmission cables from offshore substation(s) to landfall;
- HVAC transmission cables from landfall to grid connection with National Grid network;
- No requirement for an onshore HVDC converter station; and
- Requirement for an onshore HVAC substation.

3.10 Figure 3.1 and Figure 3.2 detail a schematic representation of the differences between the HVDC and HVAC technology.

Figure 3.1   Main components of HVDC transmission option

Figure 3.2   Main components of HVAC transmission option

3.11 The HVDC project parameters provided in the Scoping Report were updated during Phase 2 consultation in November 2011. Table 3.1 provides a summary of the Project One design parameters presented in November 2011 and the HVAC technology requirements. Further detail on the HVAC technology requirements are provided in the Sections below.

Table 3.1
3.12 For ease of reading this Scoping Report Addendum, the description of each design component relevant to the transmission system has been reproduced below referencing the original paragraph number in the Scoping Report. The modifications required to cover the option of a HVAC transmission system are then outlined directly below the original description in order to present an easily identifiable comparison between the two.

3.13 It is important to note that the HVAC transmission option is being considered in addition to the HVDC option, but only one transmission option will be developed during the final design of the project after consent.

Table 3.1 Comparison of parameters for HVDC and HVAC transmission options

<table>
<thead>
<tr>
<th>Component</th>
<th>Max HVDC Requirements (November 2011)</th>
<th>Max HVAC Requirements (March 2012)</th>
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<tbody>
<tr>
<td><strong>Offshore Collector Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Main Building Height from MHWS</td>
<td>40 m</td>
<td>40 m</td>
</tr>
<tr>
<td>Topside Width</td>
<td>40 m</td>
<td>40 m</td>
</tr>
<tr>
<td>Topside Length</td>
<td>45 m</td>
<td>45 m</td>
</tr>
<tr>
<td><strong>Offshore HVDC Converter Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance Offshore</td>
<td>140 km</td>
<td>NA</td>
</tr>
<tr>
<td>Main Building Height from MHWS</td>
<td>63 m</td>
<td>NA</td>
</tr>
<tr>
<td>Topside Width</td>
<td>60 m</td>
<td>NA</td>
</tr>
<tr>
<td>Topside Length</td>
<td>120 m</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Offshore HVAC Reactive Substation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance Offshore</td>
<td>NA</td>
<td>20 – 80 km</td>
</tr>
<tr>
<td>Main Building Height from MHWS</td>
<td>NA</td>
<td>50 m</td>
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<tr>
<td>Topside Width</td>
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</tr>
<tr>
<td>Topside Length</td>
<td>NA</td>
<td>45 m</td>
</tr>
<tr>
<td><strong>Offshore Export Cable</strong></td>
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<td></td>
</tr>
<tr>
<td>Number of Cables</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Voltage</td>
<td>400 kV</td>
<td>275 kV</td>
</tr>
<tr>
<td><strong>Cable Landing</strong></td>
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</tr>
<tr>
<td>Number Transition Pits</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Onshore Export Cable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trench Width</td>
<td>1.5 m</td>
<td>2.0 m</td>
</tr>
<tr>
<td>Trench Depth</td>
<td>1.5 m</td>
<td>2.0 m</td>
</tr>
<tr>
<td><strong>Onshore Jointing Pits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>5 m</td>
<td>4m</td>
</tr>
<tr>
<td>Length</td>
<td>15 m</td>
<td>10m</td>
</tr>
<tr>
<td>Depth</td>
<td>2 m</td>
<td>1.5 m</td>
</tr>
<tr>
<td>Nominal Distance Between Jointing Bits</td>
<td>0.75 km</td>
<td>0.6 – 1.0 km</td>
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<tr>
<td><strong>Onshore HVDC Converter Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Building Height</td>
<td>24 m</td>
<td>NA</td>
</tr>
<tr>
<td>Site Width</td>
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<td>NA</td>
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<tr>
<td>Site Length</td>
<td>200 m</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Onshore HVAC Substation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Building Height</td>
<td>NA</td>
<td>24 m</td>
</tr>
<tr>
<td>Site Width</td>
<td>NA</td>
<td>150 m</td>
</tr>
<tr>
<td>Site Length</td>
<td>NA</td>
<td>200 m</td>
</tr>
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3.1 OFFSHORE ELECTRICAL INFRASTRUCTURE

3.1.1 HVAC substations

*Original Text:*

3.14 Para 3.44 It is envisaged that up to three HVAC offshore substations mounted on platforms will be required for the delivery of 1.2 GW. The primary function of the HVAC offshore substations is to transform the HVAC transmission voltage down from 220/132 kV to the Median Voltage Alternating Current (MVAC) distribution voltage, nominally 33 kV but may be as high as 66 kV. The HVAC offshore substations electrically interconnect the HVDC converter station(s) with the wind turbines via inter-platform and inter-array cable circuits, respectively. Typically, the dimensions of an offshore substation out of the water will be up to 45 m in length x 40 m wide x 36 m high. [This was updated to up to 5 offshore substations of 45 m in length x 40 m wide x 40 m high in November 2011 and consulted on during Phase 2 consultation].

3.15 Para 3.45 Conceptual electrical design work to evaluate a range of different design options for the HVAC offshore substations and identify the optimal design is ongoing and will be presented in more detail for the EIA.

*Modifications/Amendments:*

3.16 If HVAC technology is adopted, transmission from the offshore substations will be directly to export cables, with no requirement for the interim connection to the HVDC converter station(s).

3.17 The design of the HVAC substations for the HVAC export option is very similar to the collector substation design for the HVDC export option. As with the HVDC option, the substations may be located near the electrical “centre of gravity” and near the outer edge of Project One. The final locations will be determined following an optimisation study of the inter-array cable layout.

3.18 In order to limit the electrical losses inherent in using HVAC transmission over long distances it is necessary to use shunt reactors to provide reactive compensation along the transmission cables. The electrical reactors will be housed in an offshore HVAC reactive substation.

3.19 One reactive substation will be required for Project One. This will be located along the export cable route 20-80 km from the coast. The final siting of the reactive substation will be subject to various engineering as well as environmental constraints.

3.20 As with other offshore structures associated with Project One, the reactive substation will be marked according to the requirements of Trinity House Lighthouse Service (THLS), Maritime and Coastguard Agency (MCA) and the Civil Aviation Authority (CAA).

3.1.2 HVDC offshore converter station(s)

*Original text*

3.21 Para 3.46 For wind farm projects beyond 70 km offshore, adopting HVDC technology becomes a more economic solution. Subzone 1 is situated more than 100 km offshore and necessarily uses HVDC technology. The primary function of the HVDC converter is to convert the 220/132 kV HVAC transmission voltage that it receives from the HVAC offshore substations to HVDC, suitable for exporting power over long distances i.e., more than 70 km.

3.22 Para 3.47 The HVDC offshore converter station(s) will be sufficiently sized to efficiently export the installed wind generation capacity, i.e., upwards of 1 GW. The converter station(s) electrically interconnects the inter-platform cable circuits with the HVDC export cable circuit.

3.23 Para 3.48 The converter station(s) shall be mounted on platforms approximately 140 km offshore. Typically, the dimensions of an HVDC offshore converter station will be up to 65 m in length x 40 m wide x 36 m high. [This was updated to 120 m in length x 60 m wide x 63 m high in November 2011 and consulted on during Phase 2 consultation].

3.24 Para 3.49 Conceptual electrical design work to evaluate a range of different design options for the electrical system and identify the optimal design is ongoing and will be presented in more detail for the EIA.
Conceptual electrical design work to evaluate a range of different design options for the electrical system and identify the optimal design is ongoing and will be presented in more detail for the EIA.

**Modifications/Amendments:**

3.26 Should HVAC technology be selected there would be no requirement for an HVDC offshore converter station.

### 3.2 SUBMARINE CABLES

#### 3.2.1 Export Cable

**Original text**

3.27 Para 3.50 The design solution for the HVDC export circuit back to shore has not yet been finalised and may comprise a single cable pair, or alternatively two cable pairs. The HVDC export cable will be sized to efficiently and economically export the installed wind generation capacity, i.e., upwards of 1 GW.

3.28 Para 3.51 It is envisaged that a bi-polar cable design will be selected. The bi-polar cable comprises two cores, one high voltage negative (with respect to earth) and the other high voltage positive (with respect to earth). Typically, the design voltage would be in the order of +/- 300 kV and would necessarily match the design voltage of the HVDC converter. **[This was updated to +/- 400 kV in November 2011 and consulted on during Phase 2 consultation]**.

**Modifications/Amendments:**

3.29 If a HVAC transmission option is selected, a single HVAC submarine cable running to the shore is expected to be used to connect each offshore collector substation to the onshore cables at the landfall point. The offshore section of the export cable is likely to be a three-core submarine cable with a voltage between 132 and 275 kV.

#### 3.2.2 Inter-platform Cables

**Original Text:**

3.30 Para 3.52 It is envisaged that up to four HVAC export cable circuits will interconnect each offshore HVAC platform with the converter station(s). Conceptual electrical design work to evaluate a range of different design options for the electrical system and identify the optimal design is ongoing and will be presented in more detail in the ES.

**Modifications/Amendments:**

3.31 Whilst the HVDC transmission option will require inter-platform cables, the HVAC transmission option will connect the HVAC substation directly to the HVAC export cables.

#### 3.2.3 Inter-array Cables

**Original Text:**

3.32 Para 3.53 Inter-array cabling will transmit power from the individual turbines to one of the HVAC substations. Each array cable circuit is referred to as a 'string' and the exact number of turbines on each string will depend on the power transmission capacity of the cable selected and the string configuration e.g. radial, ring etc. The inter-array cable is typically a single cable containing three metallic cores and an optical fibre core. The final configuration of the inter-array cable circuits will not be known until the design options have been fully evaluated.

**Modifications/Amendments:**

3.33 The original assumptions for the inter-array cabling will not change if an HVAC transmission option is selected.
3.2.4 Cable Installation

Original Text:
3.34 Para 3.54 It is envisaged that all submarine cables will, where practicable, be installed below the seabed utilising either ploughing or trenching/jetting techniques, depending on the seabed conditions. A detailed cable burial specification will be developed based on geophysical and geotechnical assessments.

3.35 Para 3.55 Where cable burial is not possible, placement of rocks (rock-dumping), frond mattresses or grout bags may be deployed to protect the cables e.g. where they enter turbine or platform foundations, crossing pipelines etc. It is conceivable that the laying of cable protection may also be necessary after burial, where sections of cables are too shallow or have otherwise become exposed as informed by the post installation inspection or periodic maintenance surveys. Full details of this process and installation will be provided in the EIA.

Modifications/Amendments:
3.36 The original assumptions for the cable installation will not change if an HVAC transmission option is selected.

3.3 OFFSHORE OPERATION AND MAINTENANCE

3.3.1 Interconnecting Cables

Original Text:
3.37 Para 3.62 Interconnecting power cables between the wind turbines and the transformer station as well as power cables to the shore will be inspected, unless they are buried. Mainly visual inspections are carried out for non buried cables and repair activities if required. For buried cables bury depth can be measured. Subsea cables connected at the offshore substation will be inspected for proper fixing and signs of wear. Cable burial to design depth will be verified. The interval between inspections should not exceed five years.

3.38 Para 3.63 With the strategic nature of the main wind farm export cables, SMart Wind will consider Cable Monitoring solutions within the O&M strategy. This type of solution enables preventative maintenance to be undertaken should a cable anomaly arise. The basic concept of the LIRA® Cable Monitoring system recognizes that there is a high correlation between the insulation condition and the properties of the insulation’s dielectric material. A change in dielectric constant (mainly capacitance), lead to changes in the cable impedance (globally and locally). The solution itself, consists of hardware, connection devices and proprietary software modules for failure analysis, degradation analysis and simulator programs.

Modifications/Amendments:
3.39 The original assumptions for the cable operation and maintenance will not change if an HVAC transmission option is selected.

3.3.2 Electrical Infrastructure

Original Text:
3.40 Para 3.64 The main activities comprise a risk and safety based inspection regime and maintenance program with global and close visual inspection, non-destructive inspection/testing, instrumentation based condition monitoring and corrective maintenance. All equipment would be maintained and certified within the latest statutory legislation or to industry best practice.

3.41 Para 3.65 Each wind turbine will operate independently of the others. The offshore substations and anemometry masts will also be monitored and maintained.

3.42 Para 3.66 The operation and control of the wind farm(s) will be managed via the integrated Supervisory Control and Data Acquisition (SCADA) system, connecting each turbine to the onshore control room. All wind turbines are connected via optical fibre network, running through the power cables, to the collector platforms, and from there, to the HVDC onshore facility.
3.43 Para 3.67 From there, all SCADA signals are passed via appropriate land communications to diagnostic centres and also to the on-shore 24 hour operations centre.

3.44 Para 3.68 Detailed operation and maintenance information will be provided in the ES.

**Modifications/Amendments:**

3.45 The original assumptions for the electrical infrastructure operation and maintenance will not change if an HVAC transmission option is selected. The HVDC onshore facility would however be an HVAC onshore facility if the HVAC option is selected.

### 3.4 ONSHORE INFRASTRUCTURE

#### 3.4.1 Onshore Cable Circuit

**Original Text:**

3.46 Para 3.76 It is envisaged that most, if not all, of the 1 GW HVDC cable circuit will comprise HVDC cables routed underground. An element of the HVDC circuit, close to the existing NGET substation, may warrant an overhead line solution. Ultimately, physical constraints, environmental constraints, land ownership and economics will determine the preferred design solution.

**Modifications/Amendments:**

3.47 The original assumptions for cable burial will not change if an HVAC transmission option is selected. However, at cable jointing locations, cable link boxes with associated above ground access will be required with a HVAC transmission option. The onshore cable route will remain as a buried cable and we maintain that no overhead lines are being considered for the entire 40km length of the onshore cable route from the landfall at Horseshoe Point to the onshore converter station at Killingholme.

3.48 Since submitting the Scoping Report in November 2010, an onshore cable corridor has been selected for Project One. The preferred cable route to the south of the Humber Estuary and landfall at Horseshoe Point, was selected in consultation with local authorities, statutory stakeholders and the local community. The offshore and onshore cable route corridors are sufficient to cover the requirements of both the HVDC and HVAC transmission options (Figure 3.3) and so will not change regardless of which option is selected.
Figure 3.3  Proposed Onshore cable route
Figure 3.3 Proposed Onshore Cable Route

Legend
- Proposed Cable Route - Current Study Area
- Onshore Substation/Converter station
- Ramsar Site
- Special Area of Conservation
- Special Protection Area
- SSSI
- National Nature Reserve
- Local Nature Reserve
- Ancient Woodland
- Scheduled Monuments
- Registered Park and Gardens
- AONB
- Heritage Coast
- Local Authority Boundary
- National Cycle Route

Killingholme Substation
Horseshoe Point
Humber Estuary SSSI

North Lincolnshire
North East Lincolnshire
West Lindsey
East Lindsey
East Riding of Yorkshire

© Crown copyright. All rights reserved. 2012 Licence number: 10000031673, 100048492. Contains Ordnance Survey data © Crown copyright and database right 2012. Path: O:\Hornsea\Tech\Drawings\7298-0256-01.mxd
3.4.2 HVDC Converter Station / HVAC Substation

*Original Text:*

3.49 Para 3.80 The onshore HVDC converter station(s) will be located as close as is practicable to the existing transmission substation located at Killingholme and owned by NG.

3.50 Para 3.81 The converter station converts the imported DC power flow from the offshore HVDC converter back to AC power, compatible with NG’s AC transmission network. The HVDC offshore converter station(s) will be sized to match the offshore converter stations i.e., sufficient to efficiently import the installed wind generation capacity, i.e. upwards of 1 GW.

3.51 Para 3.82 The HVDC converter station design is not yet finalised but the footprint or land-grab associated with the installation is estimated to be in the order of 200 m length x 150 m width x 35 m height.

*Modifications/Amendments:*

3.52 Should the HVAC transmission option be selected, there would be no requirement for the HVDC converter station. Instead a HVAC substation would be required for connection to the grid. The estimated footprint for the HVAC substation is expected to be up to 150 x 200 m (excluding mitigation areas), and would be built in the same location as the selected site for the HVDC converter station (Figure 3.4).
Figure 3.4  HVDC converter station or HVAC substation location
Figure 3.4 Proposed HVDC converter station or HVAC substation location

Scale 1:25,000

Legend

- Proposed Onshore Substation/Converter Station

SMart Wind Ltd
Hornsea Offshore Wind Farm
08/02/12
GM CD OXF7298

Figure Number: 7298/NCR/4
Rev:

Status: FINAL

Data Source: RPS 2012

Client: SMart Wind Ltd
Project: Hornsea Offshore Wind Farm

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OSGB36 BNG

Proposed Onshore Substation/ Converter Station
4 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

4.1 The potential impacts of the HVDC transmission system were considered in the Scoping Report (Scoping Report, Section 4). The impacts associated with an HVAC transmission system are likely to be similar to those already considered in the Scoping Report. Where there are additional components or parameters associated with HVAC technology which were not considered in the Scoping Report, the potential impacts have been identified. These are summarised for offshore and onshore impacts in Table 4.1 and Table 4.2 respectively, and presented in more detail below.

Table 4.1 HVAC transmission option offshore screening table

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<tr>
<td>HVAC export cable (offshore)</td>
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<td>HVAC transition pit/landfall</td>
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☑ Potential change or new impact from original design assumptions
❑ Potential impact no different from original design assumptions
☐ No potential impact
## Table 4.2 HVAC transmission option onshore screening table

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<td>HVAC export cable (onshore)</td>
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<td></td>
<td>Review EMF assessment due to difference in HVAC and HVDC EMF impacts.</td>
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<tr>
<td>HVAC onshore substation</td>
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<td></td>
<td></td>
<td></td>
<td>Review all onshore assessments due to additional HVAC technology option of new structure</td>
<td></td>
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<tr>
<td>HVAC transition pit/landfall</td>
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<td></td>
<td>Review assessments w.r.t. EMF impacts due to difference in HVAC and HVDC EMF impacts. Review assessments w.r.t. change in soil composition and flood risk (geology, soils, agriculture and land use, flood risk) due to potential additional trenching/drilling.</td>
<td></td>
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</tbody>
</table>

- ✓ Potential change or new impact from original design assumptions
- □ Potential impact no different from original design assumptions
- ✗ No potential impact

3.53 It is important to recognise that in most cases the potential impacts of HVAC are similar, and in many ways identical, to those considered for HVDC technology in the Scoping Report (see Scoping Report, Section 10), although the degree and location may change as detailed in 4.2 Table 3.1. This change in the project design for Project One does not result in a material change in the potential impacts identified in the Scoping Report, but will potentially change the inputs and results of the EIA.

4.3 One of the key differences between HVDC and HVAC technology will be the different effects of Electromagnetic Fields (EMF). EMF is a term used to describe the electrical and magnetic field created by the flow of electrical current through a high voltage conductor, and is present in both HVDC and HVAC electrical transmission systems. In HVAC systems, the current flows back and forth along the conductor creating an alternating field; in HVDC systems the current only flows in one direction creating a static field. As a result of these differences, electrical and magnetic field properties are different.

4.4 The earthed metallic sheaths on electricity cables are very effective at blocking the electrical field outside the cable, but not the magnetic field. However, magnetic field strength decreases rapidly by vertical and horizontal distance from the source. To date HVAC transmission systems have been commonly used for the vast majority of constructed offshore and onshore wind farms.
4.1 WIDER ASSESSMENT WITHIN THE EIA PROCESS

4.5 All additional impacts identified in this Scoping Report Addendum for the inclusion of HVAC design parameters will be incorporated into the existing assessment for:
- Transboundary impacts;
- Secondary and inter-relationship impacts
- Potential cumulative impacts;

4.6 The requirement for additional mitigation and monitoring requirements will be assessed for each receptor alone and for transboundary, secondary and inter-relationship, and cumulative impacts.
5 OFFSHORE ENVIRONMENT

5.1 A summary of the potential impacts of the additional offshore components required for the HVAC transmission option is presented in Section 5.1. A more detailed consideration of the additional project impacts to be assessed, categorised under the topic areas outlined in the Scoping Report, is presented in Sections 5.2 to 5.4.

5.1 POTENTIAL NEW OFFSHORE IMPACTS FROM HVAC TRANSMISSION

5.1.1 HVAC reactive substation

5.2 The requirement for a reactive substation along the offshore export cable route will result in impacts not considered in the Scoping Report. For most impacts this relates to additional construction vessel impacts, seabed footprint and the physical presence within the offshore cable corridor. As a result, all relevant Environmental Statement (ES) chapters (as identified in Table 4.1) will be updated to include the potential impact of the reactive substation.

5.3 The potential new impacts of most significance, relating to the reactive substation are:

- The physical presence of the reactive substation impacting shipping and navigation, commercial fisheries and infrastructure and other marine users during construction, operation and decommissioning. The reactive substation will be further removed from the turbine arrays than the HVAC substations or the HVDC converter stations considered in the Scoping Report. A review of the impact assessments for shipping and navigation, commercial fisheries and infrastructure and other marine users will be undertaken to consider the potential impacts from the reactive substation.

- Potential visual impacts of the reactive substation on landscape, seascape, and visual amenity. The reactive substation will be sited along the offshore cable corridor and will be located at a distance from other key offshore Project One infrastructure, such as turbines and collector stations. As a result it may have additional visual impacts which will need to be assessed. A review of the impact assessment for landscape, seascape, and visual amenity will be undertaken to consider the potential impacts from the reactive substation.

5.1.2 HVAC export cable route and landfall

5.4 An HVAC export cable option may require additional trenches and so have the potential to result in additional impacts not considered in the Scoping Report. The potential new impacts relating to the HVAC export cable route and landfall are:

- Additional trenching impacts of the export cables on the marine geology, bathymetry, seabed features and sediments, and physical processes. HVAC cables will need to be trenched individually (i.e. cannot be bundled) and so up to five cable trenches may be required. The potential impacts during construction, operation, and decommissioning from any additional trenching will be the same as those already considered, however the previous assumption was up to four trenches. A review of the impact assessments for marine geology, bathymetry, seabed features and sediments, and physical processes will be undertaken to consider potential impacts from additional trenching.

- As noted in Section 4, HVAC EMF impacts are different to those of HVDC. EMF impacts associated with the HVAC export cables on benthic and epibenthic environment, fish and shellfish ecology, commercial fisheries will need to be considered. EMFs can also impact on ships navigation systems, therefore, potential EMF impacts on ports, shipping and navigation will need to be considered. A review of the impact assessments for benthic and epibenthic environment, fish and shellfish ecology, commercial fisheries, and ports, shipping and navigation will be undertaken to consider potential impacts of EMF impacts associated with HVAC.
5.2 OFFSHORE PHYSICAL ENVIRONMENT

5.2.1 Marine geology, bathymetry, seabed features and sediments
5.5 Potential project impacts on Marine Geology outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report, Section 5.1).
5.6 Additional project impacts to be assessed:
   ▪ Potential construction, operation and maintenance and decommissioning project impacts outlined in the Scoping Report will need to be assessed due to the potential requirement for an extra trench for the HVAC export cable and for the reactive substation located in the offshore cable corridor.

5.2.2 Physical processes
5.7 Potential project impacts on physical processes outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report, Section 5.2).
5.8 Additional project impacts to be assessed:
   ▪ All the potential construction, operation and maintenance and decommissioning project impacts outlined in the Scoping Report will need to be assessed for in light of the increased number of trenches required for the HVAC export cable and for the reactive substation.

5.2.3 Water quality
5.9 Potential project impacts on water quality outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report, Section 5.3).
5.10 Additional project impacts to be assessed:
   ▪ All the potential construction, operation and maintenance and decommissioning project impacts outlined in the Scoping Report will need to be assessed for in light of the increased number of trenches required for the HVAC export cable and for the reactive substation located in the offshore cable corridor.

5.2.4 Air quality
5.11 Potential project impacts on air quality outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report, Section 5.4).
5.12 Additional project impacts to be assessed:
   ▪ All the potential construction, operation and maintenance and decommissioning project impacts outlined in the Scoping Report will need to be assessed for in light of the increased number of trenches required for the HVAC export cable and for the reactive substation located in the offshore cable corridor.

5.3 OFFSHORE BIOLOGICAL ENVIRONMENT

5.3.1 Offshore nature conservation designations
5.13 Potential project impacts on offshore nature conservation designation outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 6.1).
5.14 Additional project impacts to be assessed:
   ▪ All the potential construction, operation and maintenance and decommissioning project impacts outlined in the Scoping Report will need to be assessed for in light of the increased number of trenches required for the HVAC export cable and for the reactive substation located in the offshore cable corridor.

5.3.2 Benthic and epibenthic environment
5.15 Potential project impacts on benthic ecology outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 6.2).
5.16 Additional project impacts to be assessed:

**Construction and decommissioning**

- Loss of habitat under reactive station foundation footprints;
- Disturbance to habitat under jack up barge during installation of reactive substation foundations;
- Increased level of suspended sediments and smothering from re-suspension of sediments during additional cable trenching, vessel anchoring and piling and/or drilling of foundations for the reactive substation; and
- Changes in sediment transport and deposition patterns as a result of the presence of additional structure (reactive substation foundation).

**Operation and maintenance**

- Electromagnetic fields from HVAC export cabling causing a disturbance to benthic and epibenthic species.

5.3.3 Fish and shellfish ecology

5.17 Potential project impacts on fish and shellfish ecology outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 6.3).

5.18 Additional project impacts to be assessed:

**Construction and decommissioning**

- Permanent loss of soft-sediment habitat within the footprint of the reactive substation;
- Temporary disturbance of habitats under jack up barge used to install the reactive substation;
- Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures and associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity; and
- Noise and vibration disturbance from piling and vessel movements for installation of the reactive substation having physiological and behavioural impacts on fish and shellfish species, including temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species.

**Operation and maintenance**

- Changes in sediment transport and deposition patterns as a result of the presence of reactive substation foundations and associated structures impacting on seabed spawning habitat;
- Increased habitat complexity due to introduction of hard substrate in the form of foundations and scour at the reactive substation site may result in changes to species composition;
- Local effects on fish and shellfish community structure caused by the reduction/elimination of commercial trawling as a consequence of the reactive substation position; and
- EMF from the HVAC export cabling causing a disturbance to fish and shellfish species.

5.3.4 Ornithology

5.19 Potential project impacts on ornithology outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 6.4).

5.20 Additional project impacts to be assessed:

**Construction and decommissioning**

- Disturbance and displacement of birds in the offshore cable corridor as a result of reactive substation construction; and
Reduction in prey availability through the disturbance and displacement of fish and other prey from construction vessels and foundation installation at the reactive substation site.

**Operation and maintenance**
- There will be no changes to the current assessment assumptions.

### 5.3.5 Marine mammals

5.21 Potential project impacts on marine mammals outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 6.5).

5.22 Additional project impacts to be assessed:

**Construction and decommissioning**
- Temporary disturbance and displacement effects resulting from the noise and vibration from installation of reactive substation;
- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration associated with installation of the reactive substation;
- Potential physical damage, masking effects, and disturbance resulting from the noise and vibration from installing the reactive substation; and
- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during construction of the reactive substation.

**Operation and maintenance**
- Disturbance and displacement of marine mammals resulting from the noise and vibration from servicing and maintenance vessels to the reactive substation;
- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from servicing and maintenance vessels at the reactive substation;
- The introduction of additional artificial hard substrates and underwater structures at the reactive substation will be colonised by sessile animals and algae, and may enrich the local biomass, resulting in an increase in food availability; and
- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during service and maintenance activities at the reactive substation.

### 5.3.6 Bats

5.23 Potential project impacts on bats outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 6.6).

5.24 Additional project impacts to be assessed:
- No change to current assessment assumptions.

### 5.4 OFFSHORE HUMAN ENVIRONMENT

#### 5.4.1 Commercial fisheries

5.25 Potential project impacts on commercial fisheries outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.1).

5.26 Additional project impacts to be assessed:

**Construction and decommissioning**
- Short term exclusion from established fishing grounds resulting from safety zones placed around construction vessels and plant for the reactive substation;
- Exclusion from fishing grounds as a result of reactive substation construction activity may lead to temporary increases in fishing effort in other areas that may already be heavily exploited; and
- Noise and vibration from piling and construction vessels during installation of the reactive substation may displace fish and shellfish populations from the area.

**Operation and maintenance**
- Potential for EMF impacts from export cables on elasmobranchs and other commercially important species;
- Infrastructure associated with reactive substation may provide additional habitat and refuge for commercially important species;
- Reactive substation may increase navigational risk to fishing vessels.

### 5.4.2 Ports, shipping and navigation

5.27 Potential project impacts on ports, shipping and navigation outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.2).

5.28 Additional project impacts to be assessed:

**Construction and decommissioning**
- Construction activities and vessels involved in the installation of the reactive substation may result in increased navigational risk.

**Operation and maintenance**
- Potential impact on existing infrastructure – increased risk/implications on early warning systems;
- Displacement of existing commercial routes including into areas used by other marine users such as offshore/recreational and vice versa;
- Potential for increased vessel to vessel collision risk associated with the displaced traffic;
- Potential for the reactive substation to produce radar reflections, blind spots, shadow areas or adverse effects; potential Impacts of vessels routeing to/from Humber and associated port functions.

### 5.4.3 Civil aviation and military activities

5.29 Potential project impacts on civil aviation and military activities outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.3).

5.30 Additional project impacts to be assessed:

**Construction and decommissioning**
- No change to current assessment assumptions.

**Operation and maintenance**

5.31 The following impacts, already assessed, will need to be reconsidered for the reactive substation:
- Primary Surveillance Radar (PSR) interference;
- Secondary Surveillance Radar (SSR) interference;
- Very High Frequency (VHF) communications interference;
- Satellite communications interference; and
- Fixed terrestrial link interference.

### 5.4.4 Radar and communications

5.32 Potential project impacts on radar and communications outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.4).

5.33 Additional project impacts to be assessed:
- No change to current assessment assumptions.
5.4.5 Ordnance

5.34 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 7.5).

5.35 Additional project impacts to be assessed:

Construction and decommissioning

- Reactive substation construction activities could disturb unknown Unexploded Ordnance (UXO) leading to additional risk to health and safety of construction workers and for damage to construction equipment and vessels.

Operation and maintenance

- No change to current assessment assumptions.

5.4.6 Maritime Archaeology and cultural heritage

5.36 Potential project impacts on marine archaeology outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.6).

Construction and decommissioning

- Potential damage or disturbance of archaeological sites, features and artefacts during construction of the reactive substation and additional trenches required for the HVAC export cable.

Operation and maintenance

- Potential seabed scour around reactive substation foundations and changes to the sediment regime within the area. Some impacts may be beneficial, for instance the burial of sites and features by increased sedimentation.

5.4.7 Landscape, seascape and visual amenity

5.37 Potential project impacts on landscape and seascape outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.7).

5.38 Additional project impacts to be assessed:

Construction and decommissioning

- During construction there will be short term seascape and visual impacts from machinery/equipment and activities including assembly and installation of the reactive substation.

Operation and maintenance

- Visual receptors on passenger ferries and shipping channel routes, RYA recreational cruising routes and other marine users may be impacted during maintenance activities. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral;
- Land based receptors may be impacted if the structure is visible from onshore. This will be determined and if identified will be assessed.
- The seascape is likely to experience direct impacts in the area where the reactive substation is located.

5.4.8 Airborne noise and vibration

5.39 Potential project impacts on noise and vibration outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.8).

5.40 Additional project impacts to be assessed:

Construction and decommissioning

- Potential impacts of construction noise from reactive substation on land-based and vessel-based receptors.

Operation and maintenance
• No change to current assessment assumptions.

5.4.9 **Infrastructure and other marine users**

5.4.1 Potential project impacts on infrastructure and other marine users outlined in the Scoping Report will remain the same for HVAC technology (Scoping Report Section 7.9).

5.4.2 Additional project impacts to be assessed:

**Construction and decommissioning**

- The export cable route and installation of the reactive substation may impact recreational activities, such as increased collision risk between leisure and watersport craft and construction vessels/plant and the displacement of activities from areas during the construction phase; and
- Potential to impact on existing oil and gas pipelines and infrastructure through cable laying, this will include a number of pipeline and cable crossings.

**Operation and maintenance**

- No change to current assessment assumptions.
6 ONSHORE ENVIRONMENT

6.1 A summary of the potential impacts of the new onshore components required for the HVAC transmission option is presented in Section 6.1. A more detailed consideration of the additional project impacts to be assessed, categorised under the topic areas outlined in the version 1 Scoping Report, is presented in Sections 6.2 to 6.4.

6.1 POTENTIAL NEW ONSHORE IMPACTS FROM HVAC TRANSMISSION

6.1.1 Potential new impacts from the HVAC onshore cable route and landing point

6.2 The onshore cable corridor which has been assessed covers a sufficient width to accommodate the alternative HVAC transmission option. The change in technology for an HVAC onshore export cable will result in additional impacts from EMF not considered in the Scoping Report:

- The HVAC cables will result in different impacts to those previously assumed for HVDC cables. A review to consider the potential impacts of onshore HVAC EMF will be undertaken.

6.1.2 Potential new impacts from the HVAC onshore substation

6.3 The requirement for an onshore substation prior to the grid connection at Killingholme will result in impacts not considered in the Scoping Report. Although these impacts are considered new, if an HVAC option is selected the HVDC converter station previously assumed for the HVDC option, and with very similar impacts, will not be required. All relevant chapters (as identified in Table 4.2) will be reviewed to include the potential impact of the onshore HVAC substation.

6.4 The potential new impacts of most significance, relating to the onshore HVAC substation are:

- Potential visual impacts on landscape and visual amenity. The HVAC substation may require a different building structure than previously assumed for the HVDC converter station due to the different technology, however the dimensions are assumed to be within the maximum dimensions already considered for the HVDC converter station. A review of the impact assessment for landscape and visual amenity will be undertaken to consider the potential impact of the HVAC substation.

- As noted in Section 4, HVAC EMF impacts are different to those of HVDC. New EMF impacts of the HVAC substation will need to be considered. A review of the impact assessment for onshore EMF will be undertaken to consider potential impacts of HVAC EMF.

6.2 ONSHORE PHYSICAL ENVIRONMENT

6.2.1 Geology, soils, agriculture and land use

6.5 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.1).

6.6 Additional project impacts to be assessed:

Construction and decommissioning

- Soil loss or structural damage and temporary disruption to drainage systems and farming operations from additional transition pits and cable ducts at landfall.

Operation and Maintenance

- No change to current assessment assumptions

6.2.2 Water resources

6.7 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.2).
6.8 Additional project impacts to be assessed:

**Construction and decommissioning**
- No change to current assessment assumptions

**Operation and Maintenance**
- Heat generation from the cables that may potentially be located within groundwater sources

6.2.3 Air quality
6.9 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.3).
6.10 Additional project impacts to be assessed:

**Construction and decommissioning**
- No change to current assessment assumptions

**Operation and Maintenance**
- No change to current assessment assumptions

6.3 **ONSHORE BIOLOGICAL ENVIRONMENT**

6.3.1 Terrestrial ecology and nature conservation
6.11 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.4).
6.12 Additional project impacts to be assessed:

**Construction and decommissioning**
- Temporary displacement of species as a result of additional construction activities.
- Disturbance to habitats or species as a result of noise, vibration, lighting and construction activities.

**Operation and Maintenance**
- No change to current assessment assumptions

6.4 **ONSHORE HUMAN ENVIRONMENT**

6.4.1 Archaeology and cultural heritage
6.13 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.5).
6.14 Additional project impacts to be assessed:

**Construction and decommissioning**
- Potential impacts on buried archaeology by additional transition pits at landfall;
- Greater impacts on buried archaeology at depths of 2 m or more as a result of a larger cable trench(es).

**Operation and Maintenance**
- No change to current assessment assumptions

6.4.2 Landscape and visual amenity
6.15 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.6).
6.16 Additional project impacts to be assessed:
Construction and decommissioning  
- No change to current assessment assumptions

Operation and Maintenance  
- No change to current assessment assumptions

6.4.3 Flood risk  
6.17 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.7).
6.18 Additional project impacts to be assessed:  
**Construction and decommissioning**  
- Temporary changes to natural surface water drainage patterns and run-off rates, and resultant potential for flooding on, or arising from construction of above ground infrastructure as a result of additional construction.
**Operation and Maintenance**  
- No change to current assessment assumptions

6.4.4 Traffic and transport  
6.19 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.8).
6.20 Additional project impacts to be assessed:  
**Construction and decommissioning**  
- No change to current assessment assumptions
**Operation and Maintenance**  
- No change to current assessment assumptions

6.4.5 Noise and vibration  
6.21 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.9).
6.22 Additional project impacts to be assessed:  
**Construction and decommissioning**  
- No change to current assessment assumptions
**Operation and Maintenance**  
- No change to current assessment assumptions

6.4.6 Socioeconomics, recreation and tourism  
6.23 Potential project impacts outlined in the Scoping Report will remain the same (Scoping Report Section 8.10).
6.24 Additional project impacts to be assessed:  
**Construction and decommissioning**  
- No change to current assessment assumptions
**Operation and Maintenance**  
- No change to current assessment assumptions
6.4.7 Electromagnetic fields

6.25 Although not originally specified in the Scoping Report, the impact of EMF from the onshore element of the export cable has been assessed for HVDC as part of the EIA process. As noted at the start of this Section, HVAC EMF impacts are different to those of HVDC, and will need to be considered in a review of the relevant chapters.

6.26 Additional project impacts to be assessed:

Construction and decommissioning

- No EMF related impacts are anticipated during the installation of the HVAC export cable onshore.

Operation and Maintenance

- Potential change of potential impacts on human health associated with HVAC transmission system.
7 ENVIRONMENTAL STATEMENT CONTENTS

7.1 Through consultation with stakeholders and rationalisation of the potential impacts and effects of Project One on the physical, biological and human environment, the ES structure has been updated from that proposed in the Scoping Report (Scoping Report, Section 9). The new structure is set out below:

Non-Technical Summary
Introductory Volume
1 Introduction
2 Policy and Legislation
3 Project Description
4 Site Selection and Alternatives
5 Assessment Methodology
6 Socioeconomics
7 Nature Conservation

Offshore Volume
Physical Environment
1 Marine Geology, Bathymetry, Seabed Features and Sediments
2 Marine Processes and Water Quality
3 Underwater Noise and Vibration

Biological Environment
4 Benthic and Epibenthic Ecology
5 Fish and Shellfish Ecology
6 Marine mammals
7 Ornithology

Human Environment
8 Commercial Fisheries
9 Shipping and Navigation
10 Military and Aviation, Radar and Communications
11 Archaeology and Ordnance
12 Seascape and Visual Resources
13 Infrastructure and Other Users

Summary
14 Summary of Impacts
15 Summary of Monitoring

Onshore Volume
Physical Environment
1 Geology and Ground Conditions
2 Hydrology and Flood Risk

Biological Environment
3 Ecology and Nature Conservation

Human Environment
4 Landscape and Visual Resources
5 Historic Environment
6 Land Use, Agriculture and Recreation
7 Traffic and Transport
8 Noise and Vibration
9 Climate, Air Quality and Health

Summary
10 Summary of Impacts
11 Summary of Monitoring

Technical Appendices
8 MITIGATION AND MONITORING

8.1. All potential mitigation and monitoring options remain unchanged from the Scoping Report (Scoping Report, Table 10.2)
9 CONSULTATION

9.1 The inclusion of an HVAC transmission option will not result in any changes to the broad consultation strategy or intent. SMart Wind is committed to a robust stakeholder engagement process and will be extending the original consultation period to ensure the impact of these changes is fully communicated to all. A revised Statement of Community Consultation (SoCC) will be issued, following the publication of this Scoping Report Addendum, which will set out a revised consultation process to take account of the inclusion of HVAC design options.

9.2 The application for the DCO for Project One was initially intended to occur in 2012. With the addition of an HVAC transmission option, and due to SMart Wind’s commitment to robust stakeholder consultation, the DCO application is now planned for Q1 2013.
10 CONTACT DETAILS

The contact address for SMart Wind is:
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11th Floor
140 London Wall
EC2Y 5DN
Email: info@SMartWind.co.uk
This report has been prepared by Emu Limited, with all reasonable skill, care and diligence within the terms of the Contract with SMart Wind Ltd.
<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AA</td>
<td>Appropriate Assessment</td>
</tr>
<tr>
<td>AAA</td>
<td>Anti-Aircraft Artillery</td>
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<tr>
<td>ACMI</td>
<td>Air Combat Manoeuvring Instrumentation</td>
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<td>ADS</td>
<td>Archaeology Data Service</td>
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<td>AGA</td>
<td>Air-Ground-Air AIS Automatic Identification System</td>
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<td>Acoustic Ground Discrimination System</td>
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<td>AHD</td>
<td>Acoustic Harassment Device</td>
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<td>AIP</td>
<td>Aeronautical Information Publication</td>
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<td>ANSP</td>
<td>Air Navigation Service Providers</td>
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<td>AON</td>
<td>Apparently Occupied Nests</td>
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<td>Area of Outstanding Natural Beauty</td>
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<td>Air Surveillance and Control System</td>
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<td>Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas</td>
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<td>AWACS</td>
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<td>BAG</td>
<td>Before-After-Gradient</td>
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<td>Biodiversity Action Plan</td>
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<td>British Broadcasting Corporation</td>
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<td>Botney Cut Formation</td>
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<td>Bolders Bank Formation</td>
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<td>Department for Business Enterprise and Regulatory Reform</td>
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<td>British Geological Survey</td>
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<td>Ballistic Missile Early Warning System</td>
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<td>British Oceanographic Data Centre</td>
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<tr>
<td>BP</td>
<td>Before present</td>
</tr>
<tr>
<td>BRE</td>
<td>Buildings Research Establishment</td>
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<td>BTO</td>
<td>British Trust for Ornithology</td>
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<td>British Wind Energy Association (now RenewableUK)</td>
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<td>Civil Aviation Authority</td>
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<td>Construction, Design and Management Regulations</td>
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<td>Centre for Environment, Fisheries and Aquaculture Science</td>
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<td>CNPMEM</td>
<td>Comité National des Pêches Maritimes et des Elevages Marins</td>
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<td>CNS</td>
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<td>CO₂</td>
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<td>Joint Radio Company</td>
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<td>MLS</td>
<td>Microwave Landing System</td>
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<td>Marine Management Organisation</td>
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<td>MOD</td>
<td>Ministry of Defence</td>
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<td>MSD</td>
<td>Minimum Separation Distance</td>
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<td>MW</td>
<td>Mega Watt</td>
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<td>North Atlantic Treaty Organization</td>
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<td>NATS En Route Ltd</td>
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<td>Full Form</td>
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<td>UKHO</td>
<td>UK Hydrographic Office</td>
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<td>ULSD</td>
<td>ultra low sulphur diesel</td>
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<td>UN</td>
<td>United Nations</td>
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<td>USAF</td>
<td>United States Air Force</td>
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<td>UXO</td>
<td>Unexploded Ordnance</td>
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<td>VHF</td>
<td>Very High Frequency</td>
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<td>VMS</td>
<td>Vessel Monitoring System</td>
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<td>VOR</td>
<td>VHF Omni-directional Radio Range</td>
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<td>Second World War</td>
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<td>Yarmouth Roads Formation</td>
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<td>Zone Assessment Methodology</td>
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<tr>
<td>ZAP</td>
<td>Zone Appraisal and Planning</td>
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<td>Zone Development Agreement</td>
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<td>ZEA</td>
<td>Zone Environmental Assessment</td>
</tr>
<tr>
<td>ZoC</td>
<td>Zone Characterisation</td>
</tr>
<tr>
<td>ZTVs</td>
<td>Zones of Theoretical Visibility</td>
</tr>
</tbody>
</table>
Glossary

Application  
An application for development consent for a project identified for consenting in the planning element of ZAP that is to be submitted to the Infrastructure Planning Commission (IPC). This may include onshore, grid connection, offshore cable route and within-Zone activities.

Appropriate Assessment (AA)  
an element of Habitats Regulations Assessment (see below).

Block  
Offshore wind farm with capacity in the region of 500 to 600 Mega Watts (MW)

Cumulative Impact Assessment (CIA)  
an assessment designed to address cumulative impacts at a suitable scale e.g., Zone or project specific.

Environmental Impact Assessment (EIA)  
a process which identifies the environmental effects (both negative and positive) of development proposals in accordance with the requirements of the EU Environmental Impact Assessment Directive (as transposed into UK law through various sets of EIA Regulations).

EIA Regulations  

Floatel  
A portmanteau of the terms floating hotel, refers to the installation of living quarters on top of rafts or semi-submersible platforms.

Habitats Regulations Assessment (HRA)  
an assessment made by a competent authority under the Conservation of Habitats and Species Regulations 2010 (the Habitats Regulations) and the Offshore Marine Conservation (Natural Habitats etc) Regulations 2007 (SI 2007 No. 1842) (the Offshore Habitats Regulations) (as amended) of any significant effects on internationally important nature sites likely to arise from the proposals. These internationally important nature sites include Special Areas of Conservation (SAC) - which have important habitat features, Special Protection Areas (SPAs) - which relate to bird populations and Ramsar sites - which are internationally important wetlands. These are often referred to as Natura 2000 sites.

In-combination Impacts  
effects on sensitive receptors that arise from different industry sectors within the same region or Zone.

Infrastructure Planning Commission (IPC)  
an independent body that decides applications for nationally significant infrastructure projects. These are large projects that support the economy and are vital public services, including railways, large wind farms, power stations, reservoirs, harbours, airports and sewage treatment works.

Nacelle  
a cover housing (separate from the fuselage) that holds engines, fuel, or equipment on a wind turbine.

Primary production  
Primary production is the production of organic compounds from atmospheric or aquatic carbon dioxide, principally through the process of photosynthesis.

Project One  
The first two offshore wind farms within the Hornsea Round 3 Zone with associated offshore cable route and onshore infrastructure.

Renewable Energy Zone (REZ)  
The area of UK waters designated pursuant to Section 84 of the Energy Act 2004.

Strategic Environmental Assessment (SEA)  
The UK Offshore Energy SEA which has been carried out by the Department of Energy and Climate Change.

Subzone  
The study area around the two Blocks that comprise a project.

Subzone 1  
The first Subzone in the Hornsea Round 3 Zone to be developed.

Vivier  
vessels with onboard systems to keep shellfish stock alive and in good condition for market whilst at sea.
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>Zone</td>
<td>The area of the seabed (which may be within the territorial limits of the UK and/or within the Renewable Energy Zone (REZ)) demarcated by the TCE for wind farm development in Round 3 and, in the context of this document, the Hornsea Zone. A distinction between the terms &quot;Zone&quot; and &quot;Zone Development Envelope&quot; is made to avoid confusion over &quot;Zone&quot; being adopted for wider use beyond that defined by TCE for Round 3. Further, please see definition of &quot;Zone Development Envelope&quot;.</td>
</tr>
<tr>
<td>Zone Appraisal and Planning (ZAP)</td>
<td>A framework intended to rationalise and balance the commercial aim of maximising development capacity aspirations with the practicalities of deliverability.</td>
</tr>
<tr>
<td>Zone Appraisal</td>
<td>An appraisal of the capacity of the Zone by looking at consenting (with a focus on environment constraints, Zone stakeholder consultation), construction, operation and connection and determining the associated optimised Zone layout for wind farms through a process of data collation and interrogation.</td>
</tr>
<tr>
<td>Zone Assessment Methodology (ZAM)</td>
<td>A document which describes the methods to be used to assess impacts across the Zone. These are implemented within the ZEA.</td>
</tr>
<tr>
<td>Zone Characterisation (ZoC)</td>
<td>A broad description of the physical, biological, socio-economic and cultural heritage characteristics of the Zone at a resolution sufficient to support Zone layout and subsequent project identification. This will not necessarily take the form of a tangible output, but reflects the increase in understanding of the Zone over time.</td>
</tr>
<tr>
<td>Zone Development Agreement (ZDA)</td>
<td>A contractual arrangement for Round 3 wind farm development between developer and TCE and, in the context of this document, the Agreement between TCE and SMart Wind Limited dated 22 December 2009.</td>
</tr>
<tr>
<td>Zone Development Envelope (ZDE)</td>
<td>The area comprising all development associated with the Zone including: the Round 3 Zone (as defined by TCE), onshore grid connection corridors and infrastructure and offshore cable corridors. The involvement of OFTOs in the development of Round 3 sites means that the Zone developer may not design and develop the transmission aspects of the projects themselves, but these will need to be considered in some form as part of the development of the Zone as a whole.</td>
</tr>
<tr>
<td>Zone Environmental Assessment (ZEA)</td>
<td>A report which presents the results from the Zone-wide assessment. This incorporates information from the ZoC, implements the methodologies set out in the ZAM, and describes potential cumulative and in-combination effects across the Zone.</td>
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1 INTRODUCTION

1.1. This Scoping Report considers the first offshore wind farm Project within the Hornsea Round 3 Zone and associated offshore cable route and onshore infrastructure, hereafter referred to as ‘Project One’. This is proposed by SMart Wind Limited (SMart Wind), a consortium of Mainstream Renewable Power Limited ("Mainstream") and Siemens Project Ventures GmbH ("SPV"). With an estimated capacity of 1.2 Gigawatt (GW), this first project is one of a number of future wind farm projects being designed within the Hornsea Zone to meet the target capacity of 4 GW by year 2020.

1.2. The Hornsea Round 3 Zone is located in the central region of the North Sea, covering an area of 4735 km² (Figure 1-1). The East Riding of Yorkshire coast lies 31 km to the west of the Zone’s boundary. The Zone’s eastern boundary is 1 km from the median line between UK and Netherlands waters.

1.3. Project One will comprise two wind farm ‘Blocks’, each of approximately 600 MW, plus all infrastructure to the onshore grid connection. The two Blocks will be situated within ‘Subzone 1’ located in the centre of the Hornsea Round 3 Zone, Subzone 1 covers an area of 619.6 km² (Figure 1-1). The East Riding of Yorkshire coast lies 103 km to the west of the boundary of Subzone 1. The eastern boundary of Subzone 1 is 39.6 km from the median line between UK and Netherlands waters.

1.4. Project One has secured a grid connection agreement for 1 GW and will connect to Killingholme substation, an existing 400 kV substation located in the Humber region which is owned by National Grid (Figure 1-2).

1.5. Project One represents a single application for a Development Consent Order (DCO) under the Planning Act 2008. The DCO application will comprise full details of the development proposal and will be accompanied by an Environmental Statement (ES) prepared in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the ‘EIA Regulations’) and supporting documents.

1.6. The Environmental Impact Assessment (EIA) will be informed by responses to this Scoping Report. Specifically, in accordance with Regulation 8 of the EIA Regulations, a Scoping Opinion is requested from the Infrastructure Planning Commission (IPC).
The promoter of this project, and the overall development of the Hornsea Zone, is SMart Wind. SMart Wind is a 50/50 joint venture between Mainstream and Siemens. SMart Wind has been created specifically for the development of the Hornsea Zone.

SPV is a global powerhouse in electronics and electrical engineering, operating in the industry, energy and healthcare sectors. Mainstream is a leading developer of large scale renewable energy projects that accelerate global progress towards a sustainable future.

Emu Ltd. has been commissioned by SMart Wind to undertake an EIA for Project One. This includes the initial review of the key environmental issues associated with the construction, operation and decommissioning of Project One. Emu Ltd. has also been commissioned to characterise the environment for the entire Hornsea Zone (Zone Characterisation (ZoC), November 2010b), which informed this scoping exercise.

Supporting Emu Ltd. throughout the EIA process are a number of organisations with specialist offshore expertise of EIA, including HR Wallingford, Cork Ecology, Craighton Ecological Services, NFFO, Poseidon ARM Ltd, BAE Systems Insyte, Pelagica, Anatec UK Ltd and SQW.

Land Use Consultants has provided the environmental and planning advice for the onshore study area.

Legal advice has been provided by Shepherd and Wedderburn LLP.

The Crown Estate (TCE) awarded SMart Wind the right to develop 4000 MW (4 GW) of wind capacity off the east coast of England, in Zone 4 (the Hornsea Zone), under the Round 3 Offshore Wind Licensing Arrangements.

The right to develop the Hornsea Zone is subject to SMart Wind being successful in gaining the necessary consents and licences from statutory bodies for the construction, operation and decommissioning of each of the individual wind farms that will be located within the Hornsea Zone.

The plan to develop the remainder of the Hornsea Zone is likely to consist of a number future Projects which have not been fully defined at this stage.
1.16. This Scoping Report applies only to Project One. Any future Projects within the Hornsea Zone will be termed Project Two, Project Three (etc.) and will each require a new Scoping Report that will consider the additional offshore and onshore infrastructure as a separate application to the IPC.

1.3 PURPOSE OF THIS DOCUMENT

1.3.1 Aims

1.17. The purpose of this Scoping Report is to inform stakeholders about Project One and receive input to ensure a robust EIA is undertaken. This document therefore sets out the proposed content, key issues and methodologies to be followed for the EIA, the results of which will be included in the ES to be submitted with the DCO application.

1.18. SMart Wind is planning to submit the application and supporting documentation for Project One in 2012, following a period of formal consultation.

1.19. This Scoping Report has a number of key functions:
- To present the key environmental issues and to propose an approach to data gathering, data analysis and assessment for comment and agreement by key regulators;
- To present key considerations such as Appropriate Assessment, cumulative and in-combination assessment and the consultation strategy; and
- To engage with the IPC, regulators and stakeholders in the EIA process, inviting them to provide baseline information and to comment on the proposed approach to the EIA.

1.20. The identification and subsequent assessment of potentially significant impacts will be based upon an understanding of the environmental conditions likely to be encountered within Project One, utilising information gained from the Hornsea Zone and other wind farm studies.

1.21. A number of environmental topics are considered in this Scoping Report. These include those topics which are proposed to be ‘scoped out’ at this stage where no effect-receptor pathways can be indentified. Only once evidence is sufficiently advanced to be confident that no effects or effect-receptor pathways exist, will topics be finally scoped out.

1.3.2 Get Involved

1.22. There are a number of ways that stakeholders (including non-statutory consultees) can be involved in the EIA process during this scoping stage. A programme of consultation will be undertaken to fulfil both environmental and planning regulations, and enable all stakeholders to comment on the proposed scheme and studies throughout the process, including the consideration of alternative onshore cable route options.

1.23. There are a number of specific questions given within this Scoping Report to focus responses, but comments on all aspects are welcome. Contact details are given in Section 13.

1.24. In the case of Project One, all onshore infrastructure will be located within (some or all of the following administrative areas, with the final areas subject to the final scheme layout for onshore infrastructure) the districts of West Lindsey and East Lindsey, the unitary authorities of City of Kingston upon Hull, East Riding of Yorkshire, North East Lincolnshire, and North Lincolnshire, and the county of Lincolnshire. The relevant local authorities are:
- West Lindsey District Council;
- East Lindsey District Council;
- Lincolnshire County Council;
- Hull City Council;
- East Riding of Yorkshire Council;

1 The preparation of the Environmental Statement (ES), under the Planning Act is governed by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. These regulations are designed to ensure that the pre-application publicity and consultation requirements of the EIA process are consistent with those of the Planning Act (through implementation of Regulations 9, 10 and 11).
North East Lincolnshire Council; and
North Lincolnshire Council.

1.4 DOCUMENT STRUCTURE

1.25. This Scoping Report has followed the advice and guidance notes available on the IPC website (www.independent.gov.uk/infrastructure).

1.26. The remainder of this Scoping Report is structured as follows:

- **Section 2**: provides the policy and legislative context for obtaining a consent to develop Project One;
- **Section 3**: provides a description of the development required for Project One, including the Zone wide studies, Subzone selection, alternatives to the development, the project description and an overview of health and safety applications to Project One;
- **Section 4**: describes the general methodology proposed for EIA, including the approach to impact assessment; cumulative and in-combination assessment, transboundary impacts and mitigation;
- **Section 5**: identifies key potential offshore physical receptors for Project One and provides a summary of the offshore environmental baseline, assessment methodology, potential impacts (cumulative, in-combination and transboundary) and mitigation for each;
- **Section 6**: identifies key potential biological offshore receptors for Project One and provides a summary of the offshore environmental baseline, assessment methodology, potential impacts (cumulative, in-combination and transboundary) and mitigation for each;
- **Section 7**: identifies key potential human offshore receptors for Project One and provides a summary of the offshore environmental baseline, assessment methodology, potential impacts (cumulative, in-combination and transboundary) and mitigation for each;
- **Section 8**: identifies key potential onshore receptors for Project One and provides a summary of the onshore environmental baseline, assessment methodology, potential impacts (cumulative, in-combination and transboundary) and mitigation for each;
- **Section 9**: provides the draft contents for the ES.
- **Section 10**: provides a summary of potential environmental impacts, mitigation and monitoring anticipated for Project One along with a summary of identified potential transboundary impacts;
- **Section 11**: provides the consultation processes applicable to this application and the consultees to be consulted as part of this scoping exercise;
- **Section 12**: sets out focused scoping questions;
- **Section 13**: provides contact details for the developer; and
- **Section 14**: provides full citations for all references within the scoping report.
2 POLICY AND LEGISLATIVE CONTEXT

2.1 The Planning Act 2008 has made significant changes to the planning system applicable to offshore wind development. Project One is a development over 100 MW and therefore classified as a Nationally Significant Infrastructure Project (NSIP) and will require a DCO issued by the IPC.

2.2 Under the current coalition government, the IPC is to be replaced by a Major Infrastructure Planning Unit (MIPU) operating as part of the Planning Inspectorate. This is due to happen in April 2012 (House of Commons Library, 2010). Decisions on major infrastructure projects will be taken by Ministers in accordance with the policy framework provided in National Policy Statements (NPSs), and on the basis of recommendations by the new MIPU.

2.3 The IPC’s fast-track application and examination processes will be retained. Under the MIPU, the statutory timetable for decision-making will be no longer than the current regime. The MIPU will be implemented through primary legislation, with transitional arrangements for ongoing applications.

2.4 Until new legislation is in place, the IPC will continue in its present role. If an application reaches decision stage and the relevant NPS has not been designated, the IPC will make a recommendation to the Secretary of State, who will take the decision. If the NPS is in place, the IPC will decide the application.

2.5 For those applications under active consideration by the IPC when it is abolished, transitional provisions will enable the examination of such applications to continue without interruption, whilst transfer to the new MIPU occurs.

2.1 NATIONAL POLICY

2.6 One of the outcomes of the Planning Act 2008 was the commitment to create a series of National Policy Statements (NPSs) that will set out national policy in relation to specified descriptions of development.

2.7 Three draft NPSs are relevant to Project One, as they will establish and confirm the need for energy infrastructure in the UK, including the development of offshore wind farms:
- NPS overarching energy (EN-1) (DECC, 2010a);
- NPS electricity networks infrastructure (EN-5) (DECC, 2010b); and
- NPS renewable energy infrastructure (EN-3) (DECC, 2010c).

2.8 The need for all types of electricity generation is outlined in Draft NPS (EN-1). The draft NPS (EN-1) states on page 16 that the IPC should assess all development consent of the types of applications for infrastructure covered by the energy NPSs on the basis that the need for those types of infrastructure has been demonstrated by the Government and that this need is urgent.

2.9 The draft NPSs establish the case for NSIPs, having integrated economic, environmental and social objectives in order to deliver sustainable development. They provide a clear statement of policy and the nature of infrastructure development necessary to deliver the Government’s wider goals of improving people’s quality of life, economic prosperity and protecting and enhancing the environment. The Secretary of State will base his decision whether or not to grant consent on the basis of the NPSs.

2.10 The Draft Marine Policy Statement (MPS) is the framework for preparing Marine Plans and taking decisions that affect the marine environment. The MPS sets out policies that shape the management and use of our marine resources and will apply to all UK waters.

2.11 The MPS will be used, and referred to, by a wide range of public authorities (including planning authorities) as well as developers and other users of the marine area. The Marine and Coastal Access Act 2009 requires all public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area to do so in accordance with the MPS and relevant Marine Plans unless relevant considerations indicate otherwise.
2.2 REGIONAL PLANNING POLICY
2.12 Regional Spatial Strategies were revoked by the Secretary of State for Communities and Local Government on the 6 July 2010. This decision by the Secretary of State is currently under judicial review in a number of cases. The ruling in the first case was that the revocation was not lawful. An appeal against this ruling is expected. Pending the outcome of these cases only regional polices specifically referencing the proposed development will be taken into account for the ES.

2.3 LOCAL PLANNING POLICY
2.13 The grid connection point at Killingholme will be within North Lincolnshire Council. As such the most relevant local policy documents include:
- North Lincolnshire Local Plan (North Lincolnshire Council, 2003);
- North Lincolnshire Infrastructure Delivery Plan (North Lincolnshire Council, 2010a);
- Local Development Framework Core Strategy Submission Draft (North Lincolnshire Council, 2010c);
- Local Transport Plan – 2006 to 2011 (North Lincolnshire Council, 2006);
- Strategic Flood Risk Assessment for North and North east Lincolnshire (North Lincolnshire Council, 2010b);
- Draft North Lincolnshire Economic Development Strategy (North Lincolnshire Council, 2009b); and

2.4 CLIMATE CHANGE POLICY
2.14 Climate change is a major concern for society as it affects our environmental, economic and social stability. Scientific literature reiterates the need to ease the production and emission of damaging levels of greenhouse gases into the atmosphere arising from agriculture, industrial airborne emissions and the burning of fossil fuels for energy and transport.

2.15 Acknowledging climate change, the United Nations convened the UN Framework Convention on Climate Change (The Earth Summit) in Rio de Janeiro in June 1992. The treaty arising from this convention was itself not binding, but it did provide for legally binding protocols, such as the Kyoto Protocol.

2.16 The development of renewable energy from the proposed development in Project One will help to offset the emission of greenhouse gases in line with the UK’s commitments under the Kyoto Protocol. The European Union’s (EU) overall emissions target under the Kyoto Protocol is a reduction of greenhouse gas emissions to 8% below 1990 levels by the commitment period of 2008 to 2012. The UK Government’s Climate Change Programme set out additional targets including a reduction of greenhouse gas emissions to 12.5% below 1990 levels by 2012 and cutting carbon dioxide (CO$_2$) emissions to 20% below 1990 levels by 2020.

2.17 Beyond 2020, the Climate Change Act 2008 has set a revised target of reducing CO$_2$ emissions by 80% by 2050 (following the work set out in the two previous White Papers). The primary objective of the proposed development is to generate renewable energy, in line with the government target of generating 20% of UK electricity demand from renewable sources by 2020.

2.5 RENEWABLE ENERGY
2.18 In March 2007, a binding target for 20% of overall EU energy consumption to be supplied by renewable sources by 2020 was agreed by the European Council. While many of the 27 EU Member States do not have sufficient resources to significantly contribute to this target, the UK is perceived to be one of the countries with a significant natural resource and access to extract this resource economically. The UK Renewable Energy Strategy was published in July 2009, and sets out how the UK will meet its share of the new EU targets.

2.19 The UK Government’s targets for renewable energy will help the UK to meet its international obligations, but also obtain greater security of energy supply through the promotion of
The construction of both onshore and offshore wind farms is expected to be the largest contributor to the development of the renewable energy sector, providing the greatest contribution to the targets.

2.20 The Energy Act 2008 implements the legislative aspects of the Energy White Paper 2007 (DTI, 2007). It was the Energy Act 2004 that enabled TCE to award licences for offshore wind farm development in the Renewable Energy Zone (REZ), and established a legal framework for offshore renewable energy projects beyond the UK's territorial waters.

2.21 As of October 2010, the UK had an installed offshore wind generation capacity of 1,341 MW. There is a further 1,153 MW under construction offshore in England and, within England and Wales, there is an additional 2,620 MW that has been consented. In England there is 2,260 MW in planning. Considering all of these values together the total offshore generation capacity in the UK (consented and submitted for consenting) is currently 7,373 MW (Renewable UK, 2010).

2.6 OFFSHORE WIND

2.6.1 Strategic Environmental Assessment


2.23 The Directive’s stated objective is: "to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment."

2.24 The Environmental Assessment of Plans and Programmes Regulations 2004 applies the SEA Directive to any plan or programme which relates either solely to the whole or any part of England or to England and other parts of the UK. The Regulations also apply to the territorial waters of the United Kingdom that are not part of Northern Ireland, Scotland or Wales, and waters in any area designated under Section 1(7) of the Continental Shelf Act 1964.

2.25 SEA is the process of appraisal through which environmental protection and sustainable development may be considered, and factored into national and local decisions regarding government (and other) plans and programmes – such as offshore energy developments. The process aims to help inform ministerial decisions through consideration of the environmental implications of the proposed action.

2.26 The Offshore Energy SEA (DECC, 2009a) was undertaken to enable further rounds of offshore wind leasing in UK waters. The environmental report for this SEA was published for consultation in January 2009, providing consideration of areas identified by TCE as offering ‘indicative economic potential for offshore wind’ as part of a UK wide assessment. Following the consultation period, the Government’s decision on the SEA and TCE’s Round 3 Zones was published on 24th June 2009 (DECC, 2009d), which was to adopt a plan/programme for offshore energy (up to 25 GW) generation to go ahead, therefore allowing TCE to continue with the competitive Round 3 leasing process.

2.27 The main potential sources of environmental effects identified within the SEA report are:

- Noise (impulsive) from seismic survey and piling during installation;
- Noise (semi-continuous or continuous) from turbines, drilling rigs, production facilities or vessels;
- Physical damage (acute) to seabed features, biota and features of archaeological interest from anchoring, pipeline construction and cable laying;
- Physical damage (non-acute) from particulate smothering;
- Physical presence of structures, colonisation of structures by organisms, avoidance of wind farm areas e.g., by birds, animal collisions with structures and turbine blades;
- Physical presence of structures, interference with other users of the sea;
- Physical presence of structures, visual intrusion;
- Chemical contamination (routine) from drilling and other discharges, antifouling coatings etc;
- Chemical contamination (accidental) from spills;
- Atmospheric emissions from fuel combustion, venting; and
- Electromagnetic fields, possible effects on electrically or magnetically sensitive species from subsea power cables.

2.28 The broad conclusions of the UK Offshore Energy SEA are:

- “The SEA recommends that within certain key areas of marine mammal sensitivity, operational criteria are established to limit the cumulative pulse noise “dose” (resulting from seismic survey and pile-driving) to which these areas are subjected. It will be necessary to consult with both industries to define the terms of such criteria; however, a simple approach could be implemented within the existing regulatory framework for activity consenting, particularly if initially developed and adopted voluntarily in collaboration within the industries (as was the case, initially, with the existing JNCC mitigation guidelines). The approach would also require a mechanism to facilitate the exchange of information, for example through a web-based forum hosted by DECC, JNCC or the future MMO;”

- “The assessment concludes that, based on available evidence, displacement, barrier effects and collisions are all unlikely to be significant to bird populations at a strategic level; and

- “To attain the 25 GW objective of the draft plan/programme, several thousand wind turbines would be needed which, depending on turbine spacing and wind farm separation, may occupy up to 10,000 km². Development on this scale is judged to have the potential to result in significant environmental effects on areas or landscapes of recognised national, European Community or international protection status, as well as on other uses of the sea. Coastal areas typically have higher environmental sensitivity, both in ecological terms (for example waterbirds and seabed habitats), and in existing human uses (for example shipping, fishing and yachting). Tourism and recreation are key activities and industries in coastal areas, many of which are also protected landscapes such as National Parks. Reflecting the relative sensitivity of multiple receptors in coastal waters, this report concludes that the bulk of this new generation capacity should be sited well away from the coast, generally outside 12 nautical miles (22 km). The proposed coastal buffer zone is not intended as an exclusion zone, since there may be scope for further offshore wind development within this area, but as mitigation for the potential environmental effects of development which may result from this draft plan/programme. The environmental sensitivity of coastal areas is not uniform, and in certain cases new offshore wind farm projects may be acceptable closer to the coast. Conversely, a coastal buffer in excess of 12 nm may be justified for some areas/developments. Detailed site-specific information gathering and stakeholder consultation is required before the acceptability of specific major Round 3 or subsequent wind farm projects close to the coast can be assessed. Marine spatial planning proposals are under consideration in Parliament, which would give coastal regulators and communities further opportunities to have a say in the way the marine environment is managed, in addition to the existing routes for consultation as part of the development consent process”.

2.29 SMart Wind considers the SEA, Zone Appraisal and Planning (ZAP) and EIA process to form a nested approach (Figure 2-1). The Offshore Energy SEA attempts to provide broad areas where development is feasible, with an assessment of the importance of areas from the perspective of the UK Government. ZAP provides SMart Wind with means to strategically appraise the Hornsea Zone to allow planning for the siting of multiple ‘Blocks’ of wind turbines in a logical and consistent way. It also allows for Zone level characterisation and assessment of cumulative/in-combination effects to underpin future development schemes and support EIA. The EIA can then focus on site specific issues at the appropriate scale and to the level of detail required to determine the significant issues.
2.30 Subzone 1 is fully located within TCE’s Round 3 Zone 4 Hornsea boundary and therefore conforms to the strategic development plan/programme for Round 3 under the SEA. During completion of the EIA for Project One, consideration will be given to the conclusions of the SEA Environmental Report (2009) and the subsequent strategic level Appropriate Assessment (AA), together with the consultation responses to the SEA, as given in the post-consultation report (DECC, 2009d).

2.31 In addition to those reports mentioned in the previous paragraph, consideration will also be given to examples of best practice that are appropriate to Project One. An indicative list includes:

- DCLG consultation on proposed amendments to Circular 02/99 and on new EIA guidance;
- IPC advice and guidance documents on the IPC website (www.independent.gov.uk/infrastructure);
- Countryside Agency/Scottish Natural Heritage (2003). Landscape Character Assessment Series Topic Paper 9: Climate change and natural forces, the consequences for landscape character;
- Countryside Agency and Scottish Natural Heritage (2002). Landscape Character Assessment Guidance for England and Scotland;
- Scottish Natural Heritage (2001). Guidelines on the Environmental Impacts of Wind Farms and Small Scale Hydro-electric Schemes. SNH;

- Scottish Natural Heritage (2005). *Cumulative Effects of Wind Farms*. SNH;
- Scottish Natural Heritage (2009). *Siting and Designing Wind Farms in the Landscape*. SNH; and

### 2.7 PLANNING CONTEXT

2.32 As the MIPU is planned to replace the IPC in April 2012, this Scoping Report for Project One falls under the auspices of the current consenting regime with the IPC. SMart Wind will observe changes to the planning framework and responsible authorities from which development consent for Project One will be sought.

2.33 The original EU Directive on Environmental Impact Assessment of the effects of projects on the environment (EIA Directive) was introduced in 1985 and was amended in 1997, 2003 and 2009. This outlines which project categories shall be subject to an EIA, which procedure shall be followed, and the content of the assessment. Article 3 of the EU EIA Directive states that: "The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 11, the direct and indirect effects of a project on the following factors:

- Human beings, fauna and flora;
- Soil, water, air, climate and the landscape;
- Material assets and the cultural heritage; and
- The interaction between the factors mentioned in the first, second and third indents."

2.34 The EIA procedure ensures that environmental consequences of projects are identified and assessed before authorisation is given. The public can give its opinion and all results are taken into account in the authorisation procedure of the project. The public is informed of the decision afterwards. The EIA Directive has been transposed into UK law through numerous pieces of legislation depending on the particular activity and whether activities are on or offshore, as discussed above.

### 2.8 DEVELOPMENT CONSENT AND EIA

#### 2.8.1 The Planning Act 2008

2.35 As previously mentioned, the Planning Act 2008 introduces a new system for approving NSIPs in England and Wales. The majority of the Act is concerned with the creation of the new system, which comprises three parts. The first is the designation of a series of National Planning Statements (NPSs) that sets out national policy in relation to specified descriptions of development. The second is the creation of a new independent body, the IPC, which would normally be the decision making body in respect of NSIPs, including offshore wind farms over 100 MW. The third and final element is the DCO that could be granted by the IPC and which would streamline the current consents process required for major infrastructure projects. Revisions to the Planning Act with regard to the IPC will be monitored by SMart Wind.

2.36 The DCO (in some cases) replaces the need for other consents to be obtained. This includes planning permission under Part 3 of the Town and Country Planning Act (TCPA) 1990, listed building consent under section 8 of the Planning (Listed Buildings and Conservation Areas) Act 1990, conservation area consent under section 74 of the Listed Buildings Act, scheduled monument consent in England and Wales under section 2 of the Ancient Monuments and Archaeological Areas Act 1979.
2.37 Under the Planning Act, the DCO may include a deemed consent of a Marine Licence\(^2\) and may remove the requirement for certain prescribed consents or authorisations to be granted as protective provisions have been inserted into the DCO.

2.8.2 The Marine and Coastal Access Act 2009

2.38 The Marine and Coastal Access Act 2009 is intended to sit alongside the Planning Act 2008 and aims to “ensure clean, healthy, safe, productive and biologically diverse oceans and seas” by implementing new planning and management systems for overseeing the marine environment. The Act’s remit includes marine fisheries policy, marine conservation and certain planning approvals for the sea bed. Like the Planning Act, the Marine and Coastal Act introduces new processes for planning and consent in an attempt to simplify the consenting process.

2.39 The MMO, established under the Marine and Coastal Access Act, has responsibilities for the planning and licensing arrangements for offshore wind farm projects with a power output of less than 100 MW. As highlighted above, since Project One is greater than 100 MW, the IPC will be responsible for the review of the application and issue of the DCO, although the MMO will remain a statutory consultee of the IPC and the applicant and will play a key role in defining the conditions relating to the deemed marine licence. The MMO will be responsible for any subsequent monitoring and enforcement of any development approved by the IPC.

2.40 The Marine and Coastal Access Act 2009 enables the designation of Marine Conservation Zones (MCZs). Although no such Zones have yet been designated under the Marine and Coastal Access Act, it is recognised that MCZs will be in place before the proposed construction of Project One. Guidance on features of conservation importance likely to form future MCZs will be considered throughout the EIA and Smart Wind are actively participating in the North Sea Marine Conservation Zones Project (Net Gain).

2.41 The first two English marine plan areas have been selected by the MMO in consultation with partners and stakeholders, in the sea area off the east coast between Flamborough Head and Felixstowe. From April 2011, these two plans will developed into a comprehensive marine planning system, enabling the effective integration of economic, social and environmental factors and promoting the sustainable development of our seas. There is an increasing conflict for space in the seas around the UK, e.g., the Round 3 programme and marine planning will aim to balance and integrate competing activities and aspirations.

2.8.3 The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007

2.42 Under the Offshore Marine (Natural Habitats, &c.) Regulations 2007 (as amended), it is an offence to deliberately capture, injure, kill or disturb a European Protected Species (EPS) and a wildlife licence would be required for works which may affect an EPS or its shelter or breeding places. Dolphins, porpoises and whales, marine turtles and sturgeon are marine EPS.

2.43 The definition of deliberate disturbance (as defined in the Offshore Marine Regulations 2010) is: “any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or in the case of animals of a hibernating or migratory species, to hibernate or migrate; or to affect significantly the local distribution or abundance of the species to which they belong.” This disturbance applies beyond 12 Nm, and therefore is applicable within Project One. If these disturbance risks cannot be avoided, then Smart Wind would need to apply for a wildlife licence from the MMO. The requirement for any marine wildlife licence will be reviewed for all phases of Project One in discussion with relevant consultees.

2.8.4 Habitats and Birds Directives and Associate Conservation Regulations

2.44 In relation to wildlife and nature conservation, two key Directives have been adopted by the European Community, namely Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the Birds Directive) (formally

\(^2\) The IPC is responsible for the determination of the application and issue of the DCO and deemed marine licence, although the MMO will remain a statutory consultee of the IPC and applicant and will play a key role in defining the conditions relating to the deemed marine licence.

2.45 These Directives provide for the protection of animal and plant species of European importance and the habitats which support them, particularly through the establishment of a network of protected sites. Elements that are significant to offshore wind development are detailed further below:

- European Protected Species;
- Designation of protected sites; and
- Appropriate Assessment.

**European Protected Species**

2.46 The requirement for protecting EPSs beyond 12 Nm comes from Article 12 of the Habitats Directive, which is implemented through the Offshore Marine Conservation (Natural Habitats, &c.) (Amended) Regulations 2010.

2.47 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) formally transpose the requirements of the Habitats Directive into national law. They build on existing nature conservation legislation for the protection of habitats and species by introducing requirements for assessing plans and projects affecting European designations and licensing certain activities affecting European Protected Species.

**Designation of Sites**

2.48 Through the Habitats and Birds Directives, sites can be designated to afford protection to those species and habitats listed in the Directives’ Annexes. Further details on this process are provided in Section 0.

**Appropriate Assessment**

2.49 Under the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 (Regulation 5(2) (g)), the applicant must submit a report considering the effect of the proposed development, alone or in-combination with other plans or projects, on the integrity of a European site (including candidate, draft, possible and proposed sites). A European site constitutes a Special Area of Conservation (SAC) under the Habitats Directive, or a Special Protection Area (SPA) under the Birds Directive. Ramsar sites are also included under UK policy.

2.50 Using this report, the IPC (as the competent authority) will then be able to determine whether an Appropriate Assessment is required under the Conservation (Natural Habitats &c) Regulations 2009 as amended (the Conservation Regulations) or Offshore Marine Regulations. In preparing this report, consultation with statutory environmental bodies will be undertaken, to help inform the nature of any likely significant effects.

2.51 A plan-level Appropriate Assessment for potential implications for European sites has already been undertaken by The Crown Estate for the nine Round 3 development Zones, in accordance with Regulation 25(1) of the Offshore Marine Regulations and 48(1) of the Conservation Regulations.

2.52 The plan-level Appropriate Assessment (AA) concluded that there will be no adverse effect on the integrity of a European/Ramsar site arising from the Round 3 plan. In reaching this conclusion, the Appropriate Assessment relies upon the following:

- “(1) That general measures typically employed on offshore wind farms to avoid or mitigate adverse environmental effects will be implemented where necessary at project-level. These measures are referred to here as ‘general environmental measures’; and
- (2) The fact that as a matter of law a project will be required to undergo project-level Appropriate Assessment wherever the possibility of a likely significant effect on a European/Ramsar site cannot be excluded” and it was possible in the plan-level AA to give direction to future project-level AA by identifying measures that will be required at that stage to avoid an adverse effect.
2.53 The specific issues relevant to the Hornsea Zone identified in the plan-level Appropriate Assessment are incorporated within Sections 0 to 8 of this Scoping Report in the environmental topics.

2.54 “Irrespective of the findings of the Plan-level AA, individual wind farm projects will require a project-level Habitats Regulations Assessment (HRA). This is because for any given project it will not be possible to exclude likely significant effects on one or more European/Ramsar sites. Project-level HRA should also address circumstances where:

- Any mitigation and avoidance measures incorporated into the plan are not delivered at project level; and/or
- New European/Ramsar sites have been notified or designated following conclusion of the Plan-level HRA (it should be noted that the process of designating European and Ramsar sites is ongoing. The Statutory Nature Conservation Agencies should be regularly contacted to obtain up to date information about likely future designations that are relevant to project level HRA); and/or;
- New information exists regarding the nature and/or sensitivities of interest features within sites which have been assessed at Plan level and with that information it is not possible to exclude likely significant effects on such features or sites; and/or;
- Additional information is available regarding specific in-combination effects relating to defined project proposals and with this additional information it is not possible to exclude likely significant effects on European/Ramsar sites.”

2.55 The decision regarding the need for (and scope of) AA at the project level will be made by the relevant competent authority (i.e., the IPC).

2.56 The EIA will therefore be informed by site specific data on cited habitats and species. The approach to data collection, analysis and assessment for these habitats and species is presented in Sections 0 to 8 for subsequent discussion and agreement with regulators, stakeholders and statutory bodies.

2.57 Based on Zone-level work that has been undertaken for the Hornsea Zone, no designations have been identified within the Zone or Subzone 1. Section 0 identifies designations within the cable route corridor.

2.58 The project-level Appropriate Assessment will take into consideration any other studies that address the identified issues, such as COWRIE (Collaborative Offshore Wind Research into the Environment) funded work.

2.8.5 EIA Rochdale Envelope Approach

2.59 At the early stages of a project, there are inevitably details that cannot be provided, such as the model of wind turbine or inter-array cabling paths. Accordingly, an iterative approach is required to assess environmental impacts as the proposals progress. The industry standard is by reference to the "Rochdale Envelope", which describes the extent of matters to be assessed in the EIA. The cases of R. v Rochdale MBC Ex p. Milne (No.1) / R.v Rochdale MBC Ex p. Tew [2000] Env. L.R. 1 and R. v Rochdale MBC Ex p. Milne (No.2) [2001] Env. L.R. 22, clarified that EIA can be carried out against a range of possible parameters. Approaching EIA in this way enables developers to identify a realistic worst-case scenario for their EIA, whilst retaining flexibility to accommodate the evolution of the proposals.

2.60 Although the IPC recognises this need for flexibility, it also cautions that the proposed parameters should not be so great that any variations would constitute a material departure from the proposals assessed in the EIA (such that the scheme intended to be implemented is not the one which is permitted) or that the outcome of the EIA exercise would be different.

2.61 With these factors in mind, SMart Wind has applied a Rochdale Envelope approach to the proposals that ensures that sufficient detail is provided to prepare an ES and comply with the requirements of Paragraph 17, Schedule 4, Part 1 of the EIA Regulations. The ES will demonstrate that the likely significant environmental impacts have been assessed. It will be produced in support of a DCO application for a scheme that is clearly defined and sufficiently

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3 Ramsar sites are wetlands of international importance designated under the Ramsar Convention
detailed to enable the IPC to determine the application and, where appropriate, to impose conditions requiring development to be carried out in accordance with the parameters of the EIA.

Q1: Have all the policy and legislative requirements relevant to Project One been identified and adequately described in this Section?
3 DESCRIPTION OF THE DEVELOPMENT

3.1 ZONE SELECTION

3.1 The Crown Estate used their Marine Resource System (MaRS) to identify 9 suitable Zones for offshore wind farms under the Round 3 tendering process, and as part of UK Offshore Energy Strategic Environmental Assessment (SEA) (DECC, 2009a). Zone 4 is the Hornsea Zone and is located in the central region of the North Sea along with other Round 1, Round 2 and Round 3 sites (Figure 3-1), other offshore wind farm developments (existing and in-development) exist beyond the UK EEZ, within French, Dutch and German waters.

3.2 SMart Wind is under a contractual arrangement for Round 3 with The Crown Estate to meet obligations for Zone development as a whole. The arrangement is documented in the Zone Development Agreement (ZDA) in respect of Zone 4 (The North Sea off Hornsea).

3.3 Project One comprises the two Blocks, the cable route to the grid connection point and the grid connection infrastructure (Figure 3-2).
3.2 ZONE APPRAISAL AND PLANNING

3.4 ZAP is a non-statutory strategic planning process developed by TCE specifically for Round 3. It is defined as “a framework intended to rationalise and balance the commercial aim of maximising development capacity aspirations with the practicalities of deliverability” (TCE, 2010a). A key objective is to give more control over development by bringing together engineers, environmentalists and planners to address Zone layout, environmental and planning constraints as early as possible. Available from: http://www.thecrownestate.co.uk/enabling-actions (register to download from this page).

3.5 ZAP can be applied to single and/or multiple wind farm developments as a ‘framing’ mechanism to facilitate consent. There is no requirement to produce documents or plans for wider dissemination, other than to ensure environmental issues and constraints are understood by regulators and stakeholders, and sufficient opportunity is provided for them to respond to any concerns.

3.6 An important objective of the Zone-based approach to offshore wind development in the UK is to allow Zone developers more control over the way a Zone is developed, and to give them the opportunity to address as many of the environmental and planning constraints as possible at a Zone-level as part of the process of site development within the Zones. ZAP is essentially an extension of the normal environmental and consenting site selection processes to the level of the Zone.

3.7 SmartWind is applying ZAP to optimise the use of the Hornsea Zone and ensure that all proposed works are delivered safely, efficiently and with minimum impact for stakeholders or the environment.

3.8 An element of the ZAP process is ZoC. The aim of ZoC is to identify those areas within the Zone which can be taken forward to the development stage from an environmental, consenting and technical perspective. Robust spatial and temporal appraisal of the Zone is required to understand and avoid environmental and consenting risks and to provide the context for ongoing development work. It is also important to avoid areas unsuitable for construction from a technical or engineering perspective. By way of context, the level of detail required for the ZoC is similar to the specification of Regional Characterisation Studies (RECs) in the aggregate industry.
3.9 ZoC has been used to determine and map potential development constraints. The identification of the Zone layout design is based on an iterative process to establish a final site selection that is environmentally acceptable.

3.10 A number of Zone level surveys have been initiated in the Hornsea Zone and include:

- Bird and marine mammals;
- Geophysical;
- Benthic;
- Shipping and navigation Survey; and
- Metocean.

3.11 These datasets (in addition to other Zone desk-studies) will inform the ZEA of the Zone and the EIA for the first project within the Zone (Project One), as depicted in Figure 3-3.

Q2: Do you have any comments on ZAP and its application in the Hornsea Zone?
Figure 3-3  Schematic of the process underpinning the development of the first and second Subzones
3.12 SMart Wind has selected an initial project within the Zone (based on detailed existing data and current technology) to accelerate the consenting timescale and to help achieve the 2020 target for renewables. The boundary of Project One will be considered in the ZAP and subsequent Subzones will be placed around it.

3.3 SUBZONE SELECTION

3.13 Within the Hornsea Zone, a broad area for the location of Subzone 1 was identified through the characterisation. Possible layout options were modelled and overlaid in the Zone, considering wind turbulence recovery and required buffer areas. The outer boundary of the overlay of several options was then defined as the first Subzone (Subzone 1) for closer study.

3.14 A programme of studies is already underway, including geophysical, benthic ecology, navigation, bird, marine mammals, metocean, geophysical, archaeological analysis, commercial fisheries and further desk studies. Using the combined results of these studies, the boundaries of the two Blocks located in Subzone 1 will be defined and more baseline environmental information will be provided. This is expected to occur in early 2011, when at least one year of bird and marine mammal data are available.

3.15 At this initial stage, the issues that are likely to arise within the first Subzone (based on the characterisation information) are detailed in Sections 0 to 8.

3.16 A robust selection exercise taking into consideration consenting and technical risks was undertaken to establish the location of Project One. This involved using GIS spatial constraints mapping coupled with expert technical and engineering judgment.

3.17 From an engineering perspective, the shallowest and flattest region was identified for early development, as proven technology can be installed, minimising any consenting and economic risks. Using bathymetric data, the shallowest area within the Zone was identified.

3.18 In parallel with this, existing environmental hard constraints in the Zone were mapped.

3.19 Hard constraints are those which preclude offshore wind farm development. The constraints used for project identification build upon the ones used by TCE, MaRS and SEA, and include the following:

- Bathymetry <5 m and >60 m;
- Oil and gas surface installations and their 6 nm buffers;
- Oil and gas subsurface installations and their 500 m buffers;
- Oil and gas safety zones;
- Live cables and pipelines and their buffers of 500 m;
- Protected wrecks and their buffers according to the Protection of Military Remains Act (1986); and
- International Maritime Organisation (IMO) routes.

3.20 In addition to these hard constraints, consideration of other challenges to consent in terms of constraints were identified:

- Volume of shipping;
- Civil aviation radar interference;
- Military air defence radar;
- Ministry of Defence (MoD) training and exercise areas (PEXA);
- Commercial fishing interactions;
- Helicopter main routes;
- Disposal sites;
- Nature conservation designations and other protected habitats;
- Fish spawning and nursery areas;
- Geological information;
- Geotechnical design parameters;
- Metocean considerations;
- Foundation type suitability; and
- Fabrication and installation costs.

3.21 Overlaying all of these constraints in the Hornsea Zone enabled the location of Subzone 1 to be identified. Thus, the location of Subzone 1 is the culmination of different studies, and is considered the most suitable location as it has the lowest technical and consenting risk at this stage. The position also allows flexibility in the location of future Blocks within the Zone.

3.4 ALTERNATIVES AND PROPOSED DEVELOPMENT SELECTION

3.22 This section considers the alternative offshore and onshore substation locations, cable landfall points and associated cable routes for Project One. The options are all encompassed with the red boundary shown in (Figure 1-1 and Figure 1-2). The location of the Blocks within Project One is not deemed to be subject to alternatives and the grid connection point is dictated by the connection agreement entered into with National Grid Electricity Transmission (NGET).

3.23 The alternatives and proposed development selection is an important requirement for the ES.

3.24 In the ES the initial stages of site selection based on the criteria described above will be discussed and will also include any subsequent refinements to the project as a consequence of the EIA and ZAP process.

3.25 Alternative options for technology, materials, methods of construction, operation, maintenance and decommissioning will be examined, taking into account potential environmental effects. Further details of alternatives considered are described in the Section below.

3.5 PROJECT DESCRIPTION

3.26 The details of the key offshore and onshore components of Project One are outlined below. These indicative details will be refined throughout the EIA process using a combination of analysis of desk studies and survey data, engineering analysis and discussions with suppliers.

3.27 Consideration has been given to the construction, operation and maintenance and decommissioning phases for all of the likely wind farm component options.

3.28 The EIA shall be undertaken on the basis of the worst case scenario for environmental impacts (for instance, foundation type and size), in line with the Rochdale Envelope Approach (see section 2.8.5).

3.5.1 Offshore Infrastructure

3.29 The key offshore infrastructure of Project One are likely to comprise:
- Anemometry masts and their associated foundations for monitoring wind speeds prior to and during construction and the performance of wind turbines during the operation phase;
- Meteorological buoys and oceanographic instruments;
- Foundations (including platform foundations);
- Offshore wind turbines;
- HVAC substations;
- HVDC converter station;
- Submarine cables (export, inter-platform and inter-array cables);
- Offshore platforms supporting some of the electrical equipment (substations and converter station) and possibly incorporating offshore facilities for the operation and maintenance of the wind farms;
- Subsea cables between the wind turbine generators, the offshore platforms and shore; and
- Scour protection around foundations and on inter-array and export subsea cables as required.

3.30 The infrastructure for Project One will not be procured until much later in the project programme, after the necessary statutory consents have been granted. In this respect a description of the likely components and their installation has been provided, together with any alternatives, as appropriate.

**Anemometry Mast**

3.31 In order to provide information on wind speed and direction, it is anticipated that an anemometry mast will be installed offshore in 2011. This detailed information will help to calculate the most efficient layout of individual blocks of turbines within Project One and to define the final layout of turbines. Consent to construct the anemometry masts will be applied for in late 2010 (separately to the main Project One application).

3.32 An anemometry mast consists of the following elements:
- Lattice tower, typically up to 120 m above mean sea level;
- Foundation (typically a monopile but a jacket structure or similar may be required);
- Platform, including boat landing;
- Instrumentation (on a tower, above and possibly below water);
- Control cabinet, solar panels and batteries;
- A platform for bird monitoring radar (if considered appropriate); and
- Aerial and marine navigational lights and markings.

**Meteorological Buoys and Oceanographic Instrumentation**

3.33 Acoustic Doppler Wave and Current Profilers (AWACs) have been deployed across the Zone to measure oceanographic conditions, and a waverider buoy deployed to the north of the Zone. A waverider buoy is a free-moving floating buoy, while AWACs are bottom-mounted using an anchored frame. Meteorological buoys have also been deployed with the AWACs. Both waveriders and AWACs collect a range of wave data; AWACs also collect information about currents.

3.34 Consent has been received to deploy the meteorological buoys and oceanographic instrumentation separately to the main Project One application.

**Foundations**

3.35 Wind turbines, offshore substations and anemometry masts will be supported on foundations supported on or embedded in the seabed. The factors influencing the choice of foundation are:
- Selection of wind turbine to be used;
- Costs and engineering;
- Environmental impact;
- Ground conditions / seabed stability; and
- Metocean conditions and detailed wind analysis.

3.36 More information is required to inform the foundation(s) choice and to determine which options are the most cost effective and environmentally appropriate. It is possible that more than one type of foundation may be used across Project One. The following foundation concepts may be considered:
- Steel monopile;
- Steel jackets supported on piles; and
- Concrete gravity base.

3.37 Indicative dimensions, construction materials and a brief description of the expected installation methods for each of the foundation options are outlined in Table 3-1. The indicative dimensions are based on a midrange turbine size and mid-range water depths and are to be used for illustrative purposes only. Further work will be undertaken in parallel with the EIA to refine these parameters. A detailed description of fabrication, installation and decommissioning methods for each foundation type will be included in the ES for Project One. The initial foundation options will be based on data from the geophysical and preliminary geotechnical campaigns which were commissioned in summer 2010 across Subzone 1. The final engineering solution will be decided upon completion of the detailed geotechnical campaign and in response to environmental constraints identified during the consultation and EIA process.

3.38 Scour can occur around the base of a foundation as a result of the flow of water around the structure. Scour may also occur on cable routes and at other offshore infrastructure such as the converter and collection stations. A number of options for scour protection could be considered for installation with Project One, depending on the final project design process, ground conditions and scour assessments. These could include:
- Rock and gravel dumping;
- Protective aprons;
- Mattresses; and
- Flow energy dissipation (frond) devices.

Table 3-1 Potential foundation types and information

<table>
<thead>
<tr>
<th>Type</th>
<th>Indicative Dimensions</th>
<th>Ground Conditions</th>
<th>Construction Material</th>
<th>Installation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monopile</td>
<td>4.5 to 6.5 m diameter driven to between 30 m and 40 m below sea-bed depending on ground conditions and water depth</td>
<td>Soft to stiff clay / loose to dense sand, gravel. Used in water depths up to 35 m.</td>
<td>Steel (pile and transition piece)</td>
<td>Pile and transition piece transported by installation vessel or barge. Pile up-ended by crane and lowered to sea bed. Pile driven by hammer (sometimes drilled). Installation template set down on sea bed. Pile stabbed and driven. Survey of pile levels and adjustment of jacket leg positions. Jacket lifted and set down on piles. Jacket levelled and pile connections grouted. Scour protection (if required).</td>
</tr>
<tr>
<td>Jacket supported on Piles</td>
<td>16 to 25 m jacket leg spacing at sea-bed level. Tubular steel members of jacket structure will be up to 1 m diameter. The piles below each leg will be up to 2.5 m diameter and be driven to between 35 m and 45 m below sea-bed.</td>
<td>Soft to stiff clay / loose to dense sand, gravel. Used in water depths 35 to 50 m.</td>
<td>Steel (jacket and piles)</td>
<td>Jacket and piles transported by barge. Installation template set down on sea bed. Piles stabbed and driven. Survey of pile levels and adjustment of jacket leg positions. Jacket lifted and set down on piles. Jacket levelled and pile connections grouted. Scour protection (if required).</td>
</tr>
<tr>
<td>Gravity Base</td>
<td>30 to 40 m diameter at sea-bed level.</td>
<td>Stiff to Hard Clay, Very dense sand, Gravel or Bedrock Used in water depths up to</td>
<td>Re-inforced concrete shell with pumped sand ballast fill</td>
<td>Seabed preparation as necessary to ensure a level base before placing of Gravity Structure. Gravity base transported by barge or heavy lift vessel (or floated). Gravity base lifted by crane (or Removed)</td>
</tr>
</tbody>
</table>
### Offshore Wind Turbines

3.39 Offshore Wind Turbines ranging in size from around 3.6 MW to 8 MW will be considered for Project One. The turbines will have a maximum rotor diameter of 150 m, maximum hub height of 120 m, and maximum rotor tip height of 200 m.

3.40 The spacing of the turbines in the final layout will be in the order of between 6 and 12 rotor diameters. The spacing between turbines within the array can also vary with direction. For the range of rotor diameters being considered at this stage, the spacing of the turbines could range between 720 m and 1,800 m. The maximum number of turbines based on optimised generation capacity for Project One of 1.2 GW will be 332 based on a 3.6 MW wind turbine generator. The minimum number of turbines based on planned generation capacity for Project One of 1 GW will be 124 based on an 8 MW wind turbine generator.

3.41 The layout of turbines across Project One is yet to be confirmed and could be a regular grid, a radial array or an irregular arrangement of turbines.

3.42 It should be noted that the exact wind turbine specifications for Project One are yet to be determined. The chosen wind turbines will be of proven technology, incorporating tapered tubular towers and three blades attached to a nacelle which will contain equipment such as the generator, gearbox and other operating equipment.

3.43 In summary, the maximum capacity Project One is capable of delivering is 1.2 GW. A range of turbine models could be used.

### HVAC substations

3.44 It is envisaged that up to three HVAC offshore substations mounted on platforms will be required for the delivery of 1.2 GW. The primary function of the HVAC offshore substations is to transform the HVAC transmission voltage down from 220/132 kV to the Median Voltage Alternating Current (MVAC) distribution voltage, nominally 33 kV but may be as high as 66 kV. The HVAC offshore substations electrically interconnect the HVDC converter station(s) with the wind turbines via inter-platform and inter-array cable circuits, respectively. Typically, the dimensions of an offshore substation out of the water will be up to 45 m in length x 40 m wide x 36 m high.

3.45 Conceptual electrical design work to evaluate a range of different design options for the HVAC offshore substations and identify the optimal design is ongoing and will be presented in more detail for the EIA.

### HVDC offshore converter station(s)

3.46 For wind farm projects beyond 70 km offshore, adopting HVDC technology becomes a more economic solution. Subzone 1 is situated more than 100 km offshore and necessarily uses HVDC technology. The primary function of the HVDC converter is to convert the 220/132 kV HVAC transmission voltage that it receives from the HVAC offshore substations to HVDC, suitable for exporting power over long distances i.e., more than 70 km.

3.47 The HVDC offshore converter station(s) will be sufficiently sized to efficiently export the installed wind generation capacity, i.e., upwards of 1 GW. The converter station(s) electrically interconnects the inter-platform cable circuits with the HVDC export cable circuit.

3.48 The converter station(s) shall be mounted on platforms approximately 140 km offshore. Typically, the dimensions of an HVDC offshore converter station will be up to 65 m in length x 40 m wide x 36 m high.
3.49 Conceptual electrical design work to evaluate a range of different design options for the electrical system and identify the optimal design is ongoing and will be presented in more detail for the EIA.

**Submarine Cables**

*HVDC Export Cable*

3.50 The design solution for the HVDC export circuit back to shore has not yet been finalised and may comprise a single cable pair, or alternatively two cable pairs. The HVDC export cable will be sized to efficiently and economically export the installed wind generation capacity, i.e., upwards of 1 GW.

3.51 It is envisaged that a bi-polar cable design will be selected. The bi-polar cable comprises two cores, one high voltage negative (with respect to earth) and the other high voltage positive (with respect to earth). Typically, the design voltage would be in the order of +/- 300 kV and would necessarily match the design voltage of the HVDC converter.

*Inter-platform Cables*

3.52 It is envisaged that up to four HVAC export cable circuits will interconnect each offshore HVAC platform with the converter station(s). Conceptual electrical design work to evaluate a range of different design options for the electrical system and identify the optimal design is ongoing and will be presented in more detail in the ES.

*Inter-array Cables*

3.53 Inter-array cabling will transmit power from the individual turbines to one of the HVAC substations. Each array cable circuit is referred to as a ‘string’ and the exact number of turbines on each string will depend on the power transmission capacity of the cable selected and the string configuration e.g. radial, ring etc. The inter-array cable is typically a single cable containing three metallic cores and an optical fibre core. The final configuration of the inter-array cable circuits will not be known until the design options have been fully evaluated.

*Cable Installation*

3.54 It is envisaged that all submarine cables will, where practicable, be installed below the seabed utilising either ploughing or trenching/jetting techniques, depending on the seabed conditions. A detailed cable burial specification will be developed based on geophysical and geotechnical assessments.

3.55 Where cable burial is not possible, placement of rocks (rock-dumping), frond mattresses\(^4\) or grout bags may be deployed to protect the cables e.g. where they enter turbine or platform foundations, crossing pipelines etc. It is conceivable that the laying of cable protection may also be necessary after burial, where sections of cables are too shallow or have otherwise become exposed as informed by the post installation inspection or periodic maintenance surveys. Full details of this process and installation will be provided in the EIA.

3.5.2 Offshore Operation and Maintenance

3.56 Once commissioned Project One will operate without intervention on a day to day basis, however turbines will require regular servicing. In order to operate and maintain offshore wind farms such as Project One that are some distance from the coast, there will be infrastructure needed offshore such as accommodation and servicing platforms. Further studies are underway to determine the amount of infrastructure needed for operation and maintenance but could potentially consist of:

- Accommodation platform(s) or floating accommodation; and
- Vessel helicopter platforms on accommodation platforms, transformer platforms, vessels, and potentially on the offshore wind turbines.

\(^4\) A frond mattress reduces potential scour by replicating the natural way that seaweed reduces water velocity locally around a structure.
3.57 The exact number of vessels that will be used for operation and maintenance has not been defined at this stage. Options being considered include:

- Use of a fixed dedicated offshore accommodation and maintenance platform;
- Use of a platform for accommodation and maintenance;
- Use of a Floatel, permanently stationed within the zone;
- Use of a dedicated Service Operations Vessel, permanently stationed within the Hornsea Zone; and
- Use of a dedicated Jack-up vessel for accommodation, permanently stationed within the Hornsea Zone.

3.58 Depending on the accommodation strategy selected, it is also likely that supply vessels will periodically service the offshore accommodation, bring spare parts, fuel, food, water etc., to the accommodation. There will be occasional requirements for a jack-up vessel within the project, in order to replace major components. These visits are expected to be relatively infrequent.

3.59 Personnel transfers to the offshore accommodation may take place using helicopters. In any event, careful consideration will be made for provision of emergency helicopter access.

3.60 In addition to planned maintenance, unscheduled maintenance occurs on wind turbines. This can consist of minor maintenance, involving manual intervention through to significant repairs, involving heavy lifting equipment such as jack up barges or alike. An overview of the key maintenance categories and repair strategies can be found below.

**Foundations and Transition Piece**

3.61 The primary activity is the inspection and maintenance of all support structures in the Hornsea Zone. Major activities include visual inspections of supporting structures, lower part of J-tube, ladder and fender, corrosion protection system, marine growth, fatigue cracks, scour and scour protection, damages and dents, deformations, debris. Typically, the interval between inspections should not exceed five years however more frequent inspections during first few years are recommended. The entire wind farm is normally inspected at least once during a five-year period. Intervals for subsequent inspections are adjusted based on findings.

**Interconnecting Cables**

3.62 Interconnecting power cables between the wind turbines and the transformer station as well as power cables to the shore will be inspected, unless they are buried. Mainly visual inspections are carried out for non buried cables and repair activities if required. For buried cables bury depth can be measured. Subsea cables connected at the offshore substation will be inspected for proper fixing and signs of wear. Cable burial to design depth will be verified. The interval between inspections should not exceed five years.

3.63 With the strategic nature of the main wind farm export cables, SMart Wind will consider Cable Monitoring solutions within the O&M strategy. This type of solution enables preventative maintenance to be undertaken should a cable anomaly arise. The basic concept of the LIRA® Cable Monitoring system recognizes that there is a high correlation between the insulation condition and the properties of the insulation’s dielectric material. A change in dielectric constant (mainly capacitance), lead to changes in the cable impedance (globally and locally). The solution itself, consists of hardware, connection devices and proprietary software modules for failure analysis, degradation analysis and simulator programs.

**Electrical Infrastructure**

3.64 The main activities comprise a risk and safety based inspection regime and maintenance program with global and close visual inspection, non-destructive inspection/testing, instrumentation based condition monitoring and corrective maintenance. All equipment would be maintained and certified within the latest statutory legislation or to industry best practice.

3.65 Each wind turbine will operate independently of the others. The offshore substations and anemometry masts will also be monitored and maintained.
The operation and control of the wind farm(s) will be managed via the integrated Supervisory Control and Data Acquisition (SCADA) system, connecting each turbine to the onshore control room. All wind turbines are connected via optical fibre network, running through the power cables, to the collector platforms, and from there, to the HVDC on-shore facility.

From there, all SCADA signals are passed via appropriate land communications to diagnostic centres and also to the on-shore 24 hour operations centre.

Detailed operation and maintenance information will be provided in the ES.

### 3.5.3 Onshore Infrastructure

Sbart Wind has secured a 1 GW connection agreement with National Grid (NG) to connect onto the UK’s onshore transmission network. The onshore transmission connection location is Killingholme, an existing 400 kV substation owned by NG and located in Lincolnshire, close to the Humber Estuary (see Figure 1-2).

Primarily, the onshore electrical infrastructure comprises a HVDC converter station, HVDC overhead line/cable circuit connecting to the offshore HVDC converter station, and HVAC overhead line/cable circuit connecting to NG’s transmission substation at Killingholme.

NG’s Killingholme substation and the offshore converter station can be considered as fixed points that need to be interconnected with a single circuit. Being the shortest distance between the two points, a straight line would be the ideal route. However, physical constraints, environmental constraints, land ownership and economics greatly influence the route possibilities. In this respect, Sbart Wind is undertaking an onshore cable route option assessment, considering potential landfall points and route corridors. Stakeholders will be invited to contribute to and comment on this study which will provide the basis for the selection of the chosen cable route to be assessed fully in the EIA.

Specifically, the onshore elements associated with the electrical installation are:

- Cable transition pit(s) at landfall;
- Jointing pits;
- HVDC circuit;
- HVDC converter station(s); and
- HVAC circuit.

#### Cable Transition Pit(s)

Once the HVDC submarine cable circuit(s) reaches shore it will transition to ‘land based’ HVDC cables and will require a ‘transition pit’ to accommodate the submarine and land based HVDC cables and transition cable joints. The number of transition pits constructed will be determined by the final design solution, i.e., number of HVDC export cables installed, but is not expected to exceed two transition pits.

#### Cable Jointing Pits

Physical constraints limit the size of the cable drum and this translates directly into a maximum length of cable that can be installed before a cable joint is required. The maximum cable length possible will vary depending on the final design solution but is estimated to be in the order of 750 m and in this respect cable jointing pits will be located along the HVDC cable route at intervals of 750 m nominally. It is estimated that the dimensions of the cable jointing pits will be up to 15 m long x 5 m wide x 2 m deep.

Following construction, the ground above the cable joint pit will be reinstated although access for occasional maintenance/repair purposes may be required.

#### HVDC Circuit

It is envisaged that most, if not all, of the 1 GW HVDC cable circuit will comprise HVDC cables routed underground. An element of the HVDC circuit, close to the existing NGET substation, may warrant an overhead line solution. Ultimately, physical constraints, environmental constraints, land ownership and economics will determine the preferred design solution.
The HVDC cables will be buried underground, installed either together in a single trench or independently in separate trenches. The design solution for the HVDC export circuit has not yet been finalised and may comprise a single cable pair, or alternatively two cable pairs.

In this respect up to four bi-polar cable cores and associated optical fibre cores (for communication purposes) will be buried.

Each cable trench is expected to be approximately 1.5 m wide x 1.5 m deep. The ‘foot-print’ or ‘land grab’ along the route length is expected to measure up to 40 m wide during construction, including temporary haul road and spoil heaps.

**HVDC Converter Station(s)**

The onshore HVDC converter station(s) will be located as close as is practicable to the existing transmission substation located at Killingholme and owned by NG.

The converter station converts the imported DC power flow from the offshore HVDC converter back to AC power, compatible with NG’s AC transmission network. The HVDC offshore converter station(s) will be sized to match the offshore converter stations i.e., sufficient to efficiently import the installed wind generation capacity, i.e. upwards of 1 GW.

The HVDC converter station design is not yet finalised but the foot-print or land-grab associated with the installation is estimated to be in the order of 200 m length x 150 m width x 35 m height.

**HVAC Circuit**

Depending on the HVDC converter's proximity in relation to NG’s existing Killingholme substation, the inter-connecting HVAC circuit may be overhead line or cable. Ultimately, physical constraints, environmental constraints, land ownership and economics will determine the preferred design solution.

**3.5.4 Development of the Blocks**

**Construction**

Offshore construction work is proposed to commence in 2014 with the preliminary engineering design and construction logistics work indicating that the offshore construction period for Project One will last for up to 3 years.

Further information will be gathered on the construction process, once all the parameters have been defined in detail. There are some key elements that will define the construction methodologies, including:

- Port(s) used as the base for the construction phase;
- Foundation types;
- Wind turbine selection; and
- Vessels used for the offshore construction works.

A number of ports exist on the east coast of England and the mainland European coast that may be suitable for much of the construction and operation activities required for Project One. Part of the detailed project design and logistics planning for Project One involves the assessment of a number of potentially suitable port facilities. Decisions on all of the above elements will be addressed during the detailed design and will be presented within the ES.

In addition to ports used during the construction of Project One, consideration will be given to the components of Project One being brought directly to the project site from their point of manufacture.

Port development will be covered by separate existing or new consent applications and EIAs however consideration will be given to potential cumulative / in-combination effects in the EIA for Project One.
**Construction Activities**

3.89 The high level construction activities for Project One are as follows (note that some of these activities will happen in parallel):

- Construction site personnel are mobilised and the wind farm components are delivered to the ports;
- Seabed preparation;
- The foundations are transported to site and placed in position by the installation vessel;
- Installation of tower, nacelle, hub and blades of the wind turbine generators;
- The offshore substation module is transported to site and installed from an installation vessel;
- The subsea inter array cables are installed and terminated;
- The high voltage subsea cable is installed between the shore and offshore substation;
- The high voltage onshore cable is jointed to the high voltage subsea cable(s);
- All systems are tested and commissioned; and
- The construction site and personnel are demobilised.

3.90 Foundation installation will be one of the first offshore construction activities to take place. Methods of installation for foundations vary significantly depending upon the foundation type selected. Techniques typically employed for foundation installation include:

- Pile driving;
- Pile drilling;
- Sea bed levelling (for gravity base structures);
- Ballasting (for gravity base structures); and
- Grouted connections (e.g. for connecting piles to jacket).

3.91 Following foundation installation, offshore wind turbines will be installed. Commonly, towers and nacelles are pre-erected or erected individually at the site using a crane barge. Alternatively a jack-up platform with a mounted crane may be utilised. Blades are subsequently fitted to the tower/nacelle structure as individual components or in a part assembled state.

3.5.5 Decommissioning

3.92 At the end of the operational lifetime of Project One, it is anticipated that there will be a requirement for all structures above the seabed to be completely removed. The decommissioning sequence will generally be the reverse of the construction sequence. Decommissioning industry best practice/legislation will be applied at that time.

3.93 At the end of The Crown Estate lease period, it is a condition of the lease as well as a statutory requirement (through the provisions of the Energy Act 2004 (as amended)) that Project One is decommissioned. A decommissioning plan will be prepared at the request of the Secretary of State and, prior to construction, funds must also be set aside for the purposes of decommissioning. For the purposes of the EIA, the decommissioning of the wind farm is likely to be the reverse of the construction process.

3.5.6 Health and Safety

3.94 Construction in the marine environment is potentially hazardous. Therefore the application of health and safety measures to all activities in the pre-construction, construction, operation and maintenance and decommissioning of Project One will be undertaken.

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Q4: *Does the description of Project One provide enough information with regards to the nature of the development at this early stage of the projects’ development?*
4 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

4.1 INTRODUCTION
4.1 This section describes the principles of EIA and the approach being taken to identify and evaluate potential impacts associated with Project One. It outlines the methodologies for cumulative and in-combination impact assessment including transboundary issues, and (where appropriate) mitigation measures required to address any potential negative impacts.

4.2 The assessment will use an evidence-based approach that is systematic and auditable to evaluate and interpret potential impacts of Project One activities on sensitive physical, biological and human receptors.

4.2 BASIS OF THE ASSESSMENT
4.3 The impact assessment methodology is based on widely used EIA principles and draws upon a number of guidance documents and regulations, including:

- Criteria listed in Annex III of the EC Environmental Assessment Directive (97/11/EC). This is an assessment process developed to provide advice on operations within European marine sites (Europa, 2010a);
- Best guidance on how to address cumulative impacts with respect to birds and wind farms has been published by COWRIE (King et al., 2009);
- Maclean et al (2009) a Review of Assessment Methodologies for Offshore Wind farms (COWRIE METH-08-08);
- The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000;
- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Impact Assessment, 2004 (IEMA, 2004);
- Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) Regulations 1999; and

4.4 Further guidance and regulations will be considered, should they become available during the EIA process.

4.5 This assessment of impacts is designed to evaluate potential changes to baseline conditions, both positive and negative, as a result of planned construction and operational activities. The impact methodology adheres to standardised terminology, with documentation to support the decisions made, but retains flexibility for individual receptors.

4.6 Central to the assessment is the conceptual ‘source-pathway-receptor’ model. The model is effective at identifying potential impacts resulting from the proposed activities on the receiving environment and its sensitive receptors (Figure 4-1). It allows for a more transparent approach to conducting the assessment process by guiding assessors through the linkages between the source of the effects and the routes through the environment to potentially sensitive receptors.

4.7 The term ‘source’ describes the origin of the potential impacts (e.g. the effects of cable laying and plume dispersion) and the term ‘pathway’ as the means (e.g. deposition of sediment via the water column to the seabed, sediment transport processes, ingestion) by which the effect reaches the receiving sensitive ‘receptor’ (e.g. benthic organisms, habitats, fisheries, maritime archaeology). The model can also be applied to near-field and far-field impacts in the context of ongoing or natural environmental changes.
A positive impact is considered to result in an improvement to the baseline conditions or to introduce a new desirable factor.

A negative impact is considered to result in an adverse change from baseline conditions or introduce a less desirable factor.

Figure 4-1  Conceptual EIA ‘Source-Pathway-Receptor’ model and the process of impact significance in relation to monitoring
4.2.1 Defining Effects And Impacts

4.8 Project One has the potential to create a range of ‘effects’ in the environment that provide a route for which sensitive receptors may be impacted. It is important to distinguish between the terms ‘effects’ and ‘impacts’ as they are often used interchangeably to mean similar things. However, within the context of this assessment methodology they are not because not all effects have an impact on the environment as some receptors may not be sensitive to them.

4.9 Effects are the physical changes in the environment that are set in motion as a consequence of a particular activity (e.g. placement of gravity bases onto the seabed, piling, trenching). Effects are usually measureable (e.g., volume, weight, length, time, area) and include a range of physical changes to the environment (e.g., sediment removal, elevated turbidity, mobilisation of contaminants, noise, navigation, changes in wave conditions, removal of hedgerow, felling of trees, disturbance of soil, removal of turf).

4.10 Impacts are the potential changes in baseline conditions of sensitive receptors (e.g. benthic invertebrates, fish, birds, marine mammals, commercial fisheries, archaeology, terrestrial mammals, invertebrates, habitat complexity) as a result of an effect. They can be classified as direct, indirect, secondary, cumulative and in-combination, positive or negative, although the relationship between them is not always straightforward.

- Direct impacts: Arise from activities associated with the Project One area;
- Indirect impacts: Occur as a consequence of a direct impact (sometimes as part of a chain of events) and may be experienced at a point in space or time that is removed from the direct impact;
- Secondary impacts: Socioeconomic and cultural changes which may be experienced at a point in space or time that is removed from both direct and indirect impacts;
- Cumulative impacts: Those resulting from the combined effects of one wind farm development with other wind farm developments through space and time, and in the context of natural variability;
- In-combination impacts: The impacts resulting from the combined effects of one wind farm development with other sea and land users generating similar impacts through space and time, and in the context of natural variability; and
- Positive or negative impacts: Positive impacts (see definition above) merit just as much consideration as negative ones, as international, national and local policies increasingly press for projects to deliver positive biodiversity outcomes.

4.11 It is also important to consider the reversibility of impacts. An irreversible (permanent) impact is when recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. By contrast, a reversible (temporary) impact is one where spontaneous recovery is possible naturally or where mitigation measures have been effective. It is possible for the same activity to cause both irreversible and reversible impacts.

Effects are measurable physical changes caused by activities.
Impacts are the resultant changes to sensitive receptors.

4.3 ASSESSMENT OF IMPACTS

4.3.1 Determining Magnitude of Effects

4.12 Predicting the physical effects of wind farm construction and operational activities on the environment is a critical step in the assessment process. It involves determining the magnitude of the potential physical changes in the environment and comparing it to baseline conditions. In this way, inferences can be made on future potential changes to sensitive receptors based on changes in physical effects.
4.13 A sensitive receptor can only be exposed to change if there is a pathway through which an effect can be transmitted between the source activity and the receptor. For assessment purposes, magnitude of effects is collectively quantified on the following three factors:

- **Extent**: Is the area over which the effect occurs;
- **Duration**: Is the time for which the effect is expected to last; and
- **Frequency**: Is simply how often an effect (as a result of an activity) takes place.

### 4.3.2 Probability

4.14 It is important to consider the likelihood that an effect will occur as predicted, the limitations to certainty are described and the consequences for confidence in predictions stated clearly. The following four-point scale is employed to aid decision-making regarding the impact assessment:

- **Certain/near certain**: Probability estimated at 95% chance or higher;
- **Probable**: Probability estimated above 50% but below 95%;
- **Unlikely**: Probability estimated above 5% but less than 50%; and
- **Extremely unlikely**: Probability estimated at less than 5%.

4.15 The reason for including 'Extremely unlikely' in the scale is that some effects may be very improbable, but extremely serious should they occur and hence merit contingency planning. Where doubt exists between two closely matched categories within the scale of probability, the more conservative one is used.

### 4.3.3 Determining Vulnerability of a Receptor

4.16 The vulnerability of a receptor is essentially the comparison of the predicted exposure to an effect with regards to its sensitivity (or response to that effect). Where the exposure and sensitivity characteristics overlap then vulnerability exists and an impact is likely. This is often referred to as risk. When exposure or change occur for which the receptor is not sensitive, then no impact will occur.

4.17 An impact can only occur if a receptor is sensitive to an effect and subsequently undergoes a positive or negative change, that is or is not reversible, to which it is sensitive. Sensitivity is the benchmark against which changes and levels of exposure can be compared to evaluate significance, and is quantified using the following four factors:

- **Adaptability**: how well a receptor can avoid or adapt to an effect;
- **Tolerance**: the ability of a receptor to be either affected or unaffected (temporarily and/or permanently) by an effect;
- **Recoverability**: a temporal measure of how well a receptor recovers following exposure to an effect, expressed in months to years; and
- **Value**: an integral part of sensitivity and includes consideration of importance (e.g. level of conservation status and keystone species), rarity (e.g. how much of it exists relative to the potential area impacted) and worth (e.g., its socioeconomic, cultural and amenity value).

4.18 In some cases it may be applicable to compare the anticipated change against either baseline conditions or a known threshold (such as for water quality or noise).

4.19 The assessment of vulnerability is used to inform the impact assessment. Once the impact has been identified and assessed against baseline conditions it is assigned a level of significance.

### 4.3.4 Ecosystem Interactions

4.20 For simplicity, ‘ecosystem approach’ is interpreted as a more holistic view of receptors (e.g., marine mammals, birds, benthic ecology) and sector groups (e.g., oil and gas, fisheries) being assessed under EIA.
It takes into account the wider interactions between these receptors and sector groups. The intention is to identify and consider the linkages between these different disciplines and how impacts on one receptor may potentially affect the processes and sensitivities of another. This may be through indirect and/or secondary impacts.

**4.3.5 Evaluation of Impact Significance**

Impact significance reflects the level of importance placed on the impact in question and where it is acceptable to society (i.e. stakeholders, regulators and/or legislative controls).

An impact significance statement is used to summarise the evaluation process in terms of positive or negative impacts, and is defined using the following four categories:

- **Not significant**: An impact that is found not to be significant in the context of the ES objectives;
- **Minor significance**: An impact considered sufficiently small (with or without mitigation) to be well within accepted standards. No action is required as it can be controlled by adopting normal good working practice;
- **Moderate significance**: An impact within accepted limits and standards. Moderate impacts may cover a broad range, although the emphasis is on demonstrating that the impact has been reduced to a level that is as low as reasonably practical. This does not mean reducing to ‘minor’ impacts but managing ‘moderate’ ones effectively and efficiently; and
- **Major significance**: An impact where an acceptable limit or standard may be exceeded.

Determining impact significance incorporates a degree of subjectivity as decisions are based on professional judgement and experience, although underpinned by a strong evidence-base. For this reason, it would be inappropriate to apply a rigid framework to the actual categorisation of impact significance.

Significance is resolved using the best available information from a range of sources including consultation and literature reviews, surveys commissioned as part of this study, numerical modelling and historical analysis. Where data gaps exist, informed scientific interpretation and judgement based on past experience is used to evaluate their importance to the assessment. For impacts that are considered of concern, mitigation measures are proposed, where practical.

**4.3.6 Uncertainty**

It is important to establish the uncertainty of data that are used to predict the magnitude of effects and the vulnerability of receptors, as the level of confidence in the decisions made on significance depend on it. There are three levels of uncertainty, namely:

- **Low uncertainty**: Interactions are well understood and documented. Predictions are modelled and maps based on interpretations are supported by a large volume of data. Information/data has very comprehensive spatial coverage/resolution;
- **Medium uncertainty**: Interactions are understood with some documented evidence. Predictions are modelled but not validated and/or calibrated. Mapped outputs are supported by a moderate degree of evidence. Information/data has relatively moderate spatial coverage/resolution; and
- **High uncertainty**: Interactions are poorly understood and not documented. Predictions are not modelled and maps are based on expert interpretation using little or no quantitative data. Information/data has poor spatial coverage/resolution

In the absence of certainty, it is necessary to adopt a precautionary approach. Data gaps and uncertainties are reported within the impact assessment.

**4.3.7 Mitigation**

Schedule 4 of the EIA Regulations requires that where significant effects are identified, “a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment” should be included in the ES. For each
significant negative impact identified during the assessment, mitigation will be proposed and discussed with the relevant authorities.

4.3.8 Assessing Residual Impacts

4.29 Following identification of appropriate mitigation measures, impacts are re-assessed. All residual significant impacts will be described within the ES, with discussion on why further mitigation is not practicable. Where the impact is of more than minor significance an explanation will be given of how the impact has been reduced to as low as reasonably practicable.

4.3.9 Cumulative and In-combination Impacts

4.30 The assessment of cumulative impacts will involve the consideration of cumulative impacts between the two wind farms within Project One and these two wind farms with the development of a further six in the Hornsea Zone. The cumulative assessment will also consider the Round 2 wind farms in The Greater Wash area and the Round 3 Dogger Bank Zone and the East Anglia Zone.

4.31 The assessment of in-combination impacts will consider the impacts of the two wind farms within Project One alongside those of other projects within the area from other industries/activities e.g., commercial fishing, oil and gas industry and shipping.

4.32 There are currently no industry standards to define cumulative and in-combination impacts, although various guidance notes do offer a range of competing perspectives. The assessment will use a standardised approach with definitions that are considered fit-for-purpose and defensible. It will adopt lessons from other Zone scale cumulative and in-combination assessments such as the Regional Environmental Assessment (REA) currently being undertaken by the offshore aggregates industry.

4.33 To ensure the assessment of cumulative and in-combination impacts is effective, SMart Wind has introduced Zone-wide tools to facilitate the assessment. The approach is presented into three documents:

- ZoC – Zone Characterisation, which describes the environment within the Zone;
- ZAM – Zone Assessment Methodology, which details the proposed techniques (both survey and analysis) to be used for the cumulative and in-combination assessment; and
- ZEA – Zone Environmental Assessment, which documents the results of the assessment, based on information and techniques presented in the ZoC and ZAM.

4.34 Both the ZoC and ZAM are ‘live’ documents (available at www.smartwind.co.uk) which will be updated as more information becomes available, and feedback is received from consultees. This ensures the data and methodologies remain fit-for-purpose. It also ensures the statutory requirements of EIA relating to cumulative and in-combination issues are met.

4.35 ZEA is a process that assesses the cumulative and in-combination impacts at a Zone scale where multiple projects are being considered for consent. The ability to demonstrate stakeholder engagement in the formulation of cumulative and in-combination impact management strategies on a Zone scale is advantageous to the consenting process of SMart Wind’s first and future projects.

4.36 In accordance to ZAP the findings from the ZEA assessment will be used to inform cumulative impacts appropriate for EIA.

4.37 For the avoidance of any doubt, ZEA will inform and assist with the EIA exercise, but is not intended to replace it. EIA requirements must be complied with separately as a matter of law.

4.38 The EIA process will examine the interrelationship between the aspects of the environment likely to be significantly affected by the development including population, fauna, flora, soil, water, air, climatic factors, socioeconomic, material assets, including architectural and archaeological heritage, landscape and these interrelationships will be reported within the ES.

4.3.10 Transboundary Impacts

4.39 Transboundary issues are dealt with in Regulation 24 of the Infrastructure Planning (Environmental Impact Assessment) Regulations (2009) (the EIA Regulations). The
Regulations put in place procedures to address situations where development is likely to have a significant effect on the environment in another European Member State.

4.40 The Convention on Environmental Impact Assessment in a Transboundary Context (‘Espoo Convention’) was adopted on 25 February 1991 and entered into force on 10 September 1997 (modified in 2001 and 2004). This convention stipulates the obligation of parties to assess the environmental impact of certain activities that are likely to cause transboundary environmental impacts at an early stage of planning.

4.41 EC Directive 85/337 on the Assessment of the Effects of Certain Private and Public Projects on the Environment (as amended by EC Directive 97/11) implemented new requirements on transboundary consultation and requires that all significant transboundary issues set out in the Directive must be addressed throughout the EIA process. All affected parties must have the opportunity to comment and all subsequent comments must be addressed in the EIA.

4.42 The potential for transboundary impacts is likely to be limited to physical processes, natural and commercial fisheries, navigation, marine mammals and ornithological aspects; although this list is not exhaustive and other transboundary issues may emerge through further assessment during the EIA process. Any likely significant effects on the environment of another Member State of the European Economic Area will be identified and reported in the EIA. As part of early consultation, potential transboundary impacts are identified within the relevant sections of this scoping report.

Q5: Do you have any comments on the proposed EIA/ZEA approaches proposed?
Q6: Do you believe these assessment methodologies will provide a robust platform for the EIA?
5 OFFSHORE PHYSICAL ENVIRONMENT

5.1 Marine Geology, Bathymetry, Seabed Features and Sediments

This section is relevant to the offshore components of Project One and refers to Subzone 1 and the cable route corridor as appropriate. Understanding the physical environment has implications for conservation, archaeological potential and engineering considerations.

5.1.1 Marine Geology

The Quaternary Period consists of the Pleistocene and Holocene Epochs and encompasses the period during which humans first occupied and exploited the landscape. In the Hornsea Zone the majority of the Quaternary deposits lying close to the seabed consist of Bolders Bank and Botney Cut Formation (Figure 5-1). Some Eem Formation lies close to seabed towards the east of the Zone, particularly in Markham’s Hole (Figure 5-2). Other underlying Quaternary deposits are present at greater depths (and their stratigraphic relationships will be determined following interpretation of detailed geophysical surveys of Subzone 1).

5.3 The complete succession of Quaternary deposits within the Hornsea Zone consists of (youngest to oldest):

- Botney Cut Formation;
- Bolders Bank Formation;
- Eem Formation;
- Egmond Ground Formation;
- Swarte Bank Formation; and

5.4 Botney Cut Formation: This is the youngest of the Quaternary deposits and partially or completely infills valleys, which have been eroded into older deposits, within Subzone 1. The sediments of this Formation can be separated into two discrete facies:

- A seismically structureless lower unit made up of poorly sorted, gravelly coarse sands;
- An upper, parallel-bedded, soft slightly sandy mud.

5.5 Cameron et al., (1992) reported that some acoustic blanking can be seen in seismic profiles of the Botney Cut Formation and this may indicate the presence of gas. It is not possible, at this stage, to indicate whether any gas blanking will be encountered within Subzone 1. However, further interpretation of survey data will make this apparent.

5.6 Bolders Bank Formation: This makes up the majority of the Quaternary deposits near the seabed in Subzone 1. It is a blanket deposit of Weichselian till and appears mainly structureless in seismic profiles. It consists of fairly uniform, greyish-brown, gravelly sandy clay and is approximately 10 m to 15 m thick.

5.7 Previous studies have supported the presence of Bolders Bank Formation within or close to the Hornsea Zone and indicate shear strengths ranging from 50 kPa to 500 kPa (Andrews Survey, 2004). Site specific information on these deposits will be available from geophysical and geotechnical surveys undertaken within Subzone 1 and reported within the ES.

5.8 Eem Formation: No Eem Formation is found near the seabed within Subzone 1, however it does lie close to seabed towards the east of the Zone, particularly within Markham’s Hole.

5.9 Egmond Ground Formation: BGS data suggest that this Formation is also unlikely to be present within Subzone 1. However, it does unconformably underlie the Eem Formation in places. (An unconformity is a gap in the geologic record as a result of erosion or non-deposition).

5.10 Swarte Bank Formation: During the Elsterian glacial stage, a complex system of mainly north-north-west/south-south-east trending valleys was eroded into the older Quaternary deposits or into bedrock. The Swarte Bank Formation comprises the sediment which infilled
these valleys and consists of poorly-sorted gravelly coarse sand and well-bedded clays with bands of silt and sand. Where these eroded valleys are present in Subzone 1 there will be an unconformable relationship between the Bolders Banks Formation and the underlying Swarte Bank Formation. The Swarte Bank Formation is liable to be encountered at depths of approximately 12 m to 20 m below seabed (although this will be locally variable).

5.11 **Yarmouth Roads Formation**: This Formation unconformably underlies much of the Bolders Bank Formation in Subzone 1. It thickens towards the east, approaching a maximum thickness of 100 m+ and consists of fine or medium-grained sands with variable interbedded clay lamination. The Yarmouth Roads Formation is liable to be encountered at depths of approximately 12 m to 20 m below seabed (although this will be locally variable).

5.12 Figure 5-1 shows an example section of interpreted boomer data and shows thin Holocene seabed sediments overlying Quaternary deposits. A palæochannel filled with Botney Cut Formation (BCT) is incised into the Bolders Bank Formation (BDK) and underlying Yarmouth Roads Formation (YM).

![Figure 5-1](image)

**Figure 5-1** Interpreted boomer data from Subzone 1 showing Holocene sediment overlying Quaternary Formations

5.1.2 **Solid Geology (bedrock)**

5.13 Cretaceous bedrock may be exposed or lies close to the seabed in the north-west and south-west corners of the Hornsea Zone and may be composed of chalk (Chalk Group) or mudstone (Cromer Knoll Group) (BGS; 1985a, 1985b, 1987c, 1988b). However, these data also indicate that bedrock does not occur near the seabed within Subzone 1.

5.1.3 **Bathymetry**

5.14 Bathymetry (or water depths) across the Hornsea Zone are variable ranging from 24 m to 70 m with the greatest depths found within Markham’s Hole (located in the eastern part of the Zone). For Subzone 1, water depths are more uniform with the majority of the area being between 25 m and 30 m, although the greatest depth is approximately 40 m (Figure 5-2).
5.1.4 Seabed Features

Seabed features (or bedforms) include sandwaves and megaripples. On the continental shelf these bedforms develop as a result of sediment transport processes and may, therefore, indicate potential active sediment transport. The crests of sandwaves, for example, are approximately perpendicular to the direction of transporting current and generally occur in areas where current velocities exceed 65 cm/s (Johnson and Baldwin, 1996). Current speeds within the Hornsea Zone can reach 100 cm/s and are therefore of sufficient magnitude to form sandwaves. Cameron et al. (1992) reported sandwaves in the North Sea occurring in water depths between 18 m and 60 m, and water depths in Subzone 1 lie within this range.

British Geological Survey (BGS) and SeaZone data indicate that conditions within Subzone 1 are favourable to sandwave formation. Sandwave heights in the order of 1 m to 3 m have been confirmed by the preliminary results from geophysical surveys. These are lower than those found elsewhere in the wider Hornsea Zone where maximum heights reach 10 m to 15 m (Figure 5-3).
5.1.5 Seabed Sediments

5.17 The majority of seabed sediment within Subzone 1 consists of sand and gravelly sand, with slightly gravelly sand and sandy gravel as minor components (Figure 5-4). Examples of sand and slightly gravelly sand, collected to the south of the Hornsea Zone, are indicative of the sediments for this region of the southern North Sea (see images in Figure 5-4).

5.18 The seabed sediments within the Hornsea Zone are generally variable in thickness with gravelly sands or sandy gravels usually less than 2 m to 3 m thick, although slightly finer sediments such as sand or slightly gravelly sand may be thicker (BGS; 1987a, 1987b, 1988c, 1990). These sediment thicknesses are also found within Subzone 1.
Figure 5-4  Seabed sediment map of Hornsea Zone, southern North Sea and example sediment images

5.1.6 Data and Information to Inform EIA

A number of data and information sources were used in the preparation of this scoping report including:


Pers. comm.. Tappin (2009). Prof. David Tappin (BGS);

Pers. comm. James (2009). Mr Ceri James (BGS); and


5.20 A more detailed review of the grey and scientific literature will be undertaken for EIA. In addition, further geophysical and geotechnical surveys have been commissioned in summer 2010 as part of the site investigations to inform the EIA and engineering design, namely:

- Multibeam (swath) bathymetry sonar with line spacing optimized to ensure 100% seabed coverage;
- High and low resolution sidescan sonar with line spacing optimized to ensure 100% seabed coverage to depict seabed features, seabed sediment classification and seabed debris;
- High resolution seismic boomer surveys to determine subsurface layers to inform turbine foundation design and cable route corridors;
- Ultra high resolution seismic pinger surveys to determine the nature of the surface layers of the seabed to inform the suitability for cable installation, and cable route corridors;
- RoxAnn Acoustic Ground Discrimination System (AGDS) surveys to classify and map seabed sediments (also used to detect the presence of biogenic reefs and protected ecological habitats);
- Marine magnetometer surveys to identify major items of debris, wreck or changes in near surface bedrock within the Subzone and cable route corridors; and
• Geotechnical sampling using vibrocoring, cone penetration tests (CPT) and boreholes to
ground-truth geophysical data interpretations.

5.21 All survey data will be processed, interpreted and reported in order to inform the various
sections that rely on high resolution geophysical data, such as physical processes,
archaeology, benthic ecology, fish and shellfish ecology, navigation and shipping and any
other relevant issues identified as part of the EIA process.

Q7: With regard to marine geology, bathymetry, seabed features and sediments, should any
further data sources be consulted as part of the EIA process?

5.1.7 Methods Supporting EIA

5.22 Data from the geophysical survey commissioned in summer 2010 using sub-bottom seismic
reflection (boomer and pinger), multibeam bathymetric and sidescan sonars, and RoxAnn
AGDS will be used to establish surface and subsurface geology and the nature of the seabed
within Subzone 1 and the wider Zone. These data will be ground-truthed using vibrocoring,
borehole sampling and grab sampling. This will be augmented with seabed photography and
drop-down underwater video cameras where appropriate. The survey results will allow
interpretation of the most appropriate turbine foundation design.

5.23 Data collected on seabed sediments will inform the numerical models being used to predict
changes in the sediment transport regime. The outputs from these models will identify
whether there are any likely changes to the seabed due to Project One, with particular
attention to scour holes and any changes within navigation routes.

5.1.8 Potential Project Impacts

Construction Phase

5.24 The identified potential impacts on marine geology, bathymetry, seabed features and
sediments resulting from the construction of Project One are as follows:

• The construction of Project One and the associated cable trenching is considered
  unlikely to significantly change the underlying geology of Subzone 1 and the cable route
corridor.
• Temporary increase in suspended sediment and deposition from plumes could change
  sediment composition (locally);
• Changes to, removal of, or creation of large-scale seabed features such as sandwaves
  and megaripples; and
• Changes in sediment transport pathways and deposition could locally affect navigation
  channels, although it is not considered that this will cause any significant issues
  considering the water depths that are prevalent in Subzone 1.

Operation and Maintenance Phase

5.25 There are no anticipated significant impacts to geology as a result of operation and
maintenance; however changes to hydrodynamics as a result of turbine structures have the
potential to impact bathymetry, seabed features and sediment distribution.

Decommissioning Phase

5.26 The potential impacts during decommissioning are considered to be similar to those
previously described during construction.

5.1.9 Potential Transboundary Impacts

5.27 No transboundary impacts on this receptor are anticipated from Project One, as the project
lies approximately 40 km from the international boundary. This aspect has, therefore, been
scoped out of the EIA process for Project One. However, transboundary implications will still
be considered within the ZEA.
5.1.10 Potential Cumulative Impacts

5.28 No impacts on the Quaternary geology or bedrock are anticipated and therefore no cumulative impacts are considered.

5.29 Bathymetric changes are anticipated to be localised, although there is the potential for cumulative impacts between turbines if scour pits interact.

5.30 Seabed sediments, sediment transport and suspended sediments are anticipated to be localised, although there is the potential for cumulative impacts between turbines within Project One should hydrodynamic changes caused by turbines interact. This is also dependent on the nature of the sediment.

5.1.11 Potential In-combination Impacts

5.31 No impacts on the Quaternary geology or bedrock are anticipated and, therefore, no in-combination impacts are considered.

5.32 Within Project One there appear to be no structures or activities (e.g., aggregate extraction or channel dredging) which may cause in-combination impacts to bathymetry. It is however acknowledged that there is the potential for in-combination impacts between Project One and oil and gas platforms and subsea structures at a Zone wide scale, these implications will be considered within the ES and as part of the ZEA.

5.33 There is the potential for in-combination impacts to suspended sediments with aggregate extraction activities at specific locations along the cable route. These will be investigated further during the EIA process.

5.1.12 Potential Mitigation and Monitoring

5.34 The physical processes model will predict any potential changes due to bathymetry changes to the seabed sediments and sediment transport due to hydrodynamic changes from the proposed turbines. The spacing of the turbines may be designed to mitigate potential impact based on models. Furthermore, scour protection may be put in place to reduce scour associated sediment movement. Post-construction surveys will be used to verify the model predictions.

5.35 Identification of the most appropriate mitigation and monitoring measures will be determined following the findings from the impact assessments.

5.2 Physical Processes

5.36 Physical processes include tides, currents and waves operating within the Hornsea Zone and Subzone 1 that drive sediment transport.

5.2.1 Tides

5.37 Offshore tidal data have been analysed for sites at to the south-west of Subzone 1 to the south-east (see Figure 5-7). These show the tide to be semidiurnal, with macrotidal ranges (greater than 4 m) to the south-west of Subzone 1 and mesotidal ranges (between 2 m and 4 m) to the south-east of Subzone 1. The Mean Spring Range for the Hornsea Zone varies between approximately 1.75 m and 4.5 m.

5.38 Tidal current information off the Humber estuary shows a predominantly north/south tidal flow, unaffected by flows into and out of the Humber estuary. The maximum speeds on spring tides here are around 0.9 m/s, capable of transporting medium sized sand. Closer inshore, off the Outer Binks, the peak flood flow is 1.3 m/s, while the ebb is as high as 1.8 m/s. Thus, the ebb flows out of the Humber Estuary are dominant locally, transporting sediment out of the estuary.

5.39 The tidal wave passing through the Hornsea Zone propagates from north to south, i.e., high tide occurs earlier in the north and moves southwards. There is an estimated variation of 2.75 m and 10 minutes in tidal range and high water interval respectively across the Hornsea Zone. To accurately define the tidal regime for Project One will require targeted data collection within Subzone 1.

5.40 The tidal stream bearing derived is shown to occupy a fairly narrow angle, ranging from 027°T to 045°T (with a reciprocal at +180°), indicating that the flood-ebb and tidal ellipse major axis
is aligned along a north-east/south-west plane. Consequently, flood and ebb currents travelling across the Hornsea Zone do so in a south-west and north-east direction respectively.

5.2.2 Currents

5.41 Analysis of the offshore tidal data (mentioned above) has determined that the mean spring and neap current rates for the Hornsea Zone vary from 0.52 m/s to 0.62 m/s and 0.28 m/s to 0.32 m/s respectively.

5.42 The Flamborough Front is a key oceanographic feature that occurs during the summer months and is a result of the meeting of the colder, deeper stratified waters of the Northern North Sea and the warmer, shallower, well-mixed waters of the Southern North Sea (Pingree and Griffiths, 1978) (Figure 5-5). During the spring-neap tidal cycle and strong prevailing winds, the front advances and retreats to cause greater mixing through the water column (Simpson and Bowers, 1981; Wang et al., 1990). Where these two distinct water masses meet it forms an area rich in nutrients, with increased plankton growth and secondary productivity and, therefore, forms an important ecological feature (Institute of Estuarine Coastal Studies, 1992). The existence and position of the Flamborough Front may also affect the distribution of suspended sediment and observed wave shape within the Hornsea Zone.

Figure 5-5  Indicative location of the Flamborough Front

5.2.3 Waves

5.43 Waves can be characterised as wind waves and long period swell waves, which are generated by storms and show no correlation with local wind conditions. Wind speed, duration and fetch along with seabed topography are the major factors generating and propagating wind waves.

5.44 For engineering activity, wind waves are of greater importance as the influence of wind-induced waves on structures is potentially more destructive. Marine structures must be designed to sustain the forces and velocities induced by these waves.

5.45 In the Hornsea Zone, the prevailing winds come from the south-west and the wave climate is dominated by locally generated short period waves. Long period swell waves are generated from storm activity in the North Atlantic with the resulting swell waves propagating into the North Sea. These approach the Hornsea Zone from a north-easterly direction, which is more distinct in winter months than summer.
5.46 Based on data collected close to the Hornsea Zone, the estimated average wave heights for summer and winter are 1.2 m and 1.8 m respectively, and associated periods increase from 7.8 to 8.0 seconds during the summer to 8.2 to 8.5 seconds in the winter. Maximum wave predictions for nearshore are on average 1.5 m lower than those for the offshore across 1 in 1, 10 and 100 year events. For a 1 in 50 year significant wave event, the average offshore wave height is predicted to be 5.1 m. These extremes are characterised by long period swell waves that are generated by storm activity in the North Atlantic.

5.2.4 Suspended Sediment Regime

5.47 The suspended sediment regime for Subzone 1 is yet to be determined. However, it is known that both tide and wind are important processes affecting sedimentation and erosion in the North Sea. In addition, storms can enhance resuspension, although only for a few days, and so these may not have a large effect on suspended sediment concentrations. By contrast, periods with consistently high winds from one direction (usually south-west) are probably more important, since these significantly affect the suspended sediment. Such periods are often found from December to March. It has been observed from previous studies that suspended sediment concentrations are much lower during the summer than winter (Gerritsen et al., 2000).

5.48 Resuspension of seabed sediment is due to the shear stress exerted on the seabed. Waves and tidal currents combine to generate bed shear stress throughout the North Sea – waves enhance the bed stress so that sediment is mobilised and currents determine the magnitude and direction of transport (Mitchelson-Jacob and Jago, 2009).

5.49 In the Southern North Sea, the summer and winter distribution of suspended sediments in surface waters has been mapped by CEFAS (HR Wallingford et al., 2002) (Figure 5-6). The concentration of suspended sediment appears to be low in offshore areas (0-4 mg/l) compared to the higher concentrations found in estuaries. In the winter months, concentrations are higher; in general, suspended sediment concentrations are doubled.
5.50 The cable route corridor encompasses the Holderness coastline. The rapidly eroding boulder clay cliffs of the Holderness coast terminate near Kilnsea. The continued existence of the Spurn peninsula depends heavily on the supply of material from the erosion of the Holderness cliffs. The Institute of Estuarine and Coastal Studies (IECS) produced a report on 'Holderness Coastal Defence' in 1994 that included estimated sediment transport in the region from Barmston to Cowden. They estimated that the supply of sand from cliff erosion between Barmston and Hornsea was 30,000 m³/year and that this moves south past the coastal town of Hornsea.

5.51 There is a strong southerly flux of sand past Flamborough Head and along the Holderness coast, which leads to strong southerly transportation of sediment across the Humber. Prandle et al. (2001) modelled suspended sediment concentrations along the Holderness coastline and showed that, for sediment with a median grain diameter of approximately 50
microns, the eroded material could be transported within a few kilometres of the coast solely by tidal forcing.

5.52 Bedload (i.e., sediment that is moved along the seabed rather than in suspension) indicators along the edge of the Humber channel suggest a possible northerly movement of material with feedback offshore to a convergence area offshore of the Hornsea coastline (HR Wallingford et al., 2002). This indicates that the sediment movement near the coast is complex and will need careful consideration along the actual route the cable will take.

5.2.5 Data and Information to Inform EIA

5.53 Various studies and data sources will be used to inform the EIA, some of these have been identified at this early scoping stage and include:

- British Oceanographic Date Centre, including projects such as Land-Ocean Interaction Study (LOIS);
- Southern North Sea Sediment Transport Study 2 (SNS2) (HR Wallingford et al., 2002);
- Centre for Environment Fisheries and Aquaculture Science (CEFAS) studies; and
- Humber Shoreline Management Plan (SMP) 2.

5.54 Data on seabed sediments and transport will inform an oceanographic and sediment regime model. The outputs from this model will identify whether there are likely to be any changes to the physical nature of the seabed due to Project One, with particular attention to scour holes and any changes in navigation routes.

Q8: With regard to physical processes, should any further data sources be consulted as part of the EIA process?

5.2.6 Methods Supporting EIA

5.55 A metocean campaign is being undertaken to collect site-specific data. This consists of seven moorings in total, six of which collect a current profile through the water column, wave data and suspended sediments, plus meteorological data from a surface buoy (see Section 3.5.1), and one which collects wave data only (a waverider). Three of the metocean moorings and the waverider will be deployed for one year, and the remaining three for six months only over the winter period (Figure 5-7).

5.56 As can be seen, one of the 12 month moorings is located within Subzone 1. The measurements at this site include:

- Oceanographic data:
  - Wave regime (height, period and direction);
  - Current regime (speed and direction through the water column);
  - Water level (including tides and surges);
  - Water temperature; and
  - Suspended sediment values (near bed).

- Meteorological data:
  - Wind speed;
  - Wind direction;
  - Atmospheric pressure; and
  - Air temperature.
The meteorological buoys transmit data to shore in real-time so the conditions on site can inform site survey activity, and ongoing data integrity can be checked. Specific details of the measurements are given in the Zone Assessment Methodology document (ZAM) (Emu Ltd., 2010a) available on the SMart Wind website (http://www.smartwind.co.uk/).

The observations from all seven moorings, plus bathymetry and sediment information from the geophysical and benthic surveys (including particle size analysis), will be used to calibrate a physical processes model. This two-dimensional (2D) model will enhance the understanding of the oceanographic processes and thus, in conjunction with the measurements themselves and a literature review, be used to describe the baseline for the physical processes within the Subzone. The model will also extend across the Zone and wider region to ensure the processes are understood in the near and far-field areas. The model consists of a series of modules to represent the hydrodynamics, wave, and sediment transport conditions; these interlink to describe the overall oceanographic regime. This model has a variable grid to give a higher resolution within Subzone 1 and coarser resolution over the wider area. Details of the Telemac modelling system are given in the ZAM document available on the SMart Wind website (http://www.smartwind.co.uk/).

Having established that the model is representative of the conditions, the likely changes over the next 50 years will be considered. This will give context to the predicted changes resulting from the turbines themselves. Modelling will then be undertaken to establish the likely effects of the turbines at both the near-field and far-field scales. Interactions between individual turbines will be identified, and the conditions where these could potentially occur determined. In conjunction with the ZEA, these results will then be used to assess potential cumulative and far-field impacts.

Information for the cable route will be gained from existing studies. In areas where the cable route crosses sandwaves, the development and behaviour of the sandwaves along the cable route and the implications with respect to cable burial and integrity can be carried out using statistical analysis to determine risk of exposure for range of depths of burial. This will use the geophysical and geotechnical survey data that will be collected along the cable corridor in 2011.

Bathymetry will be analysed numerically to determine precise positions of crests and troughs. A spatial distribution of these characteristics will be given and used to propose safe levels of cable burial and determine an optimal cable route.
5.62 Data from historic surveys (where available) will allow the estimation of the migration rates of sand waves. This information makes it possible to estimate the bed level changes due to sand wave migration over the life time of the cables. This will be dependent on the length of the historic survey record and the quality of these records.

5.63 The sand transport regime along the proposed cable route and its immediate environs will be assessed from the general sediment transport modelling undertaken as part of the study.

5.2.7 Potential Project Impacts

5.64 The potential impacts on the oceanographic regime could occur through the pathways listed below and will be considered as part of the EIA.

**Construction Phase**
- Vessel activity:
  - Temporary disturbance to sediments caused by jack-up legs or anchor;
  - Temporary interference with seabed morphology caused by jack-up spud cans (base of the legs); and
  - Disruption to flow around jack-up legs;
- Foundation installation:
  - Increased suspended sediment dependent on method of installation;
  - Scour around foundations causing increased suspended sediment concentrations;
  - Suspension and deposition of plumes which may cause a change in sediment composition locally; and
  - Interference with seabed morphology.
- Cable installation:
  - Increased suspended sediment during jetting or trenching;
  - Suspension and deposition of plumes which may change sediment behaviour locally; and
  - Interference with seabed morphology.

5.65 Previous studies have shown suspended sediments from offshore wind farm construction are typically within background conditions and so unlikely to be significant impacts.

**Operation and Maintenance Phase**
- Maintenance vessel activity:
  - Temporary disturbance to sediments caused by jack-up legs or anchor;
  - Temporary interference with seabed morphology caused by jack-up spud cans; and
  - Disruption to flow around jack-up legs;
- Foundations:
  - Alteration of current flow around foundations;
  - Alteration of flow downstream of foundations (known as wake effects);
  - Alteration of wave regime due to dispersion of energy, possibly affecting both wave height and direction;
  - Alteration of suspended sediment concentrations and sediment pathways (collectively known as sediment transport) due to the above factors; and
  - Interference with seabed morphology (potential impact on navigation channels).
- Vessel activity:
  - Temporary disturbance to sediments caused by anchors.
- Cable route:
  - Exposure of cable if laid within sandwave fields; and
  - Interference with seabed morphology.

5.66 No far-field impacts on physical processes are anticipated.

**Decommissioning Phase**

5.67 The potential impacts during decommissioning are considered to be similar to those previously described during construction.

**5.2.8 Potential Transboundary Impacts**

5.68 No transboundary impacts are anticipated from Project One, as the project lies approximately 40 km from the international boundary. However, transboundary implications will still be considered within the ZEA.

**5.2.9 Potential Cumulative Impacts**

5.69 The potential for cumulative impacts on physical processes includes the interaction of wake effects between turbines, but these may be avoided by appropriate wind farm design. The loss of energy from the wave regime, may cause cumulative effects with other future wind farm Blocks within the Hornsea Zone, dependent on the configuration of the Zone overall.

5.70 There may be potential cumulative impacts on suspended sediment concentrations and pathways should hydrodynamic changes caused by the turbines interact.

**5.2.10 Potential In-combination Impacts**

5.71 There is the potential for in-combination impacts on suspended sediments with aggregate extraction dredging at specific locations along the cable route. These will be investigated further through the EIA process.

**5.2.11 Potential Mitigation and Monitoring**

5.72 The physical processes model and interpretation will predict any potential changes to the seabed sediments and sediment transport due to hydrodynamic changes from the proposed turbines. As with general bathymetry, changes to the spacing of the turbines at the design stage may mitigate cumulative interactions. In addition, scour protection may be put in place in order to reduce scour associated sediment movement.

**5.3 Water Quality**

5.73 Suspended sediment and contaminant levels (hydrocarbons and metals) are indicators of water quality. Sediments are present in the marine environment as both suspended and deposited particles and comprise both organic and inorganic components. The suspension of seabed sediments increases turbidity and reduces water quality. The extent to which sediments are suspended or deposited is a function of their density and the hydrodynamics of the water column (see section above). Sediment suspension may also release historic contaminants into the water column (such as metals and hydrocarbons) from the sediment and associated pore water\(^5\), which can further reduce water quality.

5.74 The most important component of water quality is background turbidity, which is highly variable in space and time. Adverse changes to turbidity can affect both local and ecosystem level interactions. For example, increased suspended sediment reduces light penetration and prevents the uptake of nutrients by primary producers; this in turn affects the distribution of zooplankton, which impacts other species in the food chain such as fish, birds and marine mammals.

5.75 Within Project One, sediment contaminant concentrations may be variable as there is an existing open disposal site, a number of oil and gas developments, military activity, wrecks, potential ordnance and shipping activities in and around the Hornsea Zone and proposed cable corridor route. However, oil and gas developments located to the east and west of

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\(^5\) Pore water is water filling the spaces (pores) between grains of sediment.
Subzone 1 are at sufficient distance to make it unlikely that they have any effect on the water and sediment quality within the development area.

5.76 Sediment type is an important factor when considering the potential presence of contaminants as they could contain contaminants that, if disturbed, might be released. Fine grained sediments, such as clays and muds can act as adsorption surfaces for some contaminants which may then be released into the marine environment when disturbed during site preparation and construction activities.

**Adsorption:** the process by which a substance, such as a gas or liquid, are retained on the surface of another substance, such as a solid.

5.3.1 Data and Information to Inform EIA

5.77 There is generally a scarcity of primary water quality data within the Project One area, although further data and information will become available during the EIA process. At this scoping stage, the key data sources identified to inform the water and sediment quality assessment are expected to include:

- Data on water and sediment quality from the British Oceanographic Data Centre (BODC);
- Environmental Statements for previous offshore infrastructure;
- Sediment grain size and distribution data along with sediment contaminant data collected as part of a Subzone benthic study;
- Report on Habitat Status of the Humber Estuary (Hemingway et al., 2008); and
- Additional published reports and papers.

Q9: With regard to water quality, should any further data sources be consulted as part of the EIA process?

5.3.2 Methods Supporting EIA

5.78 Guidance on the generic requirements for physical process studies (including water and sediment quality) is provided in two main documents:

- Cefas (2004). *Offshore Wind farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA requirements*; Version 2; and

5.79 The potential increase in turbidity and, therefore, potential associated release of contaminants resulting from disturbance to the seabed will be assessed on the basis of a qualitative analysis and comparison with the natural variability in these parameters.
5.80 A desk top study of water and sediment quality will be carried out primarily from data acquired from the British Oceanographic Data Centre (BODC), which gathers data from a number of government agencies, and the Quality Status Report (OSPAR, 2010). Supplementary data from other reports and studies will be used where applicable and necessary.

5.81 Site specific information will be collected during the Subzone benthic study identified in Section 6.2. This will provide an analysis of sediment particle size and distribution, this information will be used to model likely increases in suspended sediment during construction. Sediments will also be analysed for contaminants and concentrations will be compared to the levels set out in the Canadian Interim Marine Sediment Quality Guidelines (UK MARINE SAC, 2010) and Cefas Action Levels for dredged materials.

5.3.3 Potential Project Impacts

Construction Phase

5.82 The identified potential impacts on water quality resulting from the construction of Project One are as follows:

- Construction activities, such as the installation of foundations and the laying of cables, has the potential to release contaminants bound in sediments, and increase suspended sediment concentrations for the duration of the activity;
- Increased turbidity leads to a reduction in light penetration, which can affect primary production. Decreased primary production can impact on organisms at higher trophic levels through a reduction in food availability and can therefore affect fish and bird distributions and community composition and impact on sensitive epifaunal and infaunal communities;
- Increased turbidity can also interfere with the hunting and feeding efficiency of a wide range of animals including fish, birds and marine mammals. The resuspension of marine sediments can affect filter feeding organisms, such as shellfish, through clogging and damaging feeding and breathing apparatus. Similarly, juvenile fish can suffer damage to gills. Adult fish are likely to move away from or avoid areas of high suspended solids;
- Upon suspension, sediments may release nutrients and/or contaminants, such as metals and hydrocarbons, to the water column. The release of metals and hydrocarbons from the sediment and associated porewater can reduce water quality which may potentially impact marine organisms. A relatively small increase in nutrients could increase primary production; however a large increase in nutrients has the potential to reduce oxygen concentrations;
- Considering Subzone 1 is offshore and the seabed is predominantly sandy gravel and sand, it is unlikely that very high proportions of organic material and contaminants are present, however closer inshore within the cable route corridor, the potential for fine sediments and possible associated contaminants increases. High levels of nutrients and contaminants are more commonly associated with very fine sediments (mud and silt); and
- There is the potential for the accidental release of contaminants into marine environment during construction activities through spillage or leakage of contaminants from vessels and/or other plant.

Operation and Maintenance Phase

5.83 The identified potential impacts on water quality resulting from the operation and maintenance of Project One are as follows:

- During operation the alteration to tidal current flows and waves caused by the physical presence of the wind turbines on the seabed may result in changes in seabed scour and deposition, which affects turbidity. Turbidity changes in the operational phase are likely to be localised; and
- There is the potential for the accidental release of contaminants into marine environment during operation and maintenance activities through spillage or leakage of contaminants from vessels and/or other plant.
5.84 The identified potential impacts on water quality resulting from the decommissioning of Project One are as follows:

- The potential impacts during decommissioning are considered to be similar to those previously described during construction.

5.3.4 Transboundary Impacts

5.85 There are unlikely to be any transboundary impacts resulting from Project One in relation to water quality as the impacts on the seabed and water column will largely be localised to within close proximity of Project One. This aspect has therefore been scoped out of the EIA process.

5.3.5 Potential Cumulative Impacts

5.86 There is the potential for cumulative impacts to occur where plumes of resuspended sediments from the construction activities of neighbouring wind farms interact. Cumulative impacts are also possible during the operational phase where increased turbidity from changes in hydrodynamics and scour interact with other projects. The potential for sediment resuspension, sediment contamination, the extent of interaction with other projects and the likelihood of this having a significant effect on the marine environment will be assessed during the EIA process.

5.3.6 Potential In-combination Impacts

5.87 There is the potential for in-combination impacts to occur where plumes of resuspended sediments from the construction activities of other projects interact. In-combination impacts are also possible during the operational phase where increased turbidity from changes in hydrodynamics and scour interact with other activities and projects. The potential for sediment resuspension, sediment contamination, the extent of interaction with other activities and projects and the likelihood of this having a significant effect on the marine environment will be assessed during the EIA process.

5.3.7 Potential Mitigation and Monitoring

5.88 Mitigation options will be considered as part of the EIA. Contamination of the water column and sediment will be managed through adherence to standard protocols. Disposal of seabed material, if required for seabed preparation and/or disposal of drill arisings from foundations, will be in line with standard procedures, in agreement with relevant authorities and subject to a Food and Environment Protection Act 1985 (FEPA) licence or as deemed through a new Marine Licence. Good working practices will be adopted during the construction and maintenance phase to prevent accidental spillages and loss of solid objects.

5.89 Potential accidental spillages or leakages to be mitigated by correct servicing and maintenance of all equipment, plant and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environmental Management Plans, Environment Agency Pollution Prevention Guidelines (Environment Agency, 2010) and onsite monitoring/reporting.

5.4 Air Quality

5.90 The concentration of air pollutants within the Project One site boundary is highly variable in time and space. The main sources of atmospheric emissions in the area are from shipping, and the oil and gas industry which are covered in Sections 7.2 and 7.9 respectively.

5.91 The application of a sulphur emission control area in the North Sea, implemented at the end of 2007, has led to a significant reduction in the output of Sulphur Oxides (SO\textsubscript{X}). Conversely, Nitrogen Oxides (NO\textsubscript{X}) emissions are falling only slowly. The 2010 targets set by the UK government under Directive 2001/81/EC on National Emission Ceilings have not been met (House of Commons, 2010).

5.92 Once Project One is operational, it will reduce the emissions of other air quality pollutants (SO\textsubscript{X} and NO\textsubscript{X}) over its lifetime through the displacement of fossil fuel use, although
quantification of this will depend on assumptions regarding the nature of the generating capacity it replaces.

5.93 During construction there is the potential for a temporary reduction in air quality to occur within Project One as a consequence of emissions from construction vessels, vehicles and plant and will be considered and assessed within the EIA process.

5.94 No likely significant operational air quality effects are anticipated. The operation of Project One is unlikely to significantly increase the overall CO₂, SOₓ, NOₓ and other pollutants within the Project One site.
6 BIOLOGICAL OFFSHORE ENVIRONMENT

6.1 Offshore and Onshore Nature Conservation Designations

6.1 There is a degree of overlap between onshore and offshore with regard to nature conservation designations, therefore to provide a holistic approach to nature conservation this section considers both onshore and offshore designated sites together. This section is therefore relevant to the offshore and onshore components of Project One.

Offshore Nature Conservation Designations

6.2 There are offshore Special Areas of Conservation (SACs) in the form of candidate SACs (cSACs) and possible SACs (pSACs) north and south of Project One, these are shown in Figure 6-1 and described below.

Haisborough, Hammond and Winterton cSAC

6.3 The Hainsborough, Hammond and Winterton cSAC is designated for sandbanks, biogenic reef, harbour porpoise and grey seal and is located 89 km directly south of Subzone 1, this designation lies over the 12 Nm boundary line.

6.4 It is described as a collection of sandbanks off the north-east coast of Norfolk (JNCC, 2010a). The crest of these banks tended to be characterised by small numbers of polychaete worms and amphipods. In the troughs between the banks, where sediments are more stable, bryozoans, hydroids and sea anemones are prominent. Bivalves and crustaceans are found throughout the site. The site has also been recommended as a cSAC for its biogenic reef created by the ross worm Sabellaria spinulosa by consolidating thousands of fragile sand-tubes to create a solid structure that rises from the surrounding seabed. These tiny sand-tubes that make up the reef and support a diverse array of hydroids, sponges and tunicates.

6.5 Harbour porpoise Phocoena phocoena and grey seals Halichoerus grypus are present at the Haisborough, Hammond and Winterton cSAC and have been included as non-qualifying features.

Inner Dowsing, Race Bank and North Ridge cSAC

6.6 The Inner Dowsing, Race Bank and North Ridge cSAC is designated for sandbanks, reef, harbour porpoise and grey seal and is located 76 km south-east of Subzone 1, this designation also lies over the 12 Nm boundary line.

6.7 A characteristic feature of the cSAC is its S. spinulosa reef communities. A wide range of sandbank types are enclosed by the boundary including banks bordering channels, relict linear banks and sinusoidal banks (JNCC, 2010b). The area contains species such as polychaete and nemertean worms and the ascidian Molgula sp. The main areas of S. spinulosa reef are found in the south-west of the site. These areas support a diverse community of bryozoans, hydroids, sponges and tunicates.

6.8 Harbour porpoise and grey seal are also present at the site and have been included as non-qualifying features.

North Norfolk Sandbanks & Saturn Reef cSAC

6.9 The North Norfolk Sandbanks & Saturn Reef cSAC is designated for sandbanks and reef and is located 11 km directly south of Subzone 1. The site consists of 10 main sandbanks and a number of smaller banks, which collectively form the most extensive example of offshore linear ridge sandbanks in UK waters (JNCC, 2010c). The banks are home to invertebrate communities typical of sandy sediments, such as polychaete worms, crabs and brittlestars. The Saturn reef is a S. spinulosa biogenic reef within the candidate site.

Dogger Bank pSAC

6.10 The Dogger Bank pSAC has been identified for its sandbank and the communities it supports, including harbour porpoise and grey seal. It is located 30 km directly north of Subzone 1 and is the largest sandbank in UK waters and adjoins both Dutch and German Dogger Bank designated sites. The bank supports communities typical of sandy sediments, characterised by infaunal polychaete worms, amphipods and small clams and epifaunal hermit crabs,
flatfish and starfish (JNCC, 2010d). Sand eels are abundant on the flanks of the bank and provide a food resource for seabirds, cetaceans and other commercial fish species, such as cod *Gadus morhua*. JNCC recognises that the Dogger Bank region is an important location for the North Sea harbour porpoise population and as such they are included as a non-qualifying feature. Grey and common seals *Phoca vitulina* are known to visit the bank and are included as non-qualifying features at the site (JNCC, 2010d).

**Figure 6-1** UK offshore nature conservation designations

*Non-UK Nature Conservation Designations*

6.11 Along the coasts of Germany, Belgium, the Netherlands and Denmark there are also Natura 2000 sites comprising of SPAs and SACs, as shown in Figure 6-2, interest features for these sites are presented in Table 6-1 below.
6.12 Under Natura 2000, these designations are afforded protection, any impact on the interest features of these sites are referred to as transboundary impacts, and will be discussed in Section 6.1.4. Table 6-1 lists the interest features for the nearest two offshore non-UK designated sites: the Dutch sites Klaversbank and Doggersbank SCIs.

**Onshore and Coastal UK Nature Conservation Designations**

6.13 Along the east coast of England, there are sites designated for birds, marine mammals, certain fish species and habitats. These are described in Table 6-1 and shown in Figure 6-3. Potential impacts on the interest features of these designations will be assessed during the EIA process and are discussed further in Sections 6.3, 6.4 and 6.5.
### Table 6-1 Onshore, coastal and offshore nature conservation designations

<table>
<thead>
<tr>
<th>Importance</th>
<th>Name of Designation</th>
<th>Interest Features</th>
<th>Approximate Distance from Subzone 1 (km)</th>
<th>Approximate Distance from Killingholme (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>International UK designations</td>
<td>Dogger Bank pSAC</td>
<td>Sandbank and the communities it supports, including harbour porpoise and grey seal.</td>
<td>30</td>
<td>137</td>
</tr>
<tr>
<td></td>
<td>North Norfolk Sandbanks &amp; Saturn Reef cSAC</td>
<td>Sandbanks and reef</td>
<td>11</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Haisborough, Hammond and Winterton cSAC</td>
<td>Sandbanks, biogenic reef, harbour porpoise and grey seal.</td>
<td>89</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>Inner Dowsing, Race Bank and North Ridge cSAC</td>
<td>Sandbanks, reef, harbour porpoise and grey seal.</td>
<td>76</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Humber Flats, Marshes and Coast SPA</td>
<td>Nationally or internationally important numbers of three breeding bird species and 21 wintering species; regularly supporting over 20,000 waterfowl.</td>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Humber Estuary SAC</td>
<td>Habitats: Atlantic salt meadows, Sand dunes, Sand flats, Sandbanks, Intertidal mudflats, Coastal lagoons. Species: River lamprey, Sea lamprey and Grey seal.</td>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td>Importance</td>
<td>Name of Designation</td>
<td>Interest Features</td>
<td>Approximate Distance from Subzone 1 (km)</td>
<td>Approximate Distance from Killingholme (km)</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
<td>-------------------</td>
<td>-----------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Humber Estuary Ramsar Site</td>
<td>Genetic and ecological diversity; regularly supports 20,000 waterfowl and 1% of a waterfowl species population.</td>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gibraltar Point Ramsar Site</td>
<td>Representative wetland; rare species; regularly supports 20,000 waterfowl and 1% of a waterfowl species population.</td>
<td>121</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>The Wash Ramsar Site</td>
<td>Representative wetland; regularly supports 20,000 waterfowl and 1% of a waterfowl species population.</td>
<td>123</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>North Norfolk Coast Ramsar Site</td>
<td>Representative wetland; regularly supports 20,000 waterfowl and 1% of a waterfowl species population.</td>
<td>106</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Flamborough Head and Bempton Cliffs SPA</td>
<td>Internationally important numbers of breeding kittiwakes; nationally important numbers of breeding guillemot, razorbill and puffin.</td>
<td>117</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Hornsea Mere SPA</td>
<td>Internationally important numbers of gadwell, wintering wildfowl and breeding wetland species</td>
<td>122</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Gibraltar Point SPA</td>
<td>Wintering wildfowl (regularly supports 20,000 waterfowl and 1% of a waterfowl species population).</td>
<td>119</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>The Wash SPA</td>
<td>Internationally important numbers of thirteen species of wintering wildfowl; nationally important numbers of seven species of wintering wildfowl and one species of passerine; regularly supports over 20,000 waterfowl.</td>
<td>123</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>North Norfolk Coast SPA</td>
<td>Internationally important numbers of breeding terns and wintering wildfowl; nationally important numbers of breeding waders, wildfowl and bearded tit.</td>
<td>106</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Great Yarmouth SPA</td>
<td>Nationally important for breeding little terns.</td>
<td>122</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td>Flamborough Head SAC</td>
<td>Reefs, submerged or partly submerged sea caves, vegetated sea cliffs of the Atlantic and Baltic coasts.</td>
<td>112</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>North Norfolk Coast and Gibraltar Point Dunes SAC</td>
<td>Embryonic shifting dunes, fixed dunes with herbaceous vegetation (grey dunes), humid dune slacks, lagoons, Mediterranean and thermo-Atlantic halophilous scrubs.</td>
<td>106</td>
<td>92</td>
</tr>
<tr>
<td>Importance</td>
<td>Name of Designation</td>
<td>Interest Features</td>
<td>Approximate Distance from Subzone 1 (km)</td>
<td>Approximate Distance from Killingholme (km)</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Importance</td>
<td>The Wash and North Norfolk Coast SAC</td>
<td>perennial vegetation of stony banks, shifting dunes along the shoreline with marram (white dunes).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importance</td>
<td>Winterton-Horsey Dunes SAC</td>
<td>Embryonic shifting dunes, eu-Atlantic decalcified fixed dunes, humid dune slacks.</td>
<td>121</td>
<td>162</td>
</tr>
<tr>
<td>National</td>
<td>Dutch Doggersbank SCI</td>
<td>Resident populations of <em>Phoca vitulina, Phocoena phocoena, Halichoerus grypus</em></td>
<td>56</td>
<td>214</td>
</tr>
<tr>
<td>National</td>
<td>Dutch Klaverbank SCI</td>
<td>Resident populations of <em>Phoca vitulina, Phocoena phocoena, Halichoerus grypus</em></td>
<td>40</td>
<td>209</td>
</tr>
<tr>
<td>National</td>
<td>Saltfleetby/Theddlethorpe Dunes NNR</td>
<td>Tidal flats, dunes, salt and freshwater marsh.</td>
<td>106</td>
<td>43</td>
</tr>
<tr>
<td>National</td>
<td>Gibraltar Point NNR</td>
<td>Tidal flats, dunes, shingle, grazing marsh</td>
<td>119</td>
<td>72</td>
</tr>
<tr>
<td>National</td>
<td>The Wash NNR</td>
<td>Estuarine tidal flats, saltmarsh, sandbanks</td>
<td>136</td>
<td>85</td>
</tr>
<tr>
<td>National</td>
<td>Spurn Point NNR</td>
<td>Sand and shingle banks held together with mainly Marram grass and Sea buckthorn</td>
<td>103</td>
<td>26</td>
</tr>
<tr>
<td>National</td>
<td>Dimlington Cliff SSSI</td>
<td>SSSIs are designated for their natural features, especially those of greatest value to wildlife conservation, are most highly concentrated or of highest quality.</td>
<td>105</td>
<td>25</td>
</tr>
<tr>
<td>National</td>
<td>The Lagoons SSSI</td>
<td></td>
<td>104</td>
<td>26</td>
</tr>
<tr>
<td>National</td>
<td>Hornsea Mere SSSI</td>
<td></td>
<td>122</td>
<td>27</td>
</tr>
<tr>
<td>National</td>
<td>Humber Estuary SSSI</td>
<td></td>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td>National</td>
<td>Saltfleetby to Theddlethorpe Dunes SSSI</td>
<td></td>
<td>106</td>
<td>41</td>
</tr>
<tr>
<td>Local/Other</td>
<td>Humber Bridge Country Park LNR</td>
<td>Local Nature Reserves (LNRs) are for both people and wildlife. They are places with wildlife or geological features that are of special interest locally. They offer people</td>
<td>141</td>
<td>15</td>
</tr>
<tr>
<td>Local/Other</td>
<td>Cleethorpes LNR</td>
<td></td>
<td>114</td>
<td>20</td>
</tr>
<tr>
<td>Local/Other</td>
<td>Cleethorpes country park LNR</td>
<td></td>
<td>116</td>
<td>20</td>
</tr>
</tbody>
</table>
Importance | Name of Designation | Interest Features | Approximate Distance from Subzone 1 (km) | Approximate Distance from Killingholme (km) |
--- | --- | --- | --- | --- |
 | Danes dyke LNR | special opportunities to study or learn about nature or simply to enjoy it. | 122 | 120 |
 | Flamborough Outer Headland LNR | They range from windswept coastal headlands, ancient woodlands and flower-rich meadows to former inner city railways, long abandoned landfill sites and industrial areas now re-colonised by wildlife. | 118 | 51 |
 | South Landing LNR | | 118 | 51 |
 | Bradley and Dixon Woods (might not be relevant) LNR | | 123 | 17 |
 | Humber bridge LNR | | 140 | 15 |
 | Waters edge LNR | | 139 | 12 |
 | Far Ings LNR | | 142 | 15 |
 | Dimlington Geological Conservation Review Site | Geological and geomorphological sites. These sites display sediments, rocks, fossils, and features of the landscape that make a special contribution to our understanding and appreciation of Earth science and the geological history of Britain. | 105 | 24 |
 | Spurn Head Geological Conservation Review Site | | 104 | 27 |
 | Spurn Heritage Coast | The "heritage coast" classification scheme was initiated in 1972 to protect coastline of special scenic and environmental value from undesirable development. | 101 | 23 |

**Future Designations**

6.14 In addition to the nature conservation designations mentioned in the preceding subsections, it is important to consider the potential to cause adverse impacts upon species and/or habitats that could be identified as interest features of future nature conservation designations. This is particularly relevant to habitats and species listed in Annexes I and II of the EU Habitats Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

6.15 There is a new initiative for future nature conservation designations in the marine environment, through the introduction of Marine Conservation Zones (MCZs) under the Marine and Coastal Access Act 2009.

6.16 The locations of designated sites within the marine protected zones are subject to discussion at the time of publishing this scoping document. The recommendations of stakeholders over the location of sites are due to be placed before government in 2011, with the newly designated areas defined in 2012. SMart Wind is directly engaged with the Net Gain initiative and discussion will continue with stakeholders throughout this period over the implications for the development of Project One.

6.17 The United Kingdom is also a signatory to the 1992 Convention of Biological Diversity, an international legally binding treaty that was signed at the 1992 Earth Summit in Rio de Janeiro, which provides a legal framework for biodiversity conservation. Following consultation on the initial strategy publication, there are now 1150 Species Action Plans (SAPs) and 65 Habitat Action Plans (HAPs) for the UK most threatened (i.e., "priority") species and habitats.
6.18 These plans describe the status of each habitat and species and outline the threats they face, set targets and objectives for their management, and propose actions necessary to achieve recovery.

6.19 In addition, there are approximately 150 Local Biodiversity Action Plans (LBAPs), normally at county level. These plans usually include actions to address the needs of the UK priority habitats and species in the local area, together with a range of other plans for habitats and species that are of local importance or interest.

6.20 Certain UK priority habitats and species may exist in and around Subzone 1; the offshore and onshore cable routes corridors, landfall area locations and National Grid connection point. It is therefore important that the ES for Project One fully assesses the existence of and potential impacts upon any such habitats and/or species.

6.21 UK BAP Habitats that may occur around the Project One site include the following:

- Subtidal sands and gravels;
- Intertidal mudflats and muddy gravels;
- Arable Field Margins;
- Coastal and Floodplain Grazing Marsh;
- Coastal saltmarsh;
- Coastal Sand Dunes;
- Eutrophic Standing Waters;
- Hedgerows;
- Lowland Meadows;
- Lowland Mixed Deciduous Woodland, including Ancient Woodland;
- Maritime Cliff and Slopes;
- Ponds;
- Rivers;
- Reedbeds; and
- Wet Woodland.

6.22 These habitats have potential to support a number of protected and notable species, including UK BAP species, these may include:

- Marine mammal species;
- S. spinulosa;
- Marine fish species;
- Notable floral species, for example within arable margins, ancient woodland, unimproved grassland and wetland habitats;
- Breeding and overwintering birds;
- Mammals including bats (if buildings or trees are to be affected), badger, otter, water vole, brown hare and seal;
- Herptiles including adder, grass snake, slow worm, common lizard, natterjack toad and great crested newt; and
- Invertebrates.

6.1.1 Data and Information to Inform EIA

6.23 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:


- Natura 2000 (http://www.natura.org);
- UKBAP (http://www.ukbap.org.uk/default.aspx);
- MCZ Mapping (http://www.mc2zmapping.org);
- The National Parks and Nature Reserves of Germany (http://www.nationalparks-worldwide.info/germany.htm);
- CEFAS (Centre for Environment, Fisheries and Aquaculture Science) (http://www.cefas.co.uk);
- JNCC (Joint Nature Conservation Committee) (http://www.jncc.gov.uk);
- ICES International Council for the Exploration of the Sea (http://www.ices.dk/indexfla.asp); and

6.1.2 Methods Supporting EIA

6.24 Potential impacts upon interest features of current and future nature conservation designations will be assessed through standard EIA methodologies outlined within Section 3.5, using criteria that have been agreed with the relevant competent authority, as identified in Table 6-2. Where the potential to impact nature conservation designations occurs, sufficient information will be provided in an appropriate section within the ES and as a separate report to enable the competent authority to undertake an Appropriate Assessment, as described in Section 2.8, surveys a are likely to be required as a part of this process.

Table 6-2 Competent authorities for nature conservation designations in relevant North Sea bordering countries

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Responsible Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>England Offshore</td>
<td>JNCC</td>
</tr>
<tr>
<td>England Onshore</td>
<td>Natural England</td>
</tr>
<tr>
<td>The Netherlands Offshore</td>
<td>Netherlands Environmental Assessment Agency</td>
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<tr>
<td>The Netherlands Onshore</td>
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<tr>
<td>Denmark Offshore</td>
<td>Danish Society for Nature Conservation (DN) Danmarks</td>
</tr>
<tr>
<td>Denmark Onshore</td>
<td>Naturfredningsforening</td>
</tr>
<tr>
<td>Norway Offshore</td>
<td>Direktoratet for naturforvaltning</td>
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<tr>
<td>Norway Onshore</td>
<td></td>
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<tr>
<td>Belgium Offshore</td>
<td>Agency for Nature and Forests</td>
</tr>
<tr>
<td>Belgium Onshore</td>
<td></td>
</tr>
<tr>
<td>Germany Offshore</td>
<td>German Federal Nature Conservation Agency (BfN)</td>
</tr>
<tr>
<td>Germany Onshore</td>
<td></td>
</tr>
</tbody>
</table>

6.25 In order to make an assessment for nature conservation designations, surveys will be undertaken to gather data and consultation with relevant competent authorities will be undertaken. Surveys will be planned to examine any known and potential areas that may contain Annex I habitats, such as reefs. This will be undertaken as part of the review of geophysical data and interpretation of results from the benthic ecology survey, see Sections 5.1 and 6.2 respectively.

6.26 In addition to the literature sources listed above (Section 6.1.1) the following guidance documents will also be consulted:

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a See the Benthic Ecology, Birds and Marine Mammals sections for survey methodologies.


6.27 All available sources of data, information and guidance will be consulted, along with statutory nature conservation advisors to investigate whether the development of Project One is likely to have any adverse impacts on the interest features of existing or future nature conservation designations.

6.28 The species protected by the Birds Directive will be assessed according to the methodology in Section 6.4. The Habitats Directive Annex II marine mammal species will be assessed according to the methodology in Section 6.5.

Q11: Are these methods sufficient to inform a robust impact assessment of interest features of nature conservation designations resulting from Project One?

6.1.3 Potential Project Impacts

6.29 Potential generic impacts on the interest features of nature conservation designations associated with Project One are detailed below along with examples. Specific details on the potential impacts on individual receptors (e.g., disturbance of marine mammals resulting from the noise and vibration caused by piling) are given in the relevant sections of this Scoping report.

Construction Phase

6.30 Potential impacts on the interest features of nature conservation designations as a result of the construction phase of Project One include:

- Temporary displacement of species, for example, through the presence of construction vessels, plant and associated personnel;
- Temporary disturbance of species as a result of noise and vibration, for example piling and ground works;
- Temporary reduction in food availability through the displacement / disturbance of prey species;
- Direct injury to species, for example, collision of marine mammals with construction vessels;
- Severance and habitat fragmentation, for example, through disruption to bat foraging routes caused by hedgerow removal as a result of cable trenching;
- Direct damage to or loss of habitats, for example, damage to S. spinulosa reef through vessel anchor damage and cable trenching; and
- Permanent displacement of species as a result of land-take or habitat loss, for example, through installation of scour protection.

Operation and Maintenance Phase

6.31 Potential impacts on the interest features of nature conservation designations as a result of the operation and maintenance phase of Project One include:

- Displacement of species as a result of the presence of Project One infrastructure, for example, through the presence of the turbines within the Blocks, resulting in the displacement of sea birds;
- Disturbance of species as a result of noise and vibration from operation and maintenance activities, for example offshore service and maintenance vessels;
- Reduction in food availability through the displacement / disturbance of prey species resulting from the presence of infrastructure or service and maintenance activities;
• Severance and habitat fragmentation, for example, through disruption to bird migration routes caused by the presence of the turbines within the Blocks; and
• Direct injury to species, for example, collision of seabirds or bats with the turbines within the Blocks;

**Decommissioning Phase**

6.32 Potential impacts on the interest features of nature conservation designations as a result of the decommissioning phase of Project One include:

• Temporary displacement of species, for example, through the presence of vessels, plant and associated personnel;
• Temporary disturbance of species as a result of noise and vibration, for example cutting of piles and cable cut and burial;
• Temporary reduction in food availability through the displacement / disturbance of prey species resulting;
• Direct injury to species, for example, collision of seabirds or bats with the turbines within the Blocks;
• Direct damage to or loss of habitats, for example, damage to *S. spinulosa* reef through vessel anchor damage and pile cut and removal; and
• Permanent displacement of species as a result of land-take or habitat loss, for example, through removal of hard substrate e.g., scour protection and piles.

6.33 Annex I habitats, Annex II species will be identified through desk based studies, interpretation of survey data and consultation. The potential for Project One to impact upon these will be assessed within the EIA process.

6.1.4 **Potential Transboundary Impacts**

6.34 Certain species (e.g., marine mammals and birds) are mobile in their nature and therefore may forage within and migrate through Project One. These species are designated interest features of nature conservation designations outside of the UK EEZ. Any potential impact upon these species as a result of Project One could affect the integrity of nature conservation designations beyond the UK EEZ and are therefore considered to be potential transboundary impacts; these will be assessed during the EIA process.

6.1.5 **Potential Cumulative Impacts**

6.35 The assessment of potential cumulative impacts upon the interest features of nature conservation designations will consider cumulative impacts between Project One and the Round 2 wind farms in The Greater Wash area and the Round 3 Dogger Bank and East Anglia Zone developments.

6.36 Potential cumulative impacts for specific individual receptors are discussed in their relevant sections below.

6.1.6 **Potential In-combination Impacts**

6.37 The assessment of potential in-combination impacts will consider the impacts of Project One with other projects, industries and activities e.g., commercial fishing, oil and gas, and shipping. Impacts for specific individual receptors are discussed in their relevant sections below.

6.1.7 **Potential Mitigation and Monitoring**

6.38 Specific details on potential mitigation and monitoring for individual receptors are given in the relevant receptor specific sections of this Scoping report.

6.2 **Benthic and Epibenthic Environment**

6.39 There is a general scarcity of primary data within the Project One boundary, however there has been a long history of broad-scale benthic studies in the North Sea, and the relationships between sea temperature, primary productivity, hydrographic and sediment conditions with the benthic faunal communities are well understood.
Water depths within Subzone 1, are relatively uniform, with the majority of the area being between 25 and 30 m depth. The greatest depths within Subzone 1 are approximately 35m (See Section 5.1).

**Mapping European Seabed Habitats (MESH)**

The Mapping European Seabed Habitat (MESH) project developed maps of seabed habitat types for North West Europe. Rather than physically mapping the entirety of the seabed within the MESH study area, habitat types were inferred based on existing knowledge of the relationships between the main physical factors and selected hydrographic and biological data. The maps produced thus show the distribution of predicted or modelled habitat types although validation of classifications and refinement of boundaries is constantly undertaken through empirical observation during field surveys.

Marine landscapes developed as part of the UKSeaMap project (a contributor to the MESH project) draw upon a variety of benthic and water column environmental datasets, including sediment types, depth, turbidity and tidal current flow to classify and map the dominant seabed and water column features (Connor et al., 2006). These maps provide a broad-scale national and regional perspective regarding the distribution and extent of marine landscape types. A detail of the UKSeaMap for the Project One area is presented in Figure 6-4. Project One encompass a number of different marine landscape types as follows:

- Shelf plain sand;
- Shallow sand plain;
- Shelf coarse sediment plain;
- Shallow coarse sediment plain;
- Shallow mixed sediment plain;
- Shelf mixed sediment plain; and
- Shelf trough.

As part of the MESH project, potential (European Union Nature Information System) EUNIS habitats were mapped, Figure 6-4 shows the potential habitats found within Project One.
6.44 The MESH EUNIS habitats and UKSeaMap outputs give a broad description of the habitat type derived from published datasets such as the UK Benthos Database Version 3.01 collated from the surveys of individual oil and gas fields in the North Sea as part of either baseline studies or monitoring programmes.

![Figure 6-5 Potential EUNIS habitats from the MESH project](image)

**Subzone 1**

6.45 Principal habitat types which are predicted to occur within Subzone 1 along with their EUNIS classification (EEA, 2010) are as follows:

- Circalittoral coarse sediment (EUNIS A5.14): Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20 m. This habitat, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves;

- Deep circalittoral coarse sediment (EUNIS A5.15): Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infaunal polychaete and bivalve species;

- Circalittoral fine sand (EUNIS A5.25): Clean fine sands with less than 5% silt/clay in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15-20 m. The habitat may also extend offshore and is characterised by a wide range of echinoderms, polychaetes and bivalves; and

- Circalittoral muddy sand (EUNIS A5.26): Circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20%. This habitat is generally found in water depths of over 15-20 m and supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves, and echinoderms.

**Cable Route Corridor**

6.46 In addition to those found within Subzone 1, principal habitat types which are predicted to occur within the cable route corridor along with their EUNIS classification (EEA, 2010) are as follows:

- Infraflittoral coarse sediment (EUNIS A5.13): Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infraflittoral, are subject to disturbance by...
tidal steams and wave action. Such habitats found on the open coast or in tide-swept marine inlets are characterised by a robust fauna of infaunal polychaetes;

- Infralittoral mixed sediments (EUNIS A5.43): Shallow mixed (heterogeneous) sediments in fully marine or near fully marine conditions, supporting various animal-dominated communities, with relatively low proportions of seaweeds. This habitat may include well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in mud, sand or gravel;

- Circalittoral mixed sediments (EUNIS A5.44): Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20 m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. Due to the variable nature of the seabed a variety of communities can develop which are often very diverse. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones are often present in this habitat;

- Deep circalittoral sand (EUNIS A5.27): Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms;

- Infralittoral fine sand (EUNIS A5.23): Clean sands which occur in shallow water, either on the open coast or in tide-swept channels of marine inlets. The habitat typically lacks a significant seaweed component and is characterised by robust fauna; and

- Infralittoral muddy sand (EUNIS A5.24): Non-cohesive muddy sand (with 5% to 20% silt/clay), extending from the extreme lower shore down to more stable circalittoral zone at about 15-20 m. The habitat supports a variety of animal-dominated communities, particularly polychaetes, bivalves and the urchin Echinocardium cordatum.

6.47 Additionally within the Humber Estuary the following habitats are predicted:

- Infralittoral sandy mud (EUNIS A5.33): Cohesive sandy mud, typically with over 20% silt/clay, in depths of less than 15-20 m. This habitat is generally found in sheltered bays or marine inlets and along sheltered areas of open coast. Typical species include a rich variety of polychaetes, tube building amphipods Ampelisca spp. and deposit feeding bivalves; and

- infralittoral fine mud (EUNIS A5.34): Shallow sublittoral muds, extending from the extreme lower shore to about 15-20 m depth in fully marine or near marine conditions, predominantly in extremely sheltered areas with very weak tidal currents. Such habitats are found in sealochs and some rias and harbours.

6.48 A Zone wide benthic review has been undertaken (see Benthic Ecology Chapter of ZoC document available from the SMart Wind website, http://www.smartwind.co.uk/), this review did not identify any habitats that are particularly restricted in terms of geographical distribution within the boundaries of the Hornsea Zone, as they appear to be representative of those across the wider southern North Sea region. The potential for S. spinulosa reef habitat to occur within the Project One area has been highlighted given its presence at other locations within the region i.e., Saturn Reef. S. spinulosa is a designated feature of the North Norfolk Sandbanks & Saturn Reef offshore SAC. If present within the Project One boundary, then S. spinulosa reef is most likely to occur over coarse sandy gravel substrates adjacent to and within the influence of mobile and transient sand. S. spinulosa reef habitat is listed in Annex I of the EC Habitats Directive and is therefore protected under international statute. The project specific benthic survey will establish whether sensitive habitats are present within the Project One boundary.

6.2.1 Data and Information to Inform EIA

6.49 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- North Sea Benthos Project (NSBP) http://www.vliz.be/vmdcdata/nsbp/;

- Studies undertaken for oil and gas exploration projects;
Studies undertaken for aggregate extraction license applications;
Data from British Geological Survey (BGS);
Site assessment documents for North Norfolk Sandbanks & Saturn Reef and Dogger Bank SACs; and
UK Benthos Database accessed via Oil and Gas UK (www.ukooa.co.uk).

6.50 Data and information from a number of important regional and 'higher level' studies (see Table 6-3) will also be used during the EIA process.

Table 6-3 Important regional and 'high level' studies

<table>
<thead>
<tr>
<th>Reference</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glémarec (1973)</td>
<td>Benthic grab sampling within the North Sea</td>
</tr>
<tr>
<td>Dyer et al., (1983)</td>
<td>Wide scale Otter trawl sampling throughout the North Sea</td>
</tr>
<tr>
<td>Jennings et al., (1999)</td>
<td>Wide scale small beam trawl sampling across the North Sea</td>
</tr>
<tr>
<td>Rees et al., (1999)</td>
<td>Grab and small beam trawl sampling at various UK locations including sites in the southern North Sea.</td>
</tr>
<tr>
<td>DTi SEA 3 (2002a)</td>
<td>Environmental data acquisition to support regional level Strategic Environmental Assessment of oil and gas licensing in the North Sea.</td>
</tr>
<tr>
<td>Frid et al., (2009a; b)</td>
<td>36 year time series studies at offshore North Sea sampling station.</td>
</tr>
</tbody>
</table>

6.51 In addition to these data sources, specific Subzone 1 and cable route corridor information will be available through site specific benthic ecology surveys as described below and will be used to inform the EIA process.

6.52 The following guidance documents will also be considered during the EIA process:
- Offshore Wind Farms. Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements (CEFAS, 2004);
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR 2008); and
- Guidelines for the conduct of benthic studies at aggregate dredging sites (DTLR, 2002).

Q12: With regard to benthic and epibenthic environments, should any further data sources or guidance documents be considered as part of the EIA process?

6.2.2 Methods Supporting EIA

Subzone 1 and Cable Route Corridor

6.53 Site specific information is required and a detailed benthic and epibenthic survey encompassing Subzone 1, including a 2 km buffer and wider Zone sampling is currently being finalised. The information collected will be used to inform the EIA process.

6.54 Subzone 1 benthic survey includes the following activities:
- 0.1 m² Hamon grab sampling for the collection of quantitative seabed sediment samples for determination of macrofaunal content and particle size distribution analysis;
- Seabed digital photography and video for collection of qualitative/semi-quantitative data on seabed habitats and associated sessile epibenthos;
- 2 m scientific beam trawling for information on larger mobile epibenthos such as fish, crabs, shrimps and prawns; and
- 0.04 m² Shipek grab sampling of seabed sediment for contaminants analysis.

6.55 The location of grab, beam trawl and seabed video sampling stations within this survey array are shown in Figure 6-6. The samples are concentrated within Subzone 1, with fewer stations near the margins of the site.

![Figure 6-6 Subzone 1 benthic survey array – sampling locations](image)

6.56 Grab sampling stations were selected on a stratified random basis with consideration of the acquired geophysical data to ensure adequate coverage of the different types of sediment habitats anticipated within Subzone 1. In this way, all habitat and species resources within and around Subzone 1 would be adequately described to inform a robust EIA.

6.57 Beam trawl sampling using a Lowestoft two metre scientific beam trawl was also undertaken. This method of biological sampling attempts to identify the mobile epibenthos which may not be sampled by grab techniques. The trawl was deployed at pre-determined positions within Subzone 1 and towed for a distance of approximately 500 m.

6.58 A 165 kg mini-Hamon grab with a bite area of 0.1 m² was used to obtain quantitative seabed samples for biological and physical analysis. Samples for macroinvertebrate analysis were sieved through a 1 mm aperture mesh sieve to remove the majority of finer sediment. The contents of the sieve were then transferred to 10 litre buckets and the fauna fixed using 4% buffered formalin. Samples were stored and subsequently returned to Emu Ltd’s laboratories. An assessment of sample volume was recorded, with a brief description of the sample (sediment) type. Photographic records were also taken for each sample.

6.59 A sub-sample was taken from the grab sample for subsequent particle size analysis. The volume taken for particle size analysis was dependent upon the nature of the sediment, as described in BS1377-2 (British Standards Institution, 1990).

6.60 Beam trawl samples were identified and enumerated on site. Colonial sessile epifauna were recorded as ‘P’ present. Further processing of beam trawl samples over a 5 mm aperture mesh was undertaken in the laboratory. Specimens for which the taxonomy was uncertain were returned to Emu Ltd’s marine laboratories, for confirmation of the field identification. All samples collected were photographed.
6.61 Seabed images were acquired using a Kongsberg combined digital stills and video camera mounted on either a drop down or a towed video frame. Illumination was provided by two 150 W Halogen lights. The position of the camera frame on the seabed was recorded and with each image position fixed within Trimble HydroPro navigation software at the moment of capture. Video images were digitally overlaid with dGPS position. Two laser pointers were positioned either side of the camera at a known distance apart to provide an indication of scale.

6.62 A Shipek stainless steel grab sampler was deployed to collect undisturbed sample sediment samples for contaminants analysis. Samples were submitted to a specialist UKAS accredited chemistry laboratory for detailed analysis.

6.63 Further surveys using the similar methodologies will be undertaken along the export cable routes once the specific potential routes have been identified.

**Intertidal**

6.64 Intertidal ecology data for each potential cable landfall site will be collected using a modified Phase I biotope mapping survey. Survey methods will follow JNCC procedural guidelines for intertidal mapping (Davies *et al.*, 2001). Surveys will be designed in consultation with Natural England.

6.65 Surveys will be conducted over low water spring tide to ensure access to the lowest reaches of the shore. The entire vertical range of intertidal habitats will be surveyed form the splash/lichen zone (supra-littoral) to the sub-littoral fringe and horizontally within an area extending 250 m either side of the cable route landfall locations.

6.66 The surveys will entail the classification and mapping of discrete habitats and their associated characteristic communities (collectively termed biotopes). Biotope classification will be based on the 2004 (v04.05) Marine Habitat Classification system (Connor *et al.*, 2004).

6.67 Additional information for each biotope will include the following:
- Physical characteristics, such as substrate type and topographic features (sand ripples, areas of standing water etc);
- Conspicuous species present and their abundances; and
- Details of specimen samples taken from sites.

6.68 Particulate habitats will be sampled quantitatively using sediment corers to identify infauna and sediment particle size distribution (PSD). Faunal and floral identification will be undertaken on site or within a National Marine Biological Analytical Quality Control Scheme (NMBAQC) participating laboratory where on-site identification is not possible. PSD analysis will be undertaken within Emu Limited’s United Kingdom Accreditation Service (UKAS) accredited laboratory. Additional laboratory analyses will include biomass determination using standard wet blot methods with data conversion to ash free dry weight.

6.69 Biotope maps showing the distribution of habitats and communities will be produced for each cable landfall option. These will be augmented with target notes including features that were too small (<25 m²) to be accurately portrayed on a map, features on vertical faces, and found under boulders or overhangs. Target notes will also be used to describe human activities, such as outfalls, coastal protection measures and other man made features that are potential habitat modifiers.

6.70 The data drawn from the biotope surveys will be used to inform the EIA process. Biotopes offer a convenient ecological unit for assessment of receptor sensitivity and considerable information is available as to their tolerance and recoverability to disturbance effects. Data exist on the MarLIN website to allow an assessment of the sensitivities and re-colonisation characteristics of individual biotopes and species to be included as part of the ES. Habitat and species data will also be compared against features of conservation interest to appraise importance and further inform potential sensitivity as part of the EIA process.

6.71 Where required, biomass information will be used to assess bird prey availability to further inform the EIA process.

6.72 All intertidal surveys within or close to European Marine Sites may require permission from Natural England and guidance from RSPB and BTO to avoid disturbance to over-wintering
wildfowl and waders. The timing and / or nature of the surveys will be constrained to avoid peak periods of over-wintering birds and significant disturbance. Intertidal surveys conducted in early autumn will provide data pertinent to accurate assessment of bird prey availability for wintering bird populations.

6.2.3 Potential Project Impacts

Construction Phase

6.73 Potential impacts resulting from the construction of Project One on benthic and epibenthic communities are:

- The permanent loss of existing seabed habitats under foundations, scour protection and as a result of scour around the structures;
- Temporary loss of habitats under jack-up barges;
- Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures;
- Increased suspended sediments and smothering from resuspension of sediments during cable trenching, vessel anchoring, piling and or drilling;
- Change to water quality from accidental release of contaminants;
- Noise and vibration disturbance from piling and vessel movements having physiological and behavioural impacts on benthos;
- Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations and associated structures; and
- Re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance.

Operation and Maintenance Phase

6.74 Potential impacts resulting from the operation and maintenance of Project One on benthic and epibenthic communities are:

- The deployment and presence of artificial hard substrate structures and associated increase in colonisation of benthic species adapted to hard surfaces;
- Change to water quality from accidental release of contaminants during servicing and maintenance;
- Noise and vibration disturbance from operational turbines having physiological and behavioural impacts on benthos;
- Changes in sediment transport and deposition patterns as a result of the presence of turbines and associated structures;
- Local effects on benthic community structure caused by the reduction/elimination of commercial trawling within the area;
- Changes in the hydrodynamic regime leading to changes in seabed sediment distribution, grain size, structure with changes to resultant benthic habitat; and
- Electromagnetic fields from inter-array and export cabling causing a disturbance to benthic and epibenthic species.

Decommissioning Phase

6.75 Potential impacts resulting from the decommissioning of Project One on benthic and epibenthic communities are:

- The removal of artificial hard substrate structures and associated benthic species adapted to hard surfaces;

Q13: Are these methods sufficient to inform a robust assessment of impacts on benthos resulting from Project One?
- Temporary loss of habitats under jack-up barges during the decommissioning phase;
- Seabed disturbance from decommissioning activities, along with associated increased suspended sediments and smothering;
- Change to water quality/accidental release of contaminants from vessels and plant undertaking decommissioning;
- Noise and vibration disturbance from vessels and decommissioning activity having physiological and behavioural impacts on benthos;
- Changes in sediment transport and deposition patterns as a result of the removal of turbines and associated structures;
- Local effects on benthic community structure caused by the reinstatement of the area for commercial trawling;
- Sediment disturbance may result in some re-introduction of synthetic compounds, heavy metals or hydrocarbons if these are trapped within the substrate; and
- Changes in the hydrodynamic regime from the removal of structures leading to changes in seabed sediment distribution, grain size, structure with changes to resultant benthic habitat.

6.76 There is the potential for the introduction of alien species via ballast water from visiting vessels undertaking construction, maintenance and decommissioning works resulting in potential long term and far reaching effects. However this is ubiquitous to the whole shipping industry and is already managed by existing international and national guidelines/regulations.

6.2.4 Potential Transboundary Impacts

6.77 There are unlikely to be any transboundary impacts in relation to benthic ecology resulting from Project One as the predicted impacts on the benthic and epibenthic communities will largely be focused within the footprint of Project One. The potential for Project One to impact on the benthic and epibenthic interest features of nature conservation designations outside of the UK EEZ will be considered within the EIA process, including the interaction between physical processes and benthic ecology.

6.2.5 Potential Cumulative Impacts

6.78 The predicted impacts on benthic and epibenthic communities resulting from the construction, maintenance and decommissioning of Project One are considered to be local and largely within the footprint of the project. Therefore cumulative impacts on benthic and epibenthic communities resulting from Project One and other wind farm developments are considered to be unlikely.

6.2.6 Potential In-combination Impacts

6.79 There is the potential for in-combination impacts on benthic and epibenthic communities resulting from Project One and other developments within the region. The extent of these impacts will depend on the spatial extent and magnitude of the impacts from these developments combined with those of Project One. The following activities have been identified as having the potential for in-combination impacts with Project One:

- Oil and gas infrastructure/development;
- Existing and future seabed infrastructure (cables and pipelines);
- Commercial fishing activities;
- Navigation and shipping; and
- Aggregate extraction and disposal of dredging spoil.

6.2.7 Potential Mitigation and Monitoring

6.80 As there are no nature conservation designations within close proximity of Subzone 1, no mitigation or monitoring is expected. However, if project specific survey results later reveal
potential Annex I habitat, Annex II species and interest features, then these will be considered within the EIA.

6.81 Potential accidental spillages or leakages can be mitigated by correct servicing and maintenance of all equipment, plant and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environmental Management Plans, Environment Agency Pollution Prevention Guidelines (Environment Agency, 2010) and onsite monitoring/reporting.

6.82 Proposed monitoring requirements will be identified as part of the EIA process and agreed with the relevant competent authorities, with the degree and type required being dependent on existing baseline environmental conditions, project design and proposed construction methodology.

6.83 Experience gained during Rounds 1 and 2, including the results of specific monitoring, will also be drawn upon. In addition, the survey methodology as part of any required monitoring will be consistent with baseline surveys to ensure that data from pre and post construction surveys are comparable.

6.3 Fish and Shellfish Ecology

6.84 The Project One area supports a diverse but typical array of bottom-dwelling and pelagic fish associated with the southern North Sea. Among the most characteristic fish species are those that spawn and/or migrate through Project One, e.g., herring *Clupea harengus*, mackerel *Scomber scombrus* and plaice *Pleuronectes platessa* (Cefas, 2004). The Project One area also provides important habitat conditions for nursery grounds that support a number of fish species.

6.85 Fish species of conservation and commercial significance present including elasmobranchs (e.g., thornback ray *Raja clavata* and spotted ray *Raja montagui*). This group also includes basking shark *Cetorhinus maximus*, which is known to inhabit the southern North Sea waters (Sims et al., 2003).

6.86 The Project One area supports a range of shellfish species typical for the southern North Sea. These include, for example, Nephrops *Nephrops norvegicus*, brown crab *Cancer pagurus*, scallops *Pecten maximus* and shrimp *Pandalina borealis*. Nephrops and brown crab are commercially important species and both have spawning and nursery grounds within Project One.

**Spawning and Nursery Grounds**

6.87 A wide range of finfish and shellfish are known to utilise the region for spawning and nursery grounds, many of these areas are located within the Project One boundary. Known spawning and nursery grounds for these species are shown in Figure 6-7 to Figure 6-8 and summarised in Table 6-4.

<table>
<thead>
<tr>
<th>Species</th>
<th>Subzone 1 Spawning</th>
<th>Subzone 1 Nursery</th>
<th>Cable Route Corridor Spawning</th>
<th>Cable Route Corridor Nursery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haddock</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plaice</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cod</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Whiting</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemon sole</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dover sole</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herring</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Monkfish</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mackerel</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandeel</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sprat</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nephrops</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Brown Crab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Figure 6-7  Haddock, plaice and cod spawning and nursery grounds

Figure 6-8  Whiting, lemon sole, Dover sole and herring spawning and nursery grounds
Figure 6-9  Monkfish, mackerel, sandeel and sprat spawning and nursery grounds

Figure 6-10  Thornback ray, spotted ray, common stingray and cuckoo ray spawning and nursery grounds
Figure 6-11  Spurdog, lesser spotted dog fish and porbeagle spawning and nursery grounds

Figure 6-12  Shrimp, *Nephrops*, edible/brown crab and scallop spawning and nursery grounds
Species of Conservation and Commercial Importance

6.88 A UK Biodiversity Action Plan (UKBAP) was published in 1995, which identified a list of Species of Conservation Concern (SoCC). These are species considered to be threatened by anthropogenic activities, listed as nationally or internationally important (UKBAP website http://www.ukbap.org.uk).

6.89 Many UKBAP listed species occur within the Project One boundary such as the plaice, whiting Merlangius merlangus, herring, mackerel and Atlantic cod Gadus morhua. A number of species present within the Project One boundary, mainly the elasmobranches, are also classified under the IUCN Red List of Threatened Species. Table 6-5 provides a summary of the many species likely to utilise the Project One area for feeding, spawning, migration or nursery (this list represents species selected on commercial, ecological or major occurrence basis and is not exhaustive).

Table 6-5 Summary of the significant finfish and shellfish species likely to utilize the Project One area and their conservation status (Oceana, 2008; GBIF 2009; Walmsley and Pawson, 2007 and MCS 2008)

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Conservation and Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haddock</td>
<td>Melanogrammus aeglefinus</td>
<td>Minimum landing size in the North Sea of 30 cm.</td>
</tr>
<tr>
<td>Saithe</td>
<td>Pollachius virens</td>
<td>Minimum landing size in the North Sea of 35 cm.</td>
</tr>
<tr>
<td>Norway pout</td>
<td>Trisopterus esmarki</td>
<td>There is no minimum landing size in the North Sea. A target species for the industrial fishery. Because of large by-catches of juvenile haddock, an area in the northern North Sea has been closed for the fishery (Norway pout box).</td>
</tr>
<tr>
<td>Grey gurnard</td>
<td>Eutrigla gurnardus</td>
<td></td>
</tr>
<tr>
<td>Dover sole</td>
<td>Solea solea</td>
<td>UKBAP species; minimum landing size of 24 cm. One of the most valuable commercial species in the North Sea.</td>
</tr>
<tr>
<td>Plaice</td>
<td>Pleuronectes platessa</td>
<td>UKBAP species; minimum landing size in the North Sea of 27 cm. One of the two most important flatfish species in the North Sea. A large area along the continental coast has been closed for large beam trawlers (Plaice Box).</td>
</tr>
<tr>
<td>Whiting</td>
<td>Merlangius merlangus</td>
<td>UKBAP species; minimum landing size in North Sea of 27 cm. Fish of limited commercial interest and usually not a target species.</td>
</tr>
<tr>
<td>Herring</td>
<td>Clupea harengus</td>
<td>UKBAP species; minimum landing size of 20 cm in the North Sea. Herring is one of the most important commercial species taken in the North Sea.</td>
</tr>
<tr>
<td>Bass</td>
<td>Dicentrarchus labrax</td>
<td></td>
</tr>
<tr>
<td>Lemon sole</td>
<td>Microstomus kitt</td>
<td></td>
</tr>
<tr>
<td>Monkfish / anglerfish</td>
<td>Lophius Budegassa (black-bellied) or Lophius piscatorius (white)</td>
<td>UKBAP species; The monkfish landings from ICES sub-Areas IV (North Sea) and VI (west of Scotland) are covered by precautionary TACs.</td>
</tr>
<tr>
<td>Mackerel</td>
<td>Scomber scombrus</td>
<td>UKBAP species; minimum landing size of 30 cm in the North Sea.</td>
</tr>
<tr>
<td>Scad or horse mackerel</td>
<td>Trachurus trachurus (N Sea) *</td>
<td>UKBAP species; minimum landing size in the North Sea of 15 cm</td>
</tr>
<tr>
<td>Turbot</td>
<td>Psetta maxima</td>
<td></td>
</tr>
<tr>
<td>Brill</td>
<td>Scophthalmus rhombus</td>
<td></td>
</tr>
<tr>
<td>Atlantic cod</td>
<td>Gadus morhua</td>
<td>IUCN Red List Category – Vulnerable A1bd UKBAP and OSPAR species; minimum landing size in the North Sea of 35 cm. Used to be one of the most important commercial species in the area.</td>
</tr>
<tr>
<td>Sprat or whitebait</td>
<td>Sprattus sprattus (E Channel) *</td>
<td>No minimum landing size.</td>
</tr>
<tr>
<td>Grey thick-lipped mullet</td>
<td>Chelon labrosus</td>
<td></td>
</tr>
<tr>
<td>Thin-lipped mullet</td>
<td>Liza ramada</td>
<td></td>
</tr>
<tr>
<td>Golden grey mullet</td>
<td>Liza aurata</td>
<td></td>
</tr>
<tr>
<td>Red or stripped red mullet</td>
<td>Mullus sumuletus</td>
<td>No minimum landing size</td>
</tr>
<tr>
<td>Dab</td>
<td>Limanda limanda</td>
<td></td>
</tr>
<tr>
<td>Flounder</td>
<td>Platichthys flesus</td>
<td></td>
</tr>
<tr>
<td>Pollock</td>
<td>Pollachius pollachius</td>
<td></td>
</tr>
<tr>
<td>Sandeel **</td>
<td>Ammodytes tobianus, A. marinus, Hyperoplus immaculatus, H. lanceolatus</td>
<td>UKBAP species</td>
</tr>
<tr>
<td>Ling</td>
<td>Molva molva</td>
<td></td>
</tr>
<tr>
<td>Large spotted dogfish</td>
<td>Scyliorhinus stellaris</td>
<td></td>
</tr>
<tr>
<td>Spurdog/spiny dogfish</td>
<td>Squalus acantbias</td>
<td></td>
</tr>
<tr>
<td>Small spotted</td>
<td>Scyliorhinus canicula</td>
<td></td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Conservation and Management Measures</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>catshark / lesser spotted dogfish</td>
<td>Centroscyllium fabricii</td>
<td>EU TAC</td>
</tr>
<tr>
<td>Black dogfish</td>
<td>Centroscyllium fabricii</td>
<td>EU TAC</td>
</tr>
<tr>
<td>Blue shark</td>
<td>Prionace glauca</td>
<td>IUCN Red List Near Threatened, Barcelona Annex III, Bern Appendix IIIb, UNCLOS Annex I.</td>
</tr>
<tr>
<td>Small spotted catshark</td>
<td>Scyliorhinus canicula</td>
<td>IUCN Red List Near Threatened.</td>
</tr>
<tr>
<td>Tiger shark</td>
<td>Galeocerdo cuvier</td>
<td>IUCN Red List Endangered, Barcelona Annex II, Bern Appendix IIIb, UNCLOS Annex I, All OSPAR regions, CITES IIC; totally protected in EU; protected in British waters.</td>
</tr>
<tr>
<td>Basking shark</td>
<td>Centroscyllium maximus</td>
<td>IUCN Red List Endangered, Barcelona Annex III, Bern Appendix IIIb, UNCLOS Annex I, All OSPAR regions, CITES IIC; totally protected in EU; protected in British waters.</td>
</tr>
<tr>
<td>Starry smoothhound</td>
<td>Mustelus asterias</td>
<td>IUCN Red List Least Concern.</td>
</tr>
<tr>
<td>Smooth-hound</td>
<td>Mustelus mustelus</td>
<td>IUCN Red List Least Concern.</td>
</tr>
<tr>
<td>Tope shark</td>
<td>Galeorhinus galeus</td>
<td>IUCN Red List Vulnerable, Protected in England and Wales.</td>
</tr>
<tr>
<td>Porbeagle shark</td>
<td>Lamma nasus</td>
<td>IUCN Red List Critically Endangered, All OSPAR regions, North Sea TAC.</td>
</tr>
<tr>
<td>Blue or common skate</td>
<td>Diphurus batis</td>
<td>IUCN Red List Threatened</td>
</tr>
<tr>
<td>Longnosed skate</td>
<td>Diphurus oxyrinchus</td>
<td>IUCN Red List Threatened</td>
</tr>
<tr>
<td>Cuckoo ray</td>
<td>Leucoraja naevus</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Common eagle ray</td>
<td>Myliobatis aquila</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Bottlenosed or white skate</td>
<td>Rostroraja alba</td>
<td>IUCN Red List Endangered, Barcelona Annex III, Bern Appendix IIIb, UNCLOS Annex I, All OSPAR regions, CITES IIC; totally protected in EU; protected in British waters.</td>
</tr>
<tr>
<td>Thornback ray</td>
<td>Raja clavata</td>
<td>IUCN Red List Near Threatened, North Sea TAC</td>
</tr>
<tr>
<td>Spotted ray</td>
<td>Raja montagui</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Blonde ray</td>
<td>Raja brachyura</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Stingray</td>
<td>Dasyatis pastinaca</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Marbled electric ray (spotted torpedo)</td>
<td>Torpedo marmorata</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Electric ray</td>
<td>Torpedo nobiliana</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Lesser weever fish</td>
<td>Echichthys vipera</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Dragonet</td>
<td>Callionymus lyra</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Grey gurnard</td>
<td>Eutrigla gurnardus</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Gobies</td>
<td>Gobiidae</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Solenette</td>
<td>Buglossidium luteum</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Long Rough Dab</td>
<td>Hippoglossus pleiodes</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Scalfish</td>
<td>Angloglossus palea</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Edible or brown crab</td>
<td>Cancer pagurus</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Common lobster</td>
<td>Homarus gammarus</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Common whelk</td>
<td>Buccinum undatum</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Native oyster</td>
<td>Ostrea edulis</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Great or King scallop</td>
<td>Pecten maximus</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Cuttlefish</td>
<td>Sepia officinalis</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Squid</td>
<td>Loligo vulgaris</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Manilla clam</td>
<td>Tapes philippinarum</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Cockle</td>
<td>Cerastoderma edule</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Mussel</td>
<td>Mytilus edulis</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Spider crab</td>
<td>Maja aquinado</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Velvet swimming crab</td>
<td>Necora puber</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Green shore crab</td>
<td>Carcinus maenas</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Norway lobster</td>
<td>Nephrops norveicuscus</td>
<td>North Sea TAC</td>
</tr>
<tr>
<td>Shrimp (mainly northern prawn)</td>
<td>Pandalina borealis</td>
<td>North Sea TAC</td>
</tr>
</tbody>
</table>

6.90 Key species targeted by commercial fishing activities are discussed in further detail within Section 7.1.

6.3.1 Data and Information to Inform EIA

6.91 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- Strategic Environmental Assessment - SEA2 Technical Report 003 - Fish & Fisheries. (Rogers and Stocks, 2001);
- Cefas (2004). Offshore Wind farms – Guidance Note for EIA in Respect of FEPA and CPA Applications;
- Landings statistics from the Marine Management Organisation Fisheries Statistics Unit and Data and Communications Team;
- Data from the 2 m beam trawl surveys undertaken during the Subzone benthic ecology survey (Emu Ltd., 2010c);
- Information on the sensitivity of fish to EMF fields (e.g., Gill et al., 2009);
- Finfish spawning and nursery areas (JNCC, The Shark Trust and Coull et al., 1998);
- Shellfish spawning and nursery areas (JNCC, MarLIN and Coull et al., 1998);
- Report on Habitat Status of the Humber Estuary (Hemingway et al., 2008).
- Data from ICES and Cefas;
- UK Biodiversity Action Plan (BAP);
- The measurement of the underwater radiated noise from marine piling including characterisation of a “soft start” period (Robinson et al., 2007);
- Underwater radiated noise due to the piling for the Q7 Offshore Wind Park (De Jong et al., 2008);
- Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore wind farms, and comparison with background noise (Nedwell et al., 2004);
- Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters (Nedwell et al., 2007);
- Effects of offshore wind farm noise on marine mammals and fish (Thomson et al., 2006);
- Characteristics of oil industry dredge and drilling sounds in the Beaufort Sea (Greene, 1987); and
- Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms. (Nehls et al., 2007).

6.92 Any further data sources that become available during the consultation phase of Project One will be used to inform the EIA process.

Q14: With regard to fish and shellfish ecology, should any further data sources be consulted as part of the EIA process?

6.3.2 Methods Supporting EIA

6.93 The assessment of the fish and shellfish ecology element for Project One will be approached in three ways:
- Data collection (Hornsea Zone Characterisation - ZoC chapter);
- Project specific ecology surveys; and
- Consultation.

6.94 Ecology surveys will collect data to inform both the commercial fisheries and fish and shellfish ecology assessments within the EIA process. These will be sufficiently comprehensive to describe spatial and temporal distributions of species of commercial, recreational and conservation importance. Spawning, nursery and feeding areas, plus migration routes, will be described through desk review and consultation and supported by surveys where appropriate.

6.95 Survey methodology and sampling frequency will be intelligence led following consultation with local fisheries organisations and in consideration of current Cefas advice.
**Subzone 1 and Cable Route Corridor**

6.96 Data shall be collected by a commercial fishing vessel or other appropriately equipped survey vessel. The choice of fishing gear will be intelligence based and appropriate for the key fisheries issues identified through the desk studies and in consultation with the statutory agencies and relevant fisheries organisations. It may be necessary to slightly adapt the gear used, i.e., insert a small mesh liner in nets (blinder) for the retention of juvenile specimens and for which dispensation will be applied for.

6.97 Subject to advice from Cefas, fisheries ecology surveys may be required biannually (for example in spring and autumn) to ensure that natural seasonal changes in population structure, due to spawning behaviour for example, are fully recorded and described. Fisheries representatives and statutory agencies shall be consulted to determine the need for surveys and the most appropriate seasons for sampling to target the appearance of commercially and recreationally important species as well as species of conservation concern and to characterise temporal patterns at both wider Zone and Project One level.

6.98 The locations of sampling, together with sampling frequency and data treatments, will ensure the data collected are scientifically rigorous and suitable for EIA purposes. Fisheries experts will be on board fishing vessels to identify and record each catch on site and collect other data such as size, sex, maturity and length/frequency data. Full survey methods will be developed with the agreement of regulators and fisheries organisations.

6.99 Key survey activities are likely to include:
- Demersal beam trawling;
- Brown crab potting;
- Netting; and
- Other activities such as long-lining may also be considered.

6.100 Surveys may also be undertaken during daylight and during periods of darkness to assess nocturnal and diurnal distributions.

6.101 Additional site specific data will be available from 2 m beam trawl surveys undertaken during the Subzone 1 benthic ecology survey, as described above in Section 6.2.2.

**Intertidal**

6.102 Intertidal fisheries will be assessed at the proposed cable landfall locations. Key survey activities are likely to include:
- Seine netting;
- Fyke netting; and
- Push netting;

**Ecological Considerations**

6.103 The EIA will assess all available information to determine the presence, distribution and seasonality of the fish and shellfish resources. Species of conservation importance will be considered including elasmobranch. In addition, species that have a restricted geographical distribution and are locally abundant in the area will be assessed. Once important fish and shellfish species present within or near to the Project One boundary have been identified, aspects of their ecology that may be affected by construction will be determined. For fish and shellfish, the following aspects of their ecology will be assessed where relevant:
- Spawning grounds;
- Nursery grounds;
- Feeding grounds; and
- Migration routes.

6.104 Modelling techniques will be used to assess the impact of noise on fish and shellfish and will be assessed within the EIA process.
6.3.3 Potential Project Impacts

Construction Phase

6.105 The identified potential impacts on fish and shellfish ecology resulting from the construction of Project One are as follows:

- The permanent loss of existing seabed habitats for under foundations, scour protection and as a result of scour around the structures;
- Temporary loss of habitats under jack-up barges;
- Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures and associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity;
- Change to water quality from accidental release of contaminants;
- Noise and vibration disturbance from piling and vessel movements having physiological and behavioural impacts on fish and shellfish species, including temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species;
- Acoustic surveys that are conducted in the pre-construction phase may disturb fish and shellfish spawning;
- Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations and associated structures impacting on seabed spawning habitat;
- Changes to water quality from the re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance; and
- Increased habitat complexity due to introduction of hard substrate in the form of foundations and scour.

Operation and Maintenance Phase

6.106 The identified potential impacts on fish and shellfish ecology resulting from the operation and maintenance of Project One are as follows:

- Noise and vibration disturbance from servicing vessel movements having physiological and behavioural impacts on fish and shellfish species, including disruption to migratory pathways fish and shellfish species;
- Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations, remedial work on offshore cables and associated structures impacting on seabed spawning habitat;
- Local effects on fish and shellfish community structure caused by the reduction/elimination of commercial trawling within the area; and
- Electromagnetic fields from inter-array and export cabling causing a disturbance to fish and shellfish species.

Decommissioning Phase

6.107 Potential impacts on fish and shellfish ecology resulting from the decommissioning of Project One are as follows:

- Temporary loss of habitats under jack-up barges undertaking decommissioning;
- Seabed disturbance from decommissioning activities along with associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity;
- Change to water quality/accidental release of contaminants from vessels and plant undertaking decommissioning;

Q15: Are these methods sufficient to inform a robust assessment of impacts on fish and shellfish ecology resulting from Project One?
• Noise and vibration disturbance from decommissioning activities having physiological and behavioural impacts on fish and shellfish species, including temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species;

• Changes in sediment transport and deposition patterns as a result of the removal of turbine foundations and associated structures impacting on seabed spawning habitat;

• Changes to water quality from the re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance;

• Local effects on fish and shellfish community structure caused by the reinstatement of the area for commercial trawling; and

• Decreased habitat complexity due to the removal of artificial hard substrate structures and associated benthic species adapted to hard surfaces.

6.3.4 Potential Transboundary Impacts

6.108 Any potential impacts to the natural ecology of fish species that are of commercial importance for foreign fleets that operate within the UK EEZ will be of concern for the Member States in question. A proportion of the fishing activity within the Project One boundary is undertaken by vessels from other EU member states, it is therefore recognised that in this context there is the potential for transboundary impacts and the EIA will take account of this.

6.3.5 Potential Cumulative Impacts

6.109 There is the potential for cumulative impacts on fish and shellfish ecology between Project One and the Round 2 wind farms in The Greater Wash area and the Round 3 Dogger Bank and East Anglia Zone developments. The mobile nature of many fish and shellfish species will be considered during the assessment of cumulative impacts within the EIA Process.

6.3.6 Potential In-Combination Impacts

6.110 There is the potential for in-combination impacts to fish and shellfish ecology resulting from the construction, operation, maintenance and decommissioning of Project One in-combination with other activities or developments in the region. The spatial scope within which other activities will be considered will depend upon the magnitude and spatial extent of the effect on the environment, and will take into consideration the following activities:

• Aggregate extraction, dredging and spoil disposal;

• Navigation and shipping;

• Established commercial fishing activities;

• Existing and planned construction sub-sea cables and pipelines;

• Potential port and harbour developments; and

• Existing and potential future oil and gas installations.

6.3.7 Potential Mitigation and Monitoring

6.111 The inter-array and export cables could be armoured and/or buried at a sufficient depth (subject to engineering assessment of ground conditions) to reduce electromagnetic fields (EMF).

6.112 During construction, 24 hour working practices may be employed so that the overall construction programme and the potential for impacts to fish communities is reduced in overall time.

6.113 Changes in local fish populations within the area and associated megafauna can be assessed through scientific beam trawling as part of the ecological monitoring programme.

6.114 For some previous projects, a buffer zone has been placed around herring spawning grounds to minimise impacts. However, buffer zones have not been employed around nursery areas, as it is assumed that juvenile herring will move away from the sound source and spawning behaviour will not be affected. Other species, such as cod, spawn in the water column or...
over a wide area encompassing a number of substrate types, reducing their potential to be affected by wind farm or other localised developments.

6.115 The use of a buffer zone has large impacts on the viability of many projects and its use may not always be necessary. For example, the precise location of herring spawning grounds can change over time, the mechanism of which is not fully understood. Consequently, the nature of the impact will be fully determined before mitigation measures are proposed.

6.116 Potential accidental spillages or leakages can be mitigated by correct servicing and maintenance of all equipment, plant and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environmental Management Plans, Environment Agency Pollution Prevention Guidelines (Environment Agency, 2010) and onsite monitoring/reporting.

6.117 Proposed monitoring requirements will be identified as part of the EIA process and agreed with the relevant competent authorities, with the degree and type required being dependent on existing baseline environmental conditions, project design and proposed construction methodology.

6.118 Depending upon the foundation design chosen, soft start procedures during pile driving could be implemented to allow sensitive fish species to vacate the area, prior to higher amplitude noise being generated.

6.4 Ornithology

Breeding Seabirds

6.119 The nearest breeding seabird colonies to Project One are at Flamborough Head and Bempton Cliffs, approximately 45 km north of Project One. The proximity of these colonies suggests that it is possible that seabirds from these colonies may occur within Project One during the breeding season. To the south of Flamborough, there is a lack of habitat suitable for cliff nesting seabirds, consequently, there are fewer seabird colonies, however terns and gulls are found breeding on saltmarshes, undisturbed beaches or offshore sandbanks particularly along the North Norfolk coast. Information on the main breeding species present in the Hornsea region are presented in Table 6-6.

<table>
<thead>
<tr>
<th>Colony</th>
<th>Main Species</th>
<th>Total</th>
<th>Percentage of UK breeding population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flamborough Head &amp; Bempton Cliffs</td>
<td>Kittiwake</td>
<td>42,659 AON</td>
<td>11.6 %</td>
</tr>
<tr>
<td></td>
<td>Guillemot</td>
<td>46,685 Inds.</td>
<td>3.5 %</td>
</tr>
<tr>
<td></td>
<td>Razorbill</td>
<td>8,539 Inds.</td>
<td>5.2 %</td>
</tr>
<tr>
<td></td>
<td>Gannet</td>
<td>3,940 AOS</td>
<td>1.8 %</td>
</tr>
<tr>
<td></td>
<td>Puffin</td>
<td>2,615 Inds.</td>
<td>0.5 %</td>
</tr>
<tr>
<td>Humber flats, marshes and coast</td>
<td>Little tern</td>
<td>63 pairs</td>
<td>3.2 %</td>
</tr>
<tr>
<td>Gibraltar Point</td>
<td>Little tern</td>
<td>23 pairs</td>
<td>1.2 %</td>
</tr>
<tr>
<td>The Wash</td>
<td>Little tern</td>
<td>33 pairs</td>
<td>1.7 %</td>
</tr>
<tr>
<td></td>
<td>Lesser black-backed gull</td>
<td>1,378 AON</td>
<td>1.6 %</td>
</tr>
<tr>
<td></td>
<td>Common tern</td>
<td>152 pairs</td>
<td>1.5 %</td>
</tr>
<tr>
<td></td>
<td>Herring gull</td>
<td>1,003 AON</td>
<td>0.7 %</td>
</tr>
<tr>
<td>North Norfolk coast</td>
<td>Sandwich tern</td>
<td>3,457 pairs</td>
<td>32.8 %</td>
</tr>
<tr>
<td></td>
<td>Little tern</td>
<td>377 pairs</td>
<td>19.4 %</td>
</tr>
<tr>
<td></td>
<td>Common tern</td>
<td>460 pairs</td>
<td>4.5 %</td>
</tr>
<tr>
<td></td>
<td>Roseate tern</td>
<td>2 pairs</td>
<td>3.8 %</td>
</tr>
<tr>
<td></td>
<td>Mediterranean gull</td>
<td>2 pairs</td>
<td>1.9 %</td>
</tr>
</tbody>
</table>

1 Seabird 2000 data, taken from DECC (2009) and Mitchell et al. (2004)
2 Wanless et al., (2005)
3 Coastal colonies only
Seabirds at Sea

6.120 Likely key seabird species within the Project One boundary are: fulmar, gannet, great skua, herring gull, great black-backed gull, kittiwake, guillemot, razorbill and puffin. Of these, great skua, great black-backed gull and guillemot occur in internationally important numbers (as identified by Skov et al., 1995). In addition a review by Langston (2010) identified little gull as being a species of key concern. Table 6-7 shows likely key species present within the wider Hornsea Zone and the times of year at which they are likely to occur in highest density.

### Table 6-7 Likely key seabird species present within the Hornsea Zone (Skov et al., 1995)

<table>
<thead>
<tr>
<th>Species</th>
<th>Density</th>
<th>Highest density</th>
<th>Month</th>
<th>Area of Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulmar</td>
<td>8.21 birds/km²</td>
<td>Aug to Oct</td>
<td>SW corner</td>
<td></td>
</tr>
<tr>
<td>Gannet</td>
<td>0.54 birds/km²</td>
<td>Sep &amp; Oct</td>
<td>Whole Zone</td>
<td></td>
</tr>
<tr>
<td>Great skua</td>
<td>0.11 birds/km²</td>
<td>Sep &amp; Oct</td>
<td>Western half</td>
<td></td>
</tr>
<tr>
<td>Herring Gull</td>
<td>1.65 birds/km²</td>
<td>Nov to Feb</td>
<td>Whole Zone</td>
<td></td>
</tr>
<tr>
<td>Great black-backed gull</td>
<td>4.66 birds/km²</td>
<td>Aug to Oct</td>
<td>SW corner</td>
<td></td>
</tr>
<tr>
<td>Kittiwake</td>
<td>2.28 birds/km²</td>
<td>Apr to Sep</td>
<td>Western half</td>
<td></td>
</tr>
<tr>
<td>Guillemot</td>
<td>2.47 birds/km²</td>
<td>July</td>
<td>Whole Zone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.40 birds/km²</td>
<td>August</td>
<td>SW corner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.89 birds/km²</td>
<td>Sep &amp; Oct</td>
<td>Whole Zone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.52 birds/km²</td>
<td>Nov to Feb</td>
<td>NW corner</td>
<td></td>
</tr>
<tr>
<td>Razorbill</td>
<td>0.58 birds/km²</td>
<td>Oct &amp; Nov</td>
<td>Whole Zone</td>
<td></td>
</tr>
<tr>
<td>Puffin</td>
<td>4.44 birds/km²</td>
<td>Feb &amp; Mar</td>
<td>Western end</td>
<td></td>
</tr>
</tbody>
</table>

- Species not present at this time of year
- Moderate density (1.0 – 9.99 birds/km²)
- Very low density (<0.1 birds/km²)
- High density (≥ 10.0 birds/km²)
- Low density (0.1 – 0.99 birds/km²)

Wildfowl and Waders

6.121 Three of the top six sites currently monitored as part of the UK-wide Wetland Bird Survey (WeBS) are located on the east coast of England near to Project One; these are, The Wash, North Norfolk Coast and Humber Estuary. Key species of non-breeding wildfowl and waders occurring at these sites include: pink-footed goose *Anser brachyrhynchus*, dark-bellied Brent goose *Branta bica*, shelduck *Tadorna tadorna*, pintail *Anas acuta*, oystercatcher *Haematopus ostralegus*, ringed plover *Charadrius hiaticula*, golden plover *Pluvialis apricaria*, grey plover *Pluvialis squatarola*, lapwing *Vanellus vanellus*, knot *Calidris canuta*, sandpiper *Calidris alba*, dunlin *Calidris alpina*, black-tailed godwit *Limosa limosa*, bar-tailed godwit *Limosa lapponica*, curlew *Numenius arquata* and redshank *Tringa totanus*. All three sites hold internationally important numbers of both wildfowl and waders at certain times of year (Delaney et al., 2009).

Terrestrial Species

6.122 Large numbers of many different species of terrestrial or land birds cross the North Sea every year between Europe and Britain during spring and autumn migration (Hüppop et al., 2006). Some of these birds are likely to pass over the Hornsea Zone and therefore through Subzone 1 during these periods. The main species groups include pigeons and doves, larks,
pipits, chats, thrushes, warblers and finches. There is a general movement northwards in spring and south in autumn, but the direction and scale of movement is often dependent on prevailing weather conditions and the time of year.

**Nature Conservation Designations**

6.123 As mentioned above (Section 6.1), there are a number of onshore protected sites close to Project One, which may support bird populations that utilise the offshore areas of within the Project One boundary (Figure 6-3). It is also recognised that there may be other designated sites further away than those presented below that could potentially be impacted due to the dispersive nature of the qualifying species. These sites will be identified using known foraging ranges for the species present.

**Flamborough Head and Bempton Cliffs SPA**

6.124 Flamborough Head and Bempton Cliffs SPA lies approximately 70 km west of the Hornsea Zone. The SPA supports large numbers of breeding seabirds, specifically kittiwake. The qualifying seabird assemblage also includes auks, herring gull and gannet. During the breeding season, the SPA regularly supports 305,784 individual seabirds.

6.125 The seabirds feed and raft in the waters around the cliffs, and also feed more distantly in the North Sea. Some breeding species, such as gannet and kittiwake, may forage within the Hornsea Zone and therefore within Subzone 1, though the extent to which this occurs has not yet been quantified. The intertidal chalk platforms are also used as roosting sites, particularly at low water and notably by juvenile kittiwakes.

**Humber Flats, Marshes and Coast SPA, Ramsar site**

6.126 The Humber Flats, Marshes and Coast SPA is an extensive area of wetland and coastal habitats within the Humber Estuary and lies approximately 60 km to the west of the Hornsea Zone. The Estuary supports important numbers of waterfowl, especially geese, ducks and waders during the migration periods and during the winter and may migrate through the Hornsea Zone and therefore Subzone 1. The Estuary also supports important breeding populations of terns in the summer.

**Spurn Head NNR and Heritage Coast**

6.127 The heritage coast consists of a long, curving hook of shingle and sand arcing into the mouth of the Humber River and is a stopover point for thousands of migrating birds in the spring and autumn. It is particularly important for dunlin, knot, redshank and dark-bellied Brent geese; these may migrate through the Hornsea Zone and therefore Subzone 1.

**6.4.1 Data and Information to Inform EIA**

6.128 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- An atlas of seabird distribution in north-west European waters (Stone *et al.*, 1995);
- Birdlife report on - Important bird areas for seabirds in the North Sea including the Channel and the Kattegat. (Skov *et al.*, 1995);
- DTI report on - An analysis of ESAS seabird surveys in UK waters to highlight gaps in coverage (Pollock & Barton, 2006);
- Seabird populations of Britain and Ireland (Mitchell *et al.*, 2004);
- UK Offshore Energy Strategic Environmental Assessment (DECC, 2009a);
- Data from aerial bird surveys undertaken within the Hornsea Zone (TCE, 2010h);
- Waterbirds in the UK 2006/07: the Wetland Bird Survey (Austin *et al.*, 2008); and
- RSPB Research Report: Offshore wind farms and birds - Round 3 Zones, extensions to Round 1 & 2 sites & Scottish territorial waters (Langston, 2010).

6.129 In addition to these data sources, dedicated boat-based bird surveys have commenced since March 2010 and will continue for a two year period. The data from these surveys will be used to inform the EIA process.
6.4.2 Methods Supporting EIA

Data Acquisition

6.130 Detailed site-specific boat-based surveys at the scale of Subzone 1 are required to allow the potential impacts of Project One to be assessed. Boat-based surveys of the wider Hornsea Zone and Subzone 1 started in March 2010 and are being undertaken monthly. The surveys follow ESAS survey methods (Webb & Durink 1992), and comply with COWRIE recommendations (Camphuysen et al., 2004), with modifications for recording the height of flying birds. In addition, all terrestrial bird species seen are recorded. The ESAS survey method includes recording of marine mammals and these data will be used to augment that from dedicated marine mammal surveys. Any turtles, sharks and sunfish seen are also being recorded.

6.131 The boat-based surveys of Subzone 1 are undertaken at 2 km transect line spacing (see Figure 6-13). These will continue on a monthly basis for two years. The Zone scale survey is also undertaken each month, but with a transect line spacing of 6 km. The Zone level survey work will provide contextual information for the Subzone 1 specific surveys. These surveys will provide the baseline data to inform the EIA process and enable the assessment of the potential impacts of Project One.

6.132 Site specific surveys will employ a Before-After-Gradient (BAG) study design which assumes that impacts decline with increasing distance from the source of impact (Ellis & Schneider, 1997; Morrison et al., 2008; Manly, 2009; Smith, 2002).

Figure 6-13 Subzone 1 transect lines

Before-After-Gradient Study Design

6.133 A serious constraint on the design of any scheme to monitor the effects of an offshore wind farm development is the high mobility of seabirds and marine mammals, which makes identifying truly independent but comparable control areas practically impossible. For example, satellite-tagging has shown that breeding gannets from the Bass Rock colony range across the North Sea, at times travelling as far as the Norwegian coast (Hamer et al., 2007).
If such seabirds were displaced from the development area, they could potentially shift their feeding grounds by tens of kilometres. Thus, to be truly independent, control areas have to be considerable distances from the development sites, which could result in other problems, e.g. concerning the wider comparability of the environment and dynamics of animal populations that live there.

6.134 Therefore, the BAG design takes a much more practical and statistically no less powerful approach of examining displacement and habitat loss effects along a distance gradient from Subzone 1. It is planned to collect survey data in all areas up to a distance of 4 km from Subzone 1, and 10 km from the wider Hornsea Zone boundary. This is consistent with the surveys and analyses conducted for the Horns Rev and Nysted wind farms in Denmark (Petersen et al., 2004). To avoid underestimation of effects operating at scales greater than 8 km, additional modelling may also be necessary for some species.

6.135 When designing the surveys, SMart Wind have also considered the need for future effective monitoring of the site both during construction and when the wind farm is operational. SMart Wind believe that the BAG approach offers greater potential for the monitoring of any potential impacts form the wind farm.

6.136 The Before-After/Control-Impact (BACI) design first described by Green (1979) is routinely used for determining the effects of wind farms on birds (SNH, 2009; Drewitt and Langston, 2006; Fox et al., 2006). This study is premised on a Before-After-Gradient study design (a variant of the BACI design) which assumes that impacts decline with increasing distance from the source of the impact (Ellis and Schneider, 1997; Morrison et al., 2008; Manly, 2009 and Smith, 2002). There are several reasons for choosing this type of design:

- It is likely that any effects of Project One will decline with increasing distance from the turbines within Subzone 1;
- A gradient design can be more powerful than a control impact design in detecting impacts when impacts do decline with distance from their source (Ellis and Schneider, 1997);
- A statistically significant trend in bird numbers with distance from Subzone 1 appearing after turbine installation would provide stronger evidence that the wind farm is responsible than a simple comparison of “impacted” and “non-impacted” areas before and after turbine installation, reducing the chances of mistaking other effects as an impact of Project One (Manly, 2009);
- It avoids the intractable problem of finding discrete control sites, which are at a sufficient distance to be independent of the impacts at the development site, but are comparable in other aspects (Ellis and Schneider, 1997); and
- The results of the gradient model are easy to interpret and present to statutory and non-statutory consultees (Ellis and Schneider, 1997).

6.137 The analyses of the ornithological impacts of the Horns Rev, Nysted and Arklow Bank offshore wind farms (e.g. Petersen et al., 2007; Barton, Pollock and Harding, 2008) have all employed a BAG type design. This approach has also been advocated as good practice by Fox et al., (2006) for assessing the impact of offshore wind farms on birds.

Assessment of Baseline Data

6.138 Analysis of the data collected will provide the following information required to inform the EIA process:

- Estimate of the numbers of birds using Subzone 1 (and surrounding waters) throughout the year. This will allow the importance of Subzone 1 (and surrounding waters) to be assessed at regional, national and international levels;
- Assessment of how birds are using Subzone 1 (and surrounding waters) throughout the year, e.g., migration, feeding, breeding. This will allow the importance Subzone 1 (and surrounding waters) to be assessed at regional, national and international levels;
- Distribution of birds within Subzone 1 (and surrounding waters) throughout the year. This will allow for the comparison of different areas within the Hornsea Zone and the
development of potential mitigation measures (such as the siting of turbines and timetabling of operations); 

- Estimate of collision risk to birds and population viability analysis to assess potential impacts at a regional scale; and

- Estimate of any potential effects due to habitat loss and displacement, ‘barrier effects’ created by the presence of structures and the availability of alternative suitable habitats.

### Q17: Are these methods sufficient to inform a robust assessment of impacts on birds resulting from Project One?

#### 6.4.3 Potential Project Impacts

**Construction Phase**

6.139 The identified potential impacts on birds resulting from the construction of Project One are as follows:

- Disturbance and displacement of birds from the Project One area resulting from the presence of construction vessels and other associated plant; and

- Reduction in prey availability through the disturbance and displacement of fish and other prey from the Project One area resulting from the presence of construction vessels and other associated plant.

**Operation and Maintenance Phase**

6.140 The identified potential impacts on birds resulting from the operation and maintenance of Project One are as follows:

- Displacement of birds from Subzone 1 area resulting from the presence of turbines within the Blocks;

- Direct collision of birds utilising Subzone 1 for feeding and migration with the turbines within the Blocks;

- Barrier to daily movements and migration as a result of the turbines within the Blocks disrupting the flight-lines of birds which may cause an increase in the energetic costs;

- Disturbance and displacement of birds from the Project One area resulting from the presence of service and maintenance vessels, leading to a physical loss of foraging habitat; and

- Reduction in prey availability through the disturbance and displacement of fish and other prey from the Project One area resulting from the presence of service and maintenance vessels.

**Decommissioning Phase**

6.141 The potential impacts during decommissioning are considered to be similar to those for the construction phase.

#### 6.4.4 Potential Transboundary Impacts

6.142 Due to the highly mobile nature of birds, and the proximity of the Hornsea Zone and Project One to the waters of other North Sea bordering countries, there is the potential for transboundary impacts from the proposed development.

6.143 Desk-based studies will gather data on the species present in the Hornsea Zone and Subzone 1 with breeding colonies beyond the UK coast. These data will be used to assess the importance of the numbers of each species (i.e. percentage of the population) using the Hornsea Zone and Subzone 1 at national and international levels. The assessment methods described previously will be used to ascertain potential impacts on these populations.

6.144 Throughout the EIA, any likely significant effects from the development of Project One on the bird population of another European Member States will be identified and reported in the ES.
6.4.5 Potential Cumulative Impacts

6.145 The location of the Hornsea Zone in proximity to a number of important seabird colonies and the presence of other Round 2 and 3 Zones in the southern North Sea indicate that there is the potential for a cumulative impact.

6.146 Cumulative impacts may arise in relation to any of the potential impacts described in previous sections. It is recognised that assessing cumulative impacts is a significant challenge and that best guidance on how to address cumulative impacts with respect to birds and wind farms has been published by COWRIE (King et al., 2009), this guidance will inform the assessment of cumulative impacts within the EIA process.

6.4.6 Potential In-Combination Impacts

6.147 There is the potential for in-combination impacts to birds resulting from the construction, operation, maintenance and decommissioning of Project One in-combination with other activities or developments in the region. The spatial scope within which other activities will be considered will depend upon the magnitude and spatial extent of the effect on the environment, and will take into consideration the following activities:

- Aggregate extraction, dredging and spoil disposal;
- Navigation and shipping;
- Established commercial fishing activities;
- Potential port and harbour developments; and
- Existing and potential future oil and gas installations.

6.4.7 Potential Mitigation and Monitoring

6.148 There is a range of standard mitigation measures which can, if appropriate, be incorporated into any offshore wind farm development including the layout and siting of turbines (to avoid key areas for birds), the timing of construction (to avoid key periods for certain bird species), the routes taken by construction vessels (including following existing shipping lanes) and taking precautions to avoid rafts of moulting flightless birds (by using dedicated observers on the vessels).

6.149 Recognised standard mitigation measures are listed below:

- Aviation and navigation lighting should be optimised to avoid attracting birds taking into account impacts on safety;
- Subject to other constraints, wind turbines should be laid out within a site, to minimise collision risk, where the collision risk assessment shows there is a significant risk of collision.
- Construction vessels associated with offshore wind farms should, where practicable and compatible with operational requirements and navigational safety, avoid rafting seabirds during sensitive periods.
- The exact timing of peak migration events is inherently uncertain. Therefore, shutting down turbines within migration routes during estimated peak migration periods is unlikely to offer suitable mitigation.

6.150 The Subzone 1 survey started in March 2010 and will continue until February 2012. Potential mitigation and future monitoring will be informed by the Zone wide and Subzone 1 surveys and until the first years of bird surveys are complete it is not possible to determine what potential mitigation is most appropriate.

6.151 Results from the first 12 months of data will also inform further surveys that may be required, such as radar or other remote sensing techniques.

6.5 Marine Mammals

6.152 The waters around the Hornsea Zone support a diverse range of marine mammals. However, knowledge on the abundance, population structure and seasonal distribution remains limited. Information on seasonal movements, inter-annual variation in
abundance/density, and the distribution range for the majority of marine mammals in western European waters is lacking.

6.153 More than twenty cetacean species have been recorded in UK waters. Of these, ten species are known to occur regularly:

- Minke whale *Balaenoptera acutorostrata*;
- Harbour porpoise *Phocoena phocoena*;
- Bottlenose dolphin *Tursiops truncatus*;
- Short-beaked common dolphin *Delphinus delphis*;
- White-beaked dolphin *Lagenorhynchus albirostris*;
- Atlantic white-sided dolphin *Lagenorhynchus acutus*;
- Killer whale *Orcinus orca*;
- Risso's dolphin *Grampus griseus*; and
- Long-finned pilot whale *Globicephala melas*.

6.154 Nine further species are infrequently recorded:

- Striped dolphin *Stenella coeruleoalba*;
- Sperm whale *Physeter macrocephalus*;
- Pygmy sperm whale *Kogia breviceps*;
- Sei whale *Balaenoptera borealis*;
- Fin whale *Balaenoptera physalus*;
- Humpback whale *Megaptera novaeangliae*;
- Cuvier's beaked whale *Ziphius cavirostris*, Sowerby's;
- Beaked whale *Mesoplodon bidens*; and
- Northern bottlenose whale *Hyperoodon ampullatus*.

6.155 The marine mammal species most relevant to Project One are harbour porpoise, minke whale, short-beaked common dolphin, white-beaked dolphin, Atlantic white-sided dolphin, and bottlenose dolphin (see Figure 6-14 and Figure 6-15). Two species of seal also occur in the study area, the grey seal *Halichoerus grypus* and common seal *Phoca vitulina*.

6.156 There are currently no offshore SACs with marine mammals as qualifying features within the vicinity of Project One. However, marine mammals are listed non qualifying features of the Dogger Bank pSAC 30 km to the north of the Hornsea Zone.

6.157 Onshore designations within the vicinity of Project One with marine mammals as qualifying features include: the Humber Estuary SAC (which supports a population of grey seals on the southern edge of their distribution); and the Donna Nook NNR (the main breeding site in the region for grey seals, and an important haul out site for common seals). However, it is recognised that there may be SACs further afield with qualifying species that may be potentially affected.
Figure 6-14 Minke whale, long finned pilot whale, harbour porpoise and common bottlenose dolphin sightings between 1979 and 1997 (Reid et al., 2003), data provided by JNCC, 2009
6.5.1 Data and Information to Inform the EIA Process

An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- Background Information on North Sea Marine Mammals, Strategic Environmental Assessment – Area 2 (DTI 2001b);
- Background Information on North Sea Marine Mammals, Strategic Environmental Assessment – Area 3 (DTI, 2001c);
- Small cetaceans in the European Atlantic and North Sea (SCANS-II, 2008);
- An atlas of cetaceans distribution in north-west European waters (Reid et al., 2003);
- A review of offshore wind farm related underwater noise sources (Nedwell and Howell, 2004);
- An assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore wind farms, and comparison with background noise (Nedwell et al., 2004);
- Data from an underwater noise survey during impact piling to construct the Barrow offshore wind farm (Parvin & Nedwell, 2006a);
- Data from an underwater noise survey during impact piling to construct the Burbo Bank offshore wind farm (Parvin & Nedwell, 2006b);
- Methodologies for measuring and assessing potential changes in marine mammal behaviour, abundance or distribution arising from the construction, operation and decommissioning of offshore wind farms (Diederichs et al., 2008);
- Proceedings of the ASCOBANS/ECS workshop – Offshore wind farms and marine mammals: impacts and methodologies for assessing impacts (Evans, 2008);
• The protection of marine European Protected Species from injury and disturbance Guidance for the marine area in England and Wales and the UK offshore marine area (JNCC, 2010f);
• Report: Towards Standardised Seabirds at Sea Census Techniques in Connection with Environmental Impact Assessments for Offshore Wind farms in the UK (Camphuysen et al., 2004); and
• The JNCC Seabirds at Sea team has carried out a programme of survey and research on seabirds and cetaceans in the marine environment in the north-east Atlantic since 1979. Standardised survey methods for census of primarily seabirds, but also marine mammals, from ships have been produced by JNCC (Tasker et al., 1984 and Webb & Durinck, 1992).

6.159 In addition to the literature sources above, a dedicated two year boat-based marine mammal survey will be undertaken for Project One. The data from this survey will inform the EIA and will be reported within the ES.

Q18: With regard to marine mammals, should any further data sources be consulted as part of the EIA process?

6.5.2 Methods Supporting the EIA Process

Data acquisition

6.160 Detailed site-specific surveys at the Project One scale are required to allow the potential impacts of the project to be assessed. Obtaining sufficient data on the abundance and behaviour of marine mammals is challenging, as is determining the sensitivity and responses of marine mammals from the effects of sound (Diederichs et al., 2008).

6.161 Marine mammals are being observed in conjunction with the Project One specific bird boat-based surveys (as described in Section 6.4.2). These surveys will provide the baseline data for EIA purposes and enable the assessment of the potential impacts of Project One.

6.162 Site specific surveys will employ a Before-After-Gradient (BAG) study design which assumes that impacts decline with increasing distance from the source of impact (Ellis & Schneider, 1997; Morrison et al., 2008; Manly, 2009; Smith, 2002).

6.163 The visual survey method to quantify the distribution and abundance of marine mammals is following ESAS survey methods (Webb & Durinck 1992), and complies with COWRIE recommendations (Camphuysen et al., 2004). Any turtles, sharks and sunfish seen are also recorded. Monthly ESAS surveys within the Hornsea Zone and 10 km buffer zone record all marine mammals encountered, at the same time as recording seabirds. In addition, angle and distance of the animals from the transect line are recorded using an angle board and rangefinder. Only marine mammal data in suitable sea state (i.e., sea state 3 or less) are used for analysis.

6.164 Where possible and if weather forecasts indicate suitable weather conditions (i.e., sea state 3 or less), a fourth surveyor joins the survey team to conduct dedicated marine mammal observations. Dedicated marine mammal surveys have been carried out during the months of June to August. In other months, if areas of high densities of marine mammals are encountered in sea state less than three with only three surveyors on board, the third surveyor is used to record marine mammals. If data from initial surveys indicate that the study area is a high density area for marine mammals, then marine mammal survey effort is increased accordingly.

6.165 An acoustic survey method captures cetaceans that may be overlooked during conventional visual survey work when sea conditions are other than calm. The visual marine mammal survey data is therefore augmented by acoustic data from a hydrophone7 towed from the survey vessel. The hydrophone is linked to a computer running PAMGUARD software to record cetacean vocalisations, in particular those made by harbour porpoises and dolphin species, although, it is recognised that animals will not vocalise at all times.

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7 The equipment comprises: 200 m towed hydrophone array, Magnatec HP27 amplifier and filter unit, National Instruments USB digitiser, depth sensor, Fujitsu laptop and 1TB WD external hard drive.
6.166 SMart Wind are also considering assessing the existing sound levels within the Hornsea Zone. This will provide a baseline of the noise in the area to place any anthropogenic noise produced during the wind farm operations in context with the existing noise fields.

6.167 Visual surveys combined with towed passive acoustic monitoring (PAM) surveys provide useful supplementary information since acoustic detections are less influenced by weather and daylight than visual surveys. Depending on the vessel, it is possible to operate a hydrophone successfully up to sea state 6 (Scheidat et al., 2007).

**Assessment of Underwater Noise**

6.168 In order to assess potential impacts from underwater noise on marine mammals using the Project One area, the distribution and abundance of marine mammal species with respect to the development area will be mapped. Sound modelling of different construction scenarios will allow the potential zone of influence from Project One (with respect to noise) to be mapped on both spatial and temporal scales. This will allow the estimation of impact radii for each species of marine mammal using the area. Impact radii depend on the animals’ specific sensitivity, the source level and properties of sound (e.g. frequency band, continuous or impulsive), sound radiation at the site and effect level. Ranges at which animals may be affected will be estimated using measurements of source levels (peak, Sound Exposure Level), a sound propagation model (developed and tested for the site) and information on sound exposure levels potentially significant for the different marine mammal species/species groups (from Nehls et al., 2008). Reference will be made to the thresholds presented in JNCC (2010f) in relation to Permanent and Temporary Threshold Shift (PTS and TTS) effects.

**Before-After-Gradient Study Design**

6.169 As with birds, a serious constraint on the design of any scheme to monitor the effects of an offshore wind farm is the high mobility of marine mammals, which makes identifying truly independent but comparable control areas practically impossible. To be truly independent, control areas have to be considerable distances from the development sites, which could result in other problems, e.g. concerning the wider comparability of the environment and dynamics of animal populations that live there.

6.170 Therefore, the BAG design takes the much more practical and statistically no less powerful approach of examining displacement and habitat loss effects along a distance gradient from the development site. It is planned to collect survey data in all areas up to a distance of 4 km from Subzone 1, and 10 km from the wider Hornsea Zone boundary. This is consistent with the surveys and analyses conducted for the Horns Rev and Nysted wind farms in Denmark (Petersen et al., 2004). To avoid underestimation of effects operating at scales greater than 8 km, additional modelling may also be necessary for some species.

6.171 There are several reasons for choosing this type of design:

- It is likely that any effects of Project One will decline with increasing distance from Subzone 1;
- A gradient design can be more powerful than a control impact design in detecting impacts when impacts do decline with distance from their source (Ellis and Schneider, 1997);
- A statistically significant trend in marine mammal numbers with distance from Subzone 1 appearing after turbine installation would provide stronger evidence that Project One is responsible than a simple comparison of “impacted” and “non-impacted” areas before and after turbine installation, reducing the chances of mistaking other effects as an impact of the development (Manly, 2009);
- It avoids the intractable problem of finding discrete control sites, which are at a sufficient distance to be independent of the impacts at the development site, but are comparable in other aspects (Ellis and Schneider, 1997); and
- The results of the gradient model are easy to interpret and present to statutory and non statutory consultees (Ellis and Schneider, 1997).
Assessment of Baseline Data

6.172 Analysis of the data collected will provide the following information required for the EIA:

- Estimate of the numbers of marine mammals using Subzone 1 (and surrounding waters) throughout the year. This will allow the importance of Subzone 1 (and surrounding waters) to be assessed at regional, national and international levels;
- Assessment of how marine mammals are using Subzone 1 (and surrounding waters) throughout the year, e.g. migration, feeding, breeding. This will allow the importance of Subzone 1 (and surrounding waters) to be assessed at regional, national and international levels;
- Distribution of marine mammals within Subzone 1 (and surrounding waters) throughout the year. This will allow the importance of Subzone 1 (and surrounding waters) to be assessed at regional, national and international levels;
- Assessment of marine mammal disturbance during construction; and
- Estimate of any potential effects due to habitat loss and displacement, and the availability of alternative suitable habitats.

6.5.3 Potential Project Impacts

Construction Phase

6.173 The identified potential impacts on marine mammals resulting from the construction of Project One are as follows:

- Temporary disturbance and displacement of marine mammals resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities;
- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities;
- Potential physical damage, masking effects, and disturbance resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities; and
- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during construction activities.

Operation and Maintenance Phase

6.174 The identified potential impacts on marine mammals resulting from the operation and maintenance of Project One are as follows:

- Disturbance and displacement of marine mammals resulting from the noise and vibration from servicing and maintenance vessels;
- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from servicing and maintenance vessels;
- Potential physical damage, masking effects, and disturbance resulting from the noise and vibration from servicing and maintenance vessels;
- The introduction of artificial hard substrates and underwater structures will be colonised by sessile animals and algae, and may enrich the local biomass, resulting in an increase in food availability; and
- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during service and maintenance activities.

Q19: Are these methods sufficient to inform a robust assessment of impacts on marine mammals resulting from Project One?
Decommissioning Phase

6.175 The potential impacts during decommissioning are considered to be similar to those for the construction phase.

6.5.4 Potential Transboundary Impacts

6.176 Due to the highly mobile nature of marine mammals, and the proximity of Project One to Dutch, German and Danish waters, there is the potential for transboundary impacts from the proposed development.

6.177 Dogger Bank is a Proposed SAC (pSAC) with harbour porpoise, grey seal and common seal listed as interest features. JNCC is currently conducting a consultation on the scientific selection of the Dogger Bank SAC and its associated impact assessment. The boundaries of the pSAC adjoin Dutch and German Dogger Bank Natura 2000 sites which list the following species as interest features (see Section 6.12):

Table 6-8 Natura 2000 interest features for sites that adjoin the Dogger Bank pSAC

<table>
<thead>
<tr>
<th>Natura 2000 Site</th>
<th>Interest Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dutch Doggersbank SCI</td>
<td>Common seal, harbour porpoise and grey seal</td>
</tr>
<tr>
<td>German Doggerbank SAC</td>
<td>Common seal and harbour porpoise</td>
</tr>
</tbody>
</table>

6.178 Project One has the potential to have a likely significant effect on these features both in UK and adjoining waters. A desk-based study will gather data on marine mammal distribution in these areas and the assessment methods described previously will be used to ascertain potential impacts on these European sites.

6.179 Throughout the EIA, any likely significant effects from the development of Project One on the environment of another Member State of the European Economic Area will be identified and reported in the ES.

6.5.5 Potential Cumulative Impacts

6.180 There is the potential for cumulative impacts on marine mammals between Project One and the Round 2 wind farms in The Greater Wash area and the Round 3 Dogger Bank and East Anglia Zone developments. The mobile nature of marine mammals will be considered during the assessment of cumulative impacts within the EIA Process.

6.181 The potential effects on any given species will be considered in relation to the wider population, particularly where these are of conservation interest. Defining geographical and temporal scope for cumulative impacts is vital and likely to vary depending upon both the species and potential impacts under consideration. COWRIE guidelines will be taken into account during consideration of geographical scope for impact assessment.

6.5.6 Potential In-Combination Impacts

6.182 There is the potential for in-combination impacts to marine mammals resulting from the construction, operation, maintenance and decommissioning of Project One in-combination with other activities or developments in the region. The spatial scope within which other activities will be considered will depend upon the magnitude and spatial extent of the effect on the environment, and will take into consideration the following activities:

- Aggregate extraction, dredging and spoil disposal;
- Navigation and shipping;
- Established commercial fishing activities;
- Potential port and harbour developments; and
- Existing and potential future oil and gas installations
6.5.7 Potential Mitigation and Monitoring

6.183 Mitigating noise produced during any marine activity is based upon either minimising the noise at source or ensuring a marine mammal is not in the vicinity of operations exposed to noise. For example:

- At design stages and within the EIA process, the assessment of engineering options will include consideration of the noise produced during construction and operation of Project One.
- During construction, 24 hour working practices may be employed so that the overall construction programme and the potential for impacts to marine mammal communities is reduced in time. If piling is used, consideration will be given to engineering solutions to mask the piling noise as described in Nehls et al., (2007).

6.184 Monitoring of the surrounding area before and during the piling procedure can be undertaken:

- Depending upon the foundation design chosen, soft start procedures during pile driving may be implemented. This enables marine mammals in the area to move away from the piling location before full power is achieved with the piling device. Site specific guidance such as that described by JNCC (2010e) would be developed regarding the use of Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) Operators.
- The effectiveness of acoustic harassment devices (AHDs) such as seal scarers, and pingers (both of which were employed during the construction of the Horns Reef wind farm (Tougaard et al., 2003, 2004)) should be investigated further.

6.185 In order to minimise risk of a vessel strike, a bespoke Code of Conduct for interactions between marine mammals and vessels associated with Project One will be commissioned and actively communicated to all vessels and crew.

6.186 Mainstream Renewable Power already effectively uses a similar Code on their Scottish offshore wind farm, ‘Neart na Gaoithe’. This is based on the Scottish Natural Heritage (SNH) Wildlife Watching Code of Conduct, and agreed with all interested parties.

Q20: Have all potential impacts on marine mammals resulting from Project One been identified within this scoping report?

6.6 Bats

6.187 Eighteen species of bat regularly occur in the UK many of which are considered to be resident or semi-resident and unlikely to be recorded offshore. However, some species, notably Nathusius’ pipistrelle pipistrellus nathusii, are known to be highly migratory and cross the North Sea during spring and autumn they could therefore occur in the Hornsea Zone and within Subzone 1 as a migrant.

6.188 Recent studies undertaken in Sweden indicate that some species of bat may undertake regular foraging flights to offshore structures as far as 14 km from the coast. It is therefore important to identify the likely species of bats occurring onshore at points closest to the Hornsea Zone and also, when identified, the likely location for the onshore cables.

6.6.1 Data and Information to Inform the EIA Process

6.189 It is recognised that there have been relatively few studies undertaken assessing the occurrence of bats offshore. Consequently, there is a lack of data on the distribution and abundance of bats in UK offshore waters. However, ad hoc sightings of bats from offshore locations are recorded, particularly by the North Sea Bird Club. Additional data sources indicating likely species crossing the North Sea can be obtained from Shetland and Orkney where there are no resident bat populations and therefore any bats identified are migrants. Published literature providing background information can be obtained from the Bat Conservation Trust and includes a report undertaken by the University of Bristol on determining the potential ecological impact of wind turbines on bat populations in Britain (Jones et al., 2009). Since surveying the Hornsea Zone began in March 2010, there has been one sighting of a medium-sized bat in the eastern part of the Zone, east of Subzone 1. As the survey continues, any further sightings will continue to be logged and reported.
6.190 There are more data available on the distribution and abundance of bats onshore. Much of the data is not necessarily published but the species of bat likely to occur within the cable route corridor and grid connection location at Killingholme will be identified and the use of local knowledge will likely provide further information.

Q21: With regard to bats, should any further data sources be consulted as part of the EIA process?

6.6.2 Methods Supporting the EIA Process

6.191 Based on the number of sightings of bats from either existing offshore infrastructure or vessels it is unlikely that there will be many, if any, bats recorded from surveys being undertaken within the Hornsea Zone for Project One.

6.192 The use of existing data from other UK sources will be used to determine the likelihood of bats occurring, the species and the potential risk to the bat from Project One. The risk to differing species of bat from collisions with wind turbines has been assessed by Natural England and is based on a number of morphological, ecological and behavioural factors including flight speed, hunting techniques and migratory behaviour (Table 6-9).

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myotis species</td>
<td>Common pipistrelle</td>
<td>Noctule</td>
</tr>
<tr>
<td>Long-eared bats</td>
<td>Soprano pipistrelle</td>
<td>Leisler’s bat</td>
</tr>
<tr>
<td>Horseshoe bats</td>
<td>Serotine</td>
<td>Nathusius’ pipistrelle</td>
</tr>
<tr>
<td></td>
<td>Barbastelle</td>
<td></td>
</tr>
</tbody>
</table>

6.193 Following consultation with nature conservation agencies the assessment will be undertaken based, as far as practicable, on existing guidance (e.g., Natural England, 2009; Rodrigues et al., 2008). However, existing guidance focuses on potential impacts arising from onshore wind farms and provides details on types surveys and monitoring the can be undertaken. For offshore wind farms, particularly for locations considerable distance from the coast and away from any obvious geographical features such as headlands or islands that could cause migration corridors or hot spots it may not be appropriate or even possible to fully follow the guidance within the documents for the assessment of impacts resulting from Project One.

6.194 For the offshore component, the assessment will be based on the advice received during consultation and comprise of undertaking a thorough literature review and the collection of data from existing sources, e.g., North Sea Bird Club, Humber Industry Nature Conservation Association (INCA). The assessment will identify the species most likely to occur in Subzone 1 and assess potential impacts based on known behaviour.

6.195 Where the cables come ashore and around the substation an assessment will be made on whether the area is used by bats and, if so, which species and what times of year. An initial literature review will be undertaken and if subsequently it is recognised that there are significant gaps in knowledge or that the area is of potential importance, a dedicated bat survey will be undertaken to determine bat activity in the area particularly between April and October and locate any roosts that could be potentially impacted.

6.196 Consultation with the Nature Conservation Agency, Bat Conservation Trust and local stakeholders will be undertaken. The consultation will provide additional information on bats occurring in the area, advice on the impact assessment and the scope of any future onshore surveys.

6.197 The onshore assessment will be based on the advice received during consultation and consider the recognised risks to the species of bat likely to be present and the potential impacts arising from the onshore works.
6.6.3 Potential Project Impacts

**Construction Phase**
6.198 Impacts arising from onshore construction works may arise primarily from disturbance to roosts or important foraging areas. Bats are sensitive to anthropogenic disturbance and may leave roosts or avoid foraging areas if disturbed.

**Operation and Maintenance Phase**
6.199 It is recognised that based on evidence from onshore wind farms, wind turbines have the potential to impact on bats and depending on the location and size of the wind turbines these impacts can cause significant numbers of fatalities.
6.200 Potential impacts of wind turbines on bats are primarily twofold:

- Bats may collide directly with the turbines. The reason why bats collide with turbines is unclear but may be due to a number of factors. They may not be able to detect the turbines and therefore fly by chance into them, or they may be attracted to the turbines due to physical structure of the turbines being tall structures in an otherwise flat landscape. Migrant insects, such as migrant moths and butterflies may be attracted to the turbines in the Zone, in particular the lights and by doing so attract bats; and

- Potentially more significant impact to bats is caused by barotraumas which occurs when there is a sudden drop in air pressure causing fatal internal haemorrhaging. Onshore studies have suggested that up to 90% of bat fatalities caused by wind turbines are from barotrauma.

**Decommissioning Phase**
6.201 Impacts arising from onshore decommissioning works may arise primarily from disturbance to roosts or important foraging areas. Bats are sensitive to anthropogenic disturbance and may leave roosts or avoid foraging areas if disturbed.

6.6.4 Potential Transboundary Impacts
6.202 The majority of bats in the UK are thought to be largely sedentary or undertake only short distance seasonal migrations. Three species are recognised to be potentially long distance migrants: Noctule, Leisler's bat and Nathusius’ pipistrelle. However, other species may also undertake migrations across the North Sea.
6.203 As part of the EIA process a desk based study will be undertaken to determine, as far as possible, the potential for transboundary impacts to migratory bat species and will be reported in the ES.

6.6.5 Potential Cumulative Impacts
6.204 It is recognised that there is the potential for cumulative impacts to arise on species of migratory bats from the construction of Round 3 and Round 2 projects across the North Sea.
6.205 There is no guidance on how to undertake a cumulative impact assessment on migrating bats. However, there is guidance on assessing cumulative impacts to birds and the bat assessment will be undertaken, as far as is practicable, in a similar approach.
6.206 The assessment will consider potential cumulative impacts of Project One with other Round 3 and Round 2 projects. The cumulative impact assessment will be reliant upon publically available data and it may be that some data from other offshore wind farms may not be available.

6.6.6 Potential In-combination Impacts
6.207 There are not predicted to be any offshore activities that could cause in-combination impacts. There may, depending on the location of the onshore substation, be possible in-combination
impacts between onshore site activities and other consented projects. These other projects will, as far as possible, be identified and assessed in-combination with the onshore works within the ES.

6.6.7 Potential Mitigation and Monitoring

6.208 Effective mitigation measures capable of reducing potential impacts on bats arising from operating offshore wind turbines are limited. Research undertaken by the University of Aberdeen has indicated that the use of radar can significantly reduce the number of bat fatalities around wind turbines. Should the impact assessment identify a potentially significant impact on bats resulting from Project One then the use of radar as a means to mitigate the impact may be considered. However, this mitigation technique has not been extensively studied and further research on its effectiveness onshore would be required prior considering deployment offshore.

6.209 Further assessment on the practicality of undertaking offshore bat monitoring and the need to do so will be discussed with the Regulator and Nature Conservation Agency nearer the time.

6.210 Should the ES identify potential impacts to bats from onshore works, then appropriate mitigation measures may be identified in order to minimise the identified impacts. Further consideration of this topic is addressed in section 8 of this Scoping Report.
7 HUMAN ENVIRONMENT

7.1 Commercial Fisheries

**Project Location**

7.1 This section is relevant primarily to the offshore components of Project One, however some elements are relevant to onshore components also. Therefore reference is made to Subzone 1 and the cable route corridor (offshore and onshore) as appropriate. Subzone 1 is located in the central part of the Hornsea Zone and lies within the south-western portion of ICES IVb (Central North Sea) statistical area. The location of Subzone 1 and the cable route corridor are shown in Figure 7-1. Project One as a whole lies across a number of ICES statistical rectangles (Table 7-1).

**Table 7-1 ICES statistical rectangles overlapping Project One**

<table>
<thead>
<tr>
<th>Development area</th>
<th>ICES statistical rectangles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable route corridor</td>
<td>36E9, 36F0, 36F1, 36F2 and 35F0</td>
</tr>
<tr>
<td>Subzone 1</td>
<td>36F1, 36F2</td>
</tr>
</tbody>
</table>

Figure 7-1 Hornsea Round 3 Zone and the Project One boundary relative to ICES statistical Rectangles

**Characteristics of fleets operating within Subzone 1 and the cable route corridor**

7.2 Vessel Monitoring Systems (VMS) data indicate that, across ICES rectangles 36F1 and 36F2, which overlap Subzone 1, the majority of fishing effort is by beam trawlers, gill netting and demersal trawlers (Table 7-2). These vessels also operate across the cable route corridor. Effort by potters is seen within 36F0 portion of the cable route and they form ~21% of the total effort within this ICES rectangle. Effort by demersal seiners, gill netters and shrimpers are markedly increased across the offshore cable route corridor (Table 7-3), compared to Subzone 1.
Table 7-2  Proportion of VMS data by gear type across ICES rectangles 36F1 and 36F2 (overlapping Subzone 1)

<table>
<thead>
<tr>
<th>Gear</th>
<th>Proportion of VMS data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null*</td>
<td>70.93 %</td>
</tr>
<tr>
<td>Demersal trawl</td>
<td>15.68 %</td>
</tr>
<tr>
<td>Gill net</td>
<td>6.23 %</td>
</tr>
<tr>
<td>Demersal seine</td>
<td>4.43 %</td>
</tr>
<tr>
<td>Beam trawl</td>
<td>2.66 %</td>
</tr>
<tr>
<td>Freezer trawler</td>
<td>0.04 %</td>
</tr>
<tr>
<td>Scallop dredger</td>
<td>0.03 %</td>
</tr>
<tr>
<td>Shrimper</td>
<td>0.01 %</td>
</tr>
<tr>
<td>Drift netter</td>
<td>0.01 %</td>
</tr>
<tr>
<td>Potter</td>
<td>0.00 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

Table 7-3  Proportion of VMS data by gear type across ICES rectangles 35F0, 36E9, 36F0, 36F1 and 36F2 (overlapping the cable route corridor)

<table>
<thead>
<tr>
<th>Gear</th>
<th>Proportion of VMS data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null*</td>
<td>33.94 %</td>
</tr>
<tr>
<td>Demersal trawl</td>
<td>15.22 %</td>
</tr>
<tr>
<td>Potter</td>
<td>13.74 %</td>
</tr>
<tr>
<td>Demersal seine</td>
<td>12.47 %</td>
</tr>
<tr>
<td>Shrimper</td>
<td>11.76 %</td>
</tr>
<tr>
<td>Gill net</td>
<td>10.36 %</td>
</tr>
<tr>
<td>Scallop dredger</td>
<td>1.04 %</td>
</tr>
<tr>
<td>Beam trawl</td>
<td>0.98 %</td>
</tr>
<tr>
<td>Suction dredge</td>
<td>0.47 %</td>
</tr>
<tr>
<td>Freezer trawler</td>
<td>0.01 %</td>
</tr>
<tr>
<td>Pelagic trawler</td>
<td>0.01 %</td>
</tr>
<tr>
<td>Drift net</td>
<td>0.00 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

7.3 Catches with beam trawl are likely to form the bulk of the annual landings from Subzone 1 with the main target species being plaice and sole. These demersal flatfish species are not regarded as shoaling species therefore fishing effort is spread over wide areas.

7.4 It is recognised that in some cases, significant investments in quota have been made by vessels registered to other EU Member States in order to fish for these species within ICES Division IVb.

7.5 Demersal trawlers operating across Subzone 1 and the cable route corridor tend to tow in directions which are in line with natural seabed contours.

7.6 Vessel numbers vary and their presence is likely to be dependent upon demersal and or Nephrops catches elsewhere. Important Nephrops grounds are located immediately north of

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*The gear type deployed by those vessels identified as “null” is unknown, but the majority are expected to be that of foreign beam trawlers.
the Subzone 1, running parallel to the northern edge of the Hornsea Zone and also in the
easternmost part of the Hornsea Zone.

7.7 While not being regarded as the main fishing area for sandeel, some activity within Subzone
1 should be anticipated. Most sandeel fishing is conducted on and around the edge of the
Dogger Bank, which is located approximately 75 km to the north of Subzone 1. However, as
the fishery in the Dogger Bank area decreases, vessels open up a wider search for new
shoals and engage in fishing wherever sandeel occur.

7.8 Further details of the fishing methods, gear types and fleet metier profiles are provided in the
Hornsea ZoC document (available on the SMart Wind website, http://www.smartwind.co.uk/)
and will be further detailed within the ES.

Fishing characteristics

7.9 Landing statistics (Figure 7-2) show that, by value, the species landed by UK registered
vessels (and foreign vessels into UK ports) is dominated by lobster and brown crab in the
inshore areas across the cable route corridor, moving to Nephrops, plaice and sole to the
east within ICES rectangles overlapping Subzone 1.

Figure 7-2 Proportion of annual (2009) landings value by species and ICES rectangle. Data
includes landings for UK registered vessels into UK and foreign ports and
foreign vessel landings into UK ports.

7.10 The main commercial target finfish species within the Project One boundary include:
- Plaice Pleuronectes platessa;
- Sole Solea solea;
- Cod Gadus morhua;
- Turbot Psetta maxima;
- Sandeel Ammodytidae; and
- Sprat Sprattus sprattus.

7.11 The main commercial target shellfish species within the Project One boundary include:
- Norway lobster Nephrops norvegicus (referred to as Nephrops);
- Brown crab Cancer pagurus;
- Lobster Homarus gammarus; and
- Scallops Pecten maximus.
7.12 The type of species landed is largely corroborated by VMS data presented in Figure 7-3, with one major exception. The foreign vessels operating across Subzone 1 (and to a lesser extent the cable route corridor) are expected to be landing high volumes of plaice and sole, which are not reflected in Figure 7-2 (due to it not including all landings by all EU Member States). Subzone 1 is likely to be targeted by a combination of Dutch, Belgian, French, German and Danish fleets and therefore the landings data presented under-represent the proportion of plaice and sole, as well as all other species, taken from this area.

7.13 As described previously, VMS allows the presence of vessels using different types of gear in the study area to be identified. VMS is primarily used as an enforcement tool and therefore direct interpretation of effort is difficult to make. Note, for example, that a single vessel can be represented by several data points. VMS data is presented in Figure 7-3 and surveillance data is presented in Figure 7-4.

Figure 7-3  VMS data for vessels ≥15m over a one year period (from 2008-2009) presenting actively fishing vessels by gear type.
Subzone 1

7.14 Subzone 1, the wider Hornsea Zone and surrounding area are fished by a number of different fleets from the UK and other parts of the EU. The sand and gravelly sand substrate provide a suitable habitat for demersal finfish and crustaceans, permitting the use of mobile gears such as beam and bottom otter trawls over much of the area. Muddy substrates are present to the north of Subzone 1 and favour vessels targeting Nephrops and a mixed demersal fishery.

7.15 VMS data show fishing vessels operating throughout Subzone 1, with those categorised as "null" being the most frequently present. These are expected to be non-UK registered beam trawlers (notably Dutch), but also reflect some other gear types such as demersal trawlers. The effort is highest in the western Subzone 1, along the northern edge and at the east of Subzone 1. A patch of demersal seining is recorded within the north eastern corner of Subzone 1 and these vessels are also likely to be targeting plaice and sole.

7.16 Surveillance data presented in Figure 7-4 show a very patchy coverage of demersal trawling and beam trawling vessels within Subzone 1. Both VMS data and surveillance records indicate that the effort of fishing within Subzone 1 are likely to be lower compared to other areas of the Hornsea Zone.

7.17 Demersal trawlers predominately operate immediately adjacent to (but just outside of) the northern edge of Subzone 1. These vessels are likely to be targeting Nephrops, as well as plaice and sole as part of a mixed demersal fishery.

7.18 A large proportion of crabs and lobster form the landings by UK vessels from ICES rectangle 36F1. This is not supported by VMS or surveillance data, but may be due to the offshore vivier fleet or a result of proportional misrepresentation due to lack of EU data (note that the value from 36F1 currently appears to be significantly less than the other ICES rectangles). It is expected that plaice and sole will dominate the catch in this ICES rectangle.

7.19 Industrial fishing (mostly for sandeels) by Danish vessels, predominately occurs on the outer sandbanks, but fishing within Subzone 1 may occur.
7.20 Landings from 36F1 and 36F2 are dominated by sole and plaice (by value), followed by crabs, lobster, turbot and Nephrops (Figure 7-5).

7.21 Landings from 36F1 and 36F2 by UK vessels into all ports and foreign vessels into UK ports have decreased overall from 2005 to 2009 (Figure 7-6). This is largely due to a reduction in the crab and lobster landings across this period. Sole has also steadily decreased from 2005-2008, but 2009 landings have more than doubled since 2008. Plaice landings reduced across 2005-2006, then remained fairly consistent until and increase into 2009. Again, it should be noted that these landings do not represent the total landed from Subzone 1 and full data will be analysed during the EIA process.

Figure 7-5  Value (£’000) landed in 2009 from ICES rectangles 36F1 and 36F2 (which overlap Subzone 1) by UK registered vessels into all ports and non-UK registered vessels into UK ports

Figure 7-6  Annual trend from 2005-2009 for species landed from 36F1 and 36F2 (which overlap Subzone 1) by UK registered vessels into all ports and non-UK registered vessels into UK ports.
Cable route corridor

7.22 Effort within the portion of the cable route corridor that overlaps ICES rectangles 36F1 and 36F2 appears patchy with some beam trawling and demersal trawling recorded. Effort across the western section of 36F2 (which does not overlap with cable corridor) is more consistent with a number of gear types recorded, including demersal trawl, beam trawl and gill netters.

7.23 Closer to shore, within 36F0 and 35F0, a fleet of potters operate targeting crab and lobster. Some demersal seining and scallop dredging is also recorded in 36F0 and gill netting, suction dredging and demersal trawling in 35F0. The western parts of 36F0 and 35F0, at the mouth of the Humber Estuary, are predominately targeted by shrimpers, with some demersal seining and demersal trawling likely to be targeting Nephrops, cod and ray species.

7.24 Landing statistics corroborate that potters have significant effort over this area with crab and lobster accounting for a large majority of the landings (Figure 7-7).

7.25 Landings trends from 2005-2009 by UK vessels into all ports and foreign vessels into UK ports have remained much more consistent (Figure 7-8). Lobster landings increased from 2005-2006 where they have remained fairly consistent with a small increase in 2008 and decrease in 2009.

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**Figure 7-7**  Value (£'000) landed in 2009 from ICES rectangles 35F0, 36E9, 36F0, 36F1 and 36F2 (which overlap the cable route corridor) by UK registered vessels into all ports and non-UK registered vessels into UK ports.
7.26 The French National Committee on Marine Fisheries and Aquaculture (CNPMEM, 2009) have undertaken a preliminary assessment of French fishing vessel activities within Round 3 Zones, based on VMS data analysed by IFREMER. During 2008 a total of 30 French vessels were recorded active within the Hornsea Zone with the majority undertaking demersal and/or pelagic trawling and one purse seiner. All effort is recoded to the east and west extremities of the Hornsea Zone and outside of the Project One boundary (Pers. comms. Lucie Toulhoat, Comité National des Pêches Maritimes et des Elevages Marins, (15th October 2010)).

7.1.1 Data and Information to Inform EIA

Data currently obtained

7.27 The following data have been collated to inform the Scoping phase of Project One:

Landing Statistics

7.28 Landing statistics have been provided by the Marine Management Organisation (MMO, 2010a) for the period 2005-2009. These statistics provide data for the following landings:

- UK registered vessels landing into UK ports;
- UK registered vessels landing into foreign ports; and
- Foreign registered vessels landing into UK ports.

7.29 Landings data include statistics for all vessels (including the <10 m fleet). The Registration of Fish Buyers and Sellers and Designation of Fish Auction Sites Regulations 2005 have had a significant impact on the recording of firsthand sales in the fish trade. Under these regulations buyers and sellers must be registered and therefore all landings are captured in official statistics that provide an accurate representation of the commercial fishing industry.

7.30 Data have not yet been provided for foreign registered vessels fishing within ICES rectangles that overlap Subzone 1 and landing into foreign ports. It is understood that a large proportion of fishing effort within and around Subzone 1 is undertaken by foreign vessels landing into foreign ports. Therefore the data presented in this report does not represent all of the landings from this area (Subzone 1 and the cable route corridor).
These data will be obtained during the EIA process from EU Member States in close collaboration with the National Federation of Fishermen's Organisations (NFFO).

Landings data for all species are collected via the EU logbooks scheme and recorded by ICES statistical rectangle. As a consequence it is not possible to obtain data specifically for individual Project One elements e.g., Subzone 1 or the cable route corridor; instead data are analysed based on the ICES rectangles that overlap Subzone 1 or the cable route corridor. This can on occasion misrepresent actual activity within these areas and care is required when interpreting this data.

Vessel Monitoring System Data

Vessel Monitoring System (VMS) data have been provided by the MMO (2010b). All European commercial fishing vessels over 15 m in length are required to have a VMS on board which reports the vessels position, course and speed every 2 hours to fisheries management authorities. Each data point within the VMS spatial plot therefore represents a single two hourly ‘ping’. The constancy of VMS data makes it the best available summary of the presence of fishing vessels. No data of this kind are available for vessels <15 m in length.

The VMS data therefore does not include the large inshore fishing fleet, which predominately consists of vessels under 15 m in length. VMS data may therefore appear to show these inshore areas as having lower (or no) fishing activity, although significant activity by vessel of >15 m length may be occurring. Consultation will be required throughout the EIA process to determine extent and distribution of activity by the <15 m fleet. The EIA process will consider this, particularly when assessing activity within the cable route corridor.

In order to protect the identity of individual vessels, it has not been possible to obtain VMS data by vessel lengths or vessel nationalities, as this level of detail could potentially allow a large vessel of a certain nationality to be distinguished from the data set.

It is expected that the VMS data provided does include foreign vessels within the area (since their VMS will be picked up by UK fisheries authorities). A large proportion of VMS data across the area records vessel/gear type as “null”. It is expected that this category is the result of gear types being filtered for non-UK registered vessels. Communication with the NFFO indicates that in the main this “null” effort is most likely to be attributed to non-UK beam trawlers. However, lesser activities by other nationalities will also be shown, including trawling by French vessels. VMS data will be sought from EU Member States to corroborate this

Surveillance data

Surveillance data have been provided by the MMO including data recorded from over flight and at sea patrols. These data includes all vessel sizes.

It is recognised that these data represent a less frequent ‘snapshot’ of vessels present in the study area. It should be noted that surveillance data are likely to record vessels using mobile (towed) gear such as trawls more frequently than static gear vessels (pots and gill netters) as these spend more time on the fishing grounds.

Outstanding data requirements

Consultation with the commercial fisheries industry is vital throughout the EIA process. SMart Wind has appointed an Onshore Fisheries Liaison Representative (OFLR) and initial consultation with the OFLR and NFFO has informed this section of the Scoping Report. SMart Wind, together with the NFFO, presented details of the Hornsea development at a North Sea Regional Advisory Council (NSRAC) Demersal Working Group meeting in Brussels in September 2010. Close consultation with the OFLR, NFFO and UK and European fishing industry will continue throughout the EIA process.

Consultation with the UK and European fishing industry will be directed via the OFLR and follow best practise guidance for fisheries liaison produced by Offshore Wind and Wet Renewables Group (FLOWW).

As discussed further data and information will be sourced to inform the EIA process. These will include the following:

- Landing statistics from EU Member States with vessels operating within the Project One boundary, and the wider area and landing to their home country ports including
Netherlands, France, Belgian, Denmark and Germany. Data will be sourced in collaboration with the NFFO;

- Consultation with EU Member States to ascertain whether current VMS data include non-UK registered vessels landing into non-UK ports. Consultation will be undertaken in close collaboration with the NFFO and the Onshore Fisheries Liaison Representative (OFLR);
- Consultation with the North East Sea Fisheries Committee will be undertaken to gain further data and understanding on fishing activities within inshore waters (out to 6 nautical miles);
- Fleet metier profiles for all vessels and gear types in operation within the Project One boundary and the wider area will be generated; and
- Consultation with the fishing industry will be vital throughout the EIA process and will provide essential local knowledge, as well as the opportunity to ground-truth data. This is discussed further below.

7.42 All other relevant published data and site specific studies will be utilised in order to describe the fishing activity occurring within the Project One boundary and inform the EIA process. To explore the fisheries resources of the North Sea as defined in separate stocks by ICES area (as opposed to the just the fishing activity) ICES reports on key commercial species will be reviewed, as will other fish trawl survey reports such as those by CEFAS and previous developers in and around the subject area. Other reports of note that will be used to inform the EIA include:

- A report on the perceptions of the fishing industry into the potential socio-economic impacts of offshore wind energy developments on their work patterns and income (Mackinson et al., 2006);
- Relevant Offshore Strategic Environmental Assessment (SEA) documents;
- Cooperation to Develop Fisheries Information from the North Sea (EC, undated); and
- Options and opportunities for marine fisheries mitigation associated with wind farms (Ichthys Marine, 2009).

7.1.2 Methods to Supporting EIA

7.43 International landing statistics from other EU Member States will be assessed together with data on UK landings. As per guidelines developed for offshore wind farm development by CEFAS (2004), a five year data set will be sourced in order to determine fisheries trends across this period. Data sets will be amalgamated and analysed to determine volume and value of landings from 2005 to 2009 and seasonality within the Project One boundary.

7.44 VMS data will be further analysed to determine annual trends across a five year period and to establish seasonality of effort by gear type. VMS data from EU Member States will be examined to determine the nature of those vessels classified as “null” within the data set already held.

7.45 The methodology developed by Dunstone (2009) as part of a COWRIE study to determine the value of fishing activity by cross referencing VMS data with landings statistics per ICES rectangle will be employed during the assessment. Two modifications will be made to this approach to ensure accuracy, as follows:

- Landings statistics and VMS data from other EU Member States will be amalgamated with UK data; and
- Speeds for determining active fishing will be vessel and gear specific (as presented in Table 7-4).

7.46 VMS data do not distinguish whether a vessel is fishing, steaming or laid stationary (at anchor for example). It is however possible to interpret the data based on speed to determine
whether or not a vessel is likely to be actively fishing. The speed of active fishing is dependent on the type of fishing gear being deployed, for example it is likely that a potter will be stationary when hauling pots, but may be steaming when deploying them, while beam trawlers are likely to be fishing at higher speeds. Care is therefore required when interpreting VMS data. For the purpose of the EIA, the speeds presented in Table 7-4 are assumed to represent a fair range of active fishing speeds per vessel and gear type. The VMS data has therefore been interpreted and sorted on this basis. However, variations in fishing practices may still introduce some minor inaccuracies.

Table 7-4 Range of active fishing speeds per vessel and gear type for purpose of interpreting VMS data (NFFO, Pers. comm.)

<table>
<thead>
<tr>
<th>Vessel / gear type</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam trawlers</td>
<td>3-8 knots</td>
</tr>
<tr>
<td>Demersal trawlers (including fish and Nephrops)</td>
<td>2-6 knots</td>
</tr>
<tr>
<td>Anchor seine &amp; fly shooting (together known as demersal seine)</td>
<td>0-6 knots</td>
</tr>
<tr>
<td>Gill netters</td>
<td>0-3 knots</td>
</tr>
<tr>
<td>Potters</td>
<td>0-3 knots</td>
</tr>
<tr>
<td>Scallop dredger</td>
<td>2-6 knots</td>
</tr>
<tr>
<td>Pelagic trawler</td>
<td>0-9 knots</td>
</tr>
<tr>
<td>Shrimper</td>
<td>0-6 knots</td>
</tr>
<tr>
<td>Suction dredge</td>
<td>0-6 knots</td>
</tr>
<tr>
<td>Null*</td>
<td>0-9 knots</td>
</tr>
</tbody>
</table>

* The gear type deployed by those vessels identified as “null” is unknown, but the majority are expected to be foreign beam trawlers. A precautionary range of 0-9 knots has been taken for VMS filtering purposes.

7.47 The impacts of Project One on the fish and shellfish ecology and therefore fisheries resource, can have an indirect impact on the commercial fisheries interests. These will be informed through the studies and assessment as described in Section 6.3 and will included impacts to nursery and spawning grounds.

7.48 Offshore boat-based surveys being undertaken for marine mammal and bird observation and geophysical surveying within the Hornsea Zone have been issued with a standard log template and when possible will record fishing activity seen during these surveys.

7.49 The need for a specific fisheries survey in the form of observation trips onboard fishing vessels will be identified through the consultation as part of the EIA.

7.1.3 Potential Project Impacts

Construction Phase

7.50 The identified potential impacts on the commercial fishing industry resulting from the construction of Project One are as follows:

- Short term exclusion from established fishing grounds resulting from safety zones placed around construction vessels and plant;
- Exclusion from fishing grounds within Project One may lead to temporary increases in fishing effort in other areas that may already be heavily exploited;
- Noise and vibration from piling and construction vessels and plant may displace fish and shellfish populations from the area and therefore decrease fish numbers within the area; and
- Potential loss of fishing gear as a result of the construction activities associated with Project One.
Operation and Maintenance Phase

7.51 The identified potential impacts on the commercial fishing industry resulting from the operation and maintenance of Project One are as follows:

- The cable infrastructure, turbine foundations and scour protection poses a potential risk to fishing vessels, particularly to mobile vessels that trawl or dredge across the seabed as a result of fishing gear catching or snagging;
- The presence of foundations and ancillary infrastructure (including any applied safety zones) will represent a constraint to fishing activity and may result in the need to adapt fishing within Subzone 1. This may involve a temporary interference to traditional practice while gears are adapted;
- Potential exclusion from established fishing grounds. It is anticipated that fishing activity will not be fully excluded from the wind farm area during the operational phase. Certain gear types would not be feasible within the wind farm area on safety grounds (e.g., drift nets), and it is unlikely that heavy, large trawl gear would be able to be used, including demersal trawl, beam trawl, scallop dredging and demersal seining;
- Exclusion from fishing grounds within Project One may lead to increases in fishing effort in other areas that may already be heavily exploited;
- Potential displacement of, or reduction in, fish and shellfish resource with associated knock-on effect to the fishing industry through noise and vibration from servicing and maintenance vessels and activities and also the potential impacts on elasmobranch species due to electromagnetic fields (EMF) emissions from submarine cables;
- Potential to provide refugia for target species, offshore wind farm infrastructure, such as foundations and scour protection (where used) has the potential to attract fish and fish prey species and provide refugia for certain target species (Hiscock et al., 2002);
- Exclusion of certain types of fishing activity, such as beam trawling and demersal trawling and scallop dredging, may have localised benefits within Subzone 1. Shellfish populations, along with other benthic species, are likely to benefit from this reduced activity (Blyth et al., 2004, Kaiser et al., 2007), with the potential to benefit fishing grounds located adjacent to the site via recruitment from Subzone 1; and
- Increased navigational risk and longer steaming distances.

Decommissioning Phase

7.52 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.

7.1.4 Potential Transboundary Impacts

7.53 Due to the possible constraints that Project One may have on demersal trawling, beam trawling, demersal seining and other gears, fishing effort may be displaced to other fishing grounds including into the Dutch exclusive economic zone (EEZ) and other EU member state fishing fleets may be displaced from the Project One area.

7.1.5 Potential Cumulative Impacts

7.54 Given the proximity of Project One with the Dogger Bank and East Anglia Round 3 Zones, together with the consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms, there is the potential for cumulative impacts to occur, consideration will also be given to the potential knock on impacts of any displaced fisheries, these will be assessed during the EIA process.

7.1.6 Potential In-combination Impacts

7.55 The potential for in-combination impacts associated with Project One and other industry sectors and activities e.g., oil and gas, aggregates and telecommunications infrastructure (in particular cables) on commercial fishing will also be assessed during the EIA process.
7.1.7 Potential Mitigation and Monitoring

7.56 Early and efficient consultation with the commercial fishing sector is vital to the identification and resolution of the issues of displacement or disturbance. Smart Wind has appointed an OFLR who is based within the NFFO. Close cooperation and consultation with the fishing industry via the OFLR throughout the EIA process will be undertaken. Consultation with the industry will be vital to ground truth existing data and establish the true extent of commercial fishing within the Project One boundary.

7.57 Appropriate cable burial (subject to ground conditions) will form the key mitigation measure to reduce the risk of cable snagging and catching by fishing gear. Cables buried within mobile seabed material can become exposed over time due to scouring as a result of high tidal currents. Likewise, cable installed across hard or difficult substrate is unlikely to be adequately buried. Trenching techniques and optimisation of the location of cable route to shore will be paramount to ensure effective cable protection.

7.58 Loss or damage to gear as a result of the construction of Project One can be mitigated against through frequent communication and good management practice.

7.59 Given the safety risk involved in fishing close to wind turbine foundations, it is unlikely that fishing gear will be operated in the close vicinity to these areas, and that any Safety Zone imposed around the installed devices will reduce the risk further. Mitigation will be developed during consultation with local operators to ensure best practice with regard to fishing vessel safety is followed.

7.60 A decommissioning plan will be developed that will be approved by the regulator and will ensure that any hazards to fishing activities are identified and either removed or marked on charts and reported in the relevant fisheries media.

7.61 Mitigation and monitoring will be informed by the recent Ichthys Marine (2009) report on options and opportunities for marine fisheries mitigation associated with offshore wind farms.

7.2 Ports, Shipping and Navigation

7.62 The main shipping routes in the vicinity of the Subzone 1 run parallel to the Holderness coast which is to the west of Subzone 1, or enter the Humber Estuary to use the ports of Hull, Immingham and Grimsby (Figure 7-9). Entry to the Humber is through the IMO routeing Traffic Separation Scheme (TSS). There is also an IMO routeing Traffic Separation Scheme (TSS), approximately 52 km south east of Subzone 1, orientated southwest to northeast.
7.63 DECC (2009c) recommended that at least six port locations distributed around the UK would need to be available for the development of offshore wind farms from 2014 onwards. The Humber is one area that has been targeted for this development (Figure 7-9).

7.64 Automatic Identification System (AIS) shipping data has been and will continue to be collected for the entire Hornsea Zone from tracking equipment installed on the Southern Star, Victor Hensen and Ocean Discovery (bird and marine mammal, geophysical and geotechnical survey vessels respectively) which were operating within the Hornsea Zone during May to August 2010. These data were also supplemented using data available from coastal locations (East Yorkshire) and offshore vessels to provide coverage from shore and across the entire Hornsea Zone.

7.65 AIS is a system by which ships automatically send static, dynamic and voyage related data concerning their position, call sign and destination etc., on two individual Very High Frequency (VHF) channels to the shore and other vessels at very frequent intervals. Regulation 19 of Safety of Life at Sea (SOLAS) Chapter V - Carriage requirements for shipborne navigational systems and equipment - requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size built on or after 1st July 2002.

7.66 The AIS density data for the Hornsea Zone shows that the majority of the area has a medium to high level of shipping based on indicative national ranges for the UK, these data are shown in Figure 7-10, where each line represents an individual vessel track.

Figure 7-10 AIS data (25 May- 6 August 2010, 28 days) by ship type excluding non-routine traffic

7.67 There are areas of high density shipping where routes intersect from the Humber and North eastern UK ports; however the highest density areas occur outside of Subzone 1 (Figure 7-11). AIS density data indicate that approximately 10 vessels per day intersect Subzone 1 and this is regarded as a medium to high density of shipping, i.e., when comparing to wider Hornsea Zone.
7.68 The definition of what constitutes a major shipping lane has been based primarily on traffic volume and the importance of the lane, for example, if it is the only route available when approaching a port or a route through a channel where sea room is not available for the route to deviate without a significant impact. Where such a route is identified then generally the 90% shipping lane has been defined as unsuitable for offshore wind farm development, i.e., the part of the route, either side of the centreline, containing 90% of the traffic. A portion of Subzone 1 lies within the boundary of medium density shipping lane with approximately 2 to 4 ships per day headed mostly between Forth and Tees, and Benelux ports, (presented in Figure 7-12). There is also a narrow shipping lane heading North East/South West between the Humber and Esbjerg.
7.69 Shipping in the region ranges in size from small general cargo vessels to large container ships, bulk carriers and crude oil tankers. Traffic in the vicinity of Subzone 1 is shown in Figure 7-13. Intersecting vessels mainly comprise of medium sized cargo ships, moderate to large tankers and passenger ferries operated by DFDS Seaways on route between Ijmuiden and Newcastle. A number of fishing vessels were also recorded on AIS operating within Subzone 1.
7.70 With regard to recreational sailing, the Royal Yachting Association’s UK Coastal Atlas of Recreational Boating (RYA, 2008) shows that there are no routes or sailing areas intersecting Subzone 1. The closest cruising route relative to Subzone 1 is 13 km to the South west headed between North eastern UK and Holland (Figure 7-14).

![Figure 7-14 Recreational activity relative to Subzone 1](image_url)

7.2.1 Data and Information to Inform EIA

7.71 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- DECC online GIS ([www.maritimedata.co.uk](http://www.maritimedata.co.uk));
- UK Deal (DECC Offshore Oil and Gas / SEA data);
- MMO (Fisheries data);
- SeaZone (UKHO Marine data);
- Automatic Identification System (AIS) data;
- Radar data from the survey vessels operating in the Hornsea Zone;
- Admiralty Charts;
- Local port and harbour authorities;
- Royal Yachting Association;
- Cruising Association;
7.2.2 Methods Supporting EIA

7.72 Navigational safety is of paramount importance when considering the development of a wind farm. Guidance notes published by the Maritime and Coastguard Agency (MCA) (MGN 371); DECC and Trinity House will be taken into account (MCA, 2008).

7.73 The impact of construction, maintenance and decommissioning activity within the Subzone 1, including any exclusion zones and additional vessel traffic operating within and transiting to and from Subzone 1, will be assessed within the EIA process.

7.74 The navigation assessment will assess the potential impacts of Project One on shipping by using AIS and radar data for the area to identify the exact routes of vessels, the types of vessels, and the timings (e.g., whether there are more vessels seen in the area during different times of the year, or how long transit times are and therefore how specific vessels would be affected by the development of Project One). The assessment will also consider non-routine vessels such as fishing vessels and leisure craft, through consultation with the National Fishermen Federation Organisation (NFFO), the Royal Yachting Association (RYA) and the Cruising Association (CA).

Vessel Based AIS and Radar Data

7.75 AIS and radar data will be used to define:

- The distance from any major shipping routes as identified from the AIS data to allow the application of the MCA shipping template;
- The type of traffic using Subzone 1 and surrounding area;
- The non-transit uses of the area e.g., fishing, diving, offshore surveys, exploration drilling and recreation;
- Prescribed routeing schemes or precautionary areas;
- The proximity of Subzone 1 to areas used for anchorage, safe haven, port approaches and pilot boarding or landing areas;
- The proximity of Subzone 1 to offshore firing/bombing ranges and areas used for any maritime military purposes;
- The proximity of Subzone 1 to existing or proposed Offshore Renewable Energy Installations (OREIs), offshore oil/gas platforms, marine aggregate dredging, marine archaeological sites or wrecks, or other exploration/exploitation sites;
- The proximity of Subzone 1 relative to any designated areas for the disposal of dredging spoil;

Q24: With regard to ports, shipping and navigation, should any further data sources be consulted as part of the EIA process?
- The proximity of Subzone 1 to navigation aids and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impacts thereon; and
- An assessment of where existing traffic could be displaced to and whether there is potential for choke points/conflicts to be created.

**Effects on Navigation of Auxiliary OREI Structures**

7.76 The assessment will describe:
- The implication of tidal regimes on shipping in and around Subzone 1;
- Whether current maritime traffic flows and operations in the general area are affected by the depth of water;
- The set and rate of the tidal stream, at any state of the tide;
- Whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream;
- The implication of adverse weather conditions on shipping in and around Subzone 1; and
- Whether in bad weather and/or restricted visibility conditions the turbines within Subzone 1 could present difficulties or dangers to craft including sailing vessels.

**Visual Navigation and Collision Avoidance**

7.77 The assessment will study whether:
- Structures could block or hinder the view of other vessels under way on any route; and
- Structures could block or hinder the view of the coastline.

**Communication, Radar and Positioning Systems**

7.78 The assessment will identify:
- The potential for the structures to produce radar reflections, blind spots, shadow areas or adverse effects;
- The potential for communications to be adversely affected; and
- Whether sound signals could be masked by the structures.

7.79 More detailed discussion of these methods are included in Section 7.4

**Emergency Response**

7.80 The assessment will consider whether there would be potential navigational or communication difficulties caused to any mariners or emergency services using the area.

**Cable Routes**

7.81 The assessment will also consider the potential effect of the Project One cable corridor route on navigation in terms of planned anchoring, emergency anchoring and fishing activities.

7.82 As part of the impact assessment, a Navigational Risk Assessment will be undertaken. This will make certain assumptions as the final details of the project and construction schedule, as these will not be known pre-consent. It will follow the DECC guidance for navigational risk assessments (DTI, 2005a).

**Further Requirements**

7.83 As described above the radar and AIS data collected will cover both tidal and seasonal variations as per the requirements of MGN 371.

7.84 In addition, there will be regular consultation with the Department for Transport, Trinity House, the MCA, Chamber of Shipping and local ports to keep them informed of progress and enable appropriate feedback.
7.2.3 Potential Project Impacts

**Construction Phase**

7.85 The identified potential impacts on shipping and navigation resulting from the construction of Project One are as follows:

- An increased number of vessels within Subzone 1 during the construction phase will influence the rate of vessel-to-vessel encounters and hence the collision risk.

**Operation and Maintenance Phase**

7.86 The identified potential impacts on shipping and navigation resulting from the operation and maintenance of Project One are as follows:

- Collision risk between vessels and structures;
- Potential for the structures to produce radar reflections, blind spots, shadow areas or adverse effects;
- Potential for structures to block or hinder the view of other vessels under way on any route;
- Potential for structures to block or hinder the view of the coastline from vessels;
- The distances travelled by merchant vessels could be affected by Project One requiring vessels to travel greater distances;
- The cable route may impact on merchant ships dragging anchor or emergency anchoring in the vicinity of the cable(s);
- Potential compass deviation effects of the magnetic fields generated by the cables;
- It is considered unlikely that there will be any significant recreational activities within Subzone 1 due the distance offshore; and
- Potential for fishing activity to be displaced to outside of Subzone 1 during operation, this will influence the rate of vessel-to-vessel encounters and hence the collision risk.

**Decommissioning Phase**

7.87 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.

7.2.4 Potential Transboundary Impacts

7.88 The traffic passing through Subzone 1 is mainly trading between UK east coast ports, such as Teesport and Immingham and European ports (such as Esbjerg, Rotterdam and Amsterdam). Offshore support vessels also pass through Subzone 1 to nearby oil and gas platforms including LOGGS, Murdoch, Mimas, Trent and Tyne. Therefore there is the potential for transboundary impacts relating to merchant shipping.

7.2.5 Potential Cumulative Impacts

7.89 There is the potential for cumulative impacts between Project One, the Dogger Bank and East Anglia Round 3 Zones and the consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms, these will be assessed within the EIA process and presented within the ES.

7.2.6 Potential In-combination Impacts

7.90 In-combination impacts will be assessed, potential in-combination impacts between Project One and other activities / industries exist, specifically future oil and gas exploration.

7.2.7 Potential Mitigation and Monitoring

7.91 There are a range of measures that can be applied to mitigate the potential impacts of Project One such as through layout design. MGN 371 lists the following potential measures that could be applied to a particular development, as appropriate to the level and type of risk determined during the EIA:
Distribution of information and warnings through notices to mariners and other appropriate media;
Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC);
Safety zones of appropriate configuration, extent and application to specified vessels;
Designation of the site as an Area To Be Avoided (ATBA);
Implementation of routeing measures within or near to the development;
Monitoring by radar, AIS and / or closed circuit television (CCTV) or other agreed means;
Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs;
Any other measures and procedures considered appropriate in consultation with stakeholders (including the MCA); and
Creation of an Emergency Response Co-operation plan with the relevant Maritime Rescue Co-ordination Centre from construction phase onwards.

7.92 Other mandatory control measures and/or standard industry practice include:
Marking and lighting the site in accordance with General Lighthouse Authority requirements (which will include a system of routine inspection and maintenance of lights and marks);
MCA standards and procedures for wind turbine generator shut-down in the event of a search and rescue, counter pollution or salvage incident in or around a wind farm;
Turbine rotor blade tip clearance at a minimum 22 m above Mean High Water Springs; and
Vessel nominated as guard vessel during construction /decommissioning activities.

7.93 Mitigation for Project One will be identified during the Marine Navigation Risk Assessment and may include, in addition to the points listed above, measures such as an IMO adopted traffic routing system.

7.94 Due to the importance of the region for shipping there is significant navigational infrastructure present within the Study Area including shipping channels, anchorage areas, buoys, precautionary areas and pilot boarding areas. Where possible and practicable, cable routes will be designed to avoid navigational infrastructure.

7.3 Civil Aviation and Military Activities

Civil Aviation

7.95 Project One is located within the area covered by Anglia Radar for the provision of Air Traffic Services. Anglia Radar controllers are located at Aberdeen Airport and they use the data from the National Air Traffic Services (NATS) En-Route Ltd (NERL) En-Route Radar at Claxby. Anglia Radar’s area of authority is from the Surface to FL65 (6,500 ft) as detailed in NATS (2010a). This also indicates that beneath the Southern Managed Danger Area (MDA) (Danger Areas D323B and D323C) helicopters are restricted to FL40 (4,000 ft) unless clearance to fly above this level is given by Anglia Radar. Helicopters are also height banded so that those outbound to North Sea infrastructure fly at 2000 ft or 3000 ft, whilst those inbound fly at 1500 ft or 2500 ft. This allows for 500 ft vertical deconfliction between flights in opposite directions.

7.96 There are aerodromes and air traffic control zones located onshore from Subzone 1 and the cable route corridor. Aerodromes are safeguarded against inappropriate developments in their vicinity, as outlined in CAA (2006), Chapter 1, and CAA (2010a), Chapter 3, where proposed wind farms should be notified to the Defence Geographic Centre (DGC).

7.97 CAA (2010b), Chapter 4, Figure 4.11 illustrates a protected surface (the outer horizontal surface) with a 15,000 m radius extending at a height of 150 m outwards from the Aerodrome Reference Point (ARP). Wind farms that are situated under the protected surfaces of an aerodrome may raise objections based on the potential for physical obstruction to aircraft and instrument approach procedures and interference with Communications, Navigation and
Surveillance (CNS) infrastructure, as discussed in Section 7.4. Subzone 1, being more than 15,000 m from any airfield does not have the potential to penetrate any aerodrome protected surface.

7.98 CAA (2010b), Chapter 5, provides generic criteria for safeguarding distances. Safeguarding distances are limited to the vicinity of the aerodrome, which can be a 3, 4, 5, 17 or 30 km radius depending upon the aerodrome status (licensed or unlicensed), equipment (radar or non-radar) and instrument approach procedures.

7.99 Airfields or Air Navigation Service Providers (ANSP) with radar line of sight to wind farm developments beyond the 30 km radius are also classified as stakeholders for consultation.

7.100 CAA (2010a) mandates a 24 km radius for protection of Secondary Surveillance Radar (SSR). This differs from the advice in ICAO (2009) which recommends a radius of 15 km. The Hornsea Zone, Subzone 1, and the cable route corridor fall outside of these safeguarding ranges.

7.101 Propagation modelling (assuming a turbine height of 190 m) predicts that both the Claxby En-Route civil Primary Surveillance Radar (PSR) and the Humberside International Airport (HIA) terminal radar will have line of sight to the western portion of the Hornsea Zone. Neither radars’ coverage is predicted to extend to the boundaries of Subzone 1. The cable laying vessel or other cable laying associated activities are not considered to have potential to cause an impact on any radar system.

7.102 The Claxby PSR is used by NERL to provide an en-route service to aircraft. The upper airways (which exist at FL195 (19,500 ft) and above) that cross the Hornsea Zone as detailed in NATS (2010b) are UL975, UN97, UM982, UM981 and UM79. The upper airways which are located above the cable route corridor are: UL975, UM79, UL602, UL46 and UL90. The turbines within Subzone 1 and cable laying vessel(s) or other cable laying associated activities are not considered to have potential to cause an impact on the Upper Airways.

7.103 There are no low level airways which exist at FL195 (19,500 ft) and below crossing Subzone 1 as detailed in NATS (2010c).

7.104 The HIA terminal radar supports the provision of air traffic services to arriving and departing aircraft which includes helicopters from offshore infrastructure.

7.105 Control zones and control areas are present around both civil and military aerodromes and provide protected airspace for the various instrument approach procedures. The location of the Hornsea Zone and that of Subzone 1 are not impacted by such constraints due to their distance from shore.

7.106 Helicopters serve oil and gas platforms, rigs, accommodation blocks as well as and Floating Production, Storage and Offloading vessels (FPSO’s).

7.107 The CAA Helicopter Main Routes (HMR) is defined in NATS (2010a). HMR2 crosses the eastern half of Subzone 1 (See Figure 7-15). It is used predominantly for transit from both Norwich International Airport and the Great Yarmouth (North Denes) Heliport to offshore installations. Helicopter operators include Bristow, CHC Scotia, Bond and NHV Helicopters. There is no direct HMR link between Humberside Airport and the platforms/rigsFPSO’s in the eastern area. A large number of the offshore installations are located outside of direct HMR routing and therefore it is likely that there will be “off route” Helicopter traffic flying across the Subzone 1.

7.108 A large number of turbines beneath an HMR could force aircraft to fly higher in order to maintain a safe vertical separation from wind turbines. This may not be possible when flying through low cloud on days when the zero degree isotherm (icing level) is below 2,000 ft as defined in CAA (2010a), Chapter 3, Page 5, Para. 8).

7.109 CAA (2010a), Chapter 3, Section 8, states that “From a regulatory perspective, the area 2 Nm either side of a HMR should be obstacle free, providing one side of the route was obstacle free, some wind turbine development within 2 Nm could be manageable. The 2 Nm distance is based upon operational experience, the accuracy of navigation systems and, importantly, practicality. Such a distance (2 Nm) would provide time and space for helicopter pilots to descend safely to an operating height below the icing level”. There may therefore be opportunity to reduce the width of HMR2, 8, 9 and 10 through consultation with the Directorate of Airspace Policy (DAP).
7.110 Each offshore installation with a helipad is surrounded by a 2 Nm radius HTZ (Helicopter Traffic Zone). CAA (2010a), Chapter 3, Page 4, Section 7 details the need to maintain a 6 Nm radius around offshore surface infrastructure to allow for helicopters’ self controlled and missed approaches from all directions. Wind turbines within this 6 Nm area could impair the ability to conduct safe operations. The HMR’s, with corresponding 2 Nm safety margins, and 6 Nm approach radii for the offshore infrastructure are illustrated at Figure 7-15. A small area in the north of Subzone 1 is infringed by the 6 Nm approach radius for the Schooner helipad as described.

7.111 Helicopter based Search and Rescue (SAR) operations are operated by HM Coastguard, Ministry of Defence (MOD), and the USAF (United States Air Force). Onshore from Subzone 1, Royal Air Force (RAF) Sea King helicopters operate from RAF Boulmer and RAF Leconfield, with an operating range of approximately 250 Nm (Figure 7-15). US helicopters may operate in a SAR capacity from RAF Mildenhall when requested by the UK Rescue Coordination Centre at RAF Kinloss. SAR operations are unplanned events and thus can occur anywhere over land or sea. Wind turbines can cause obstruction to nearby SAR activities and may increase the hazards to operations within the area of wind farms. CAA (2010a), Chapter 2, Page 6, Section 9 highlights the potential for turbulence generated by the turbines affecting aircraft/helicopter operations in the vicinity of the turbines. Consultation is ongoing with the Maritime Coastguard Agency (MCA) with regard to conspicuity markings on wind turbine blades to assist helicopters in SAR scenarios.

7.112 The MOD uses all uncontrolled UK airspace and waters for Air Force, Navy and Army training.

7.113 Subzone 1 is located beneath a PEXA (Practice and Exercise Area). A PEXA is a designated offshore area which can be used by the Army, Air Force or Navy for firing practice and exercises. PEXA’s of relevance are D323B and D323C, which respectively cover the Hornsea Zone to the North West and the South East. Subzone 1 lies beneath D323C. All PEXA’s surrounding Project One are presented in Figure 7-16 and tabulated in Table 7-4.

7.114 Within D323B and D323C, air combat training, high energy manoeuvres and supersonic flight can be expected between altitudes of FL50 (5,000 ft) and FL660 (66,000 ft). Control of this...
area is managed by the Air Defence Operations Centre at RAF Boulmer. Typical aircraft that can be expected to use these areas are Typhoon, Tornado, Harrier, Tanker aircraft or Airborne Warning and Control System (AWACS) Sentry Aircraft. New aircraft joining the RAF inventory would also be expected to utilise these areas.

7.115 With respect to Project One, PEXA D323C does not represent a significant risk to turbine siting, cable routing and landfall decisions, though subsurface and surface exercises may need to be considered during turbine and cable laying installation and operations.

7.116 All operational Military airfields are inland and a considerable distance from Subzone 1. Propagation modelling (assuming 190 m turbines) predicts that none of the military airfields equipped with either PSR or Precision Approach Radar (PAR) have radar line of sight to Subzone 1. The closest RAF Flying Station, RAF Leconfield, is a SAR Helicopter Station and is not equipped with radar.

7.117 As illustrated in NATS (2010d), The London Military Air Traffic Control Centre, based at Swanwick, provides a Middle Airspace Radar Service over the whole area. When the MDA’s are not operational, this service is used by civil aircraft wishing to route directly from the UK Flight Information Region (FIR) boundary at Airways Reporting Point BODSO to Humberside, Durham Tees Valley or Newcastle Airport as detailed in NATS (2010c). London Military use the NERL Claxby PSR to provide this service.

7.118 There is a regular military low flying area that is directly adjacent to Low Flying Area (LFA) 11. It runs south from Flamborough Head to the Wash area. LFA 11 could be considered to include the offshore low flying area indicated at Figure 7-16. LFA 11 is used regularly by aircraft based elsewhere transiting to and from the RAF Air Weapons Ranges on the Wash, and training areas in LFA 5. The whole of LFA 11 allows military fixed wing aircraft to fly as low as 250 ft Minimum Separation Distance (MSD) from obstacles. LFA 11 is not designated as a tactical training area. As a result of this, with the exception of helicopters no aircraft is permitted to fly below 250 ft (MSD).

7.119 Depending on the height of the equipment on the cable laying vessel(s), there may be potential for the vessel to be considered to be a moving physical obstruction. As long as the vessel(s) is displaying the appropriate maritime light signals for the task, it is considered unlikely that it will create an aviation hazard.

7.120 Project One is not considered to have the ability to impact on the two submarine exercise areas to the north-east and north-west.

7.121 The Project One cable route corridor will need to consider the proximity to Cowden (Demolition Range, D306) and Donna Nook (Live firing and bombing, D307). These should be considered because explosive materials and ordnance have the potential to damage vessels, personnel and infrastructure.

7.122 Military radar issues are discussed in Section 7.4.
### Table 7-5 MOD Practice and Exercise Areas occurring in the vicinity of Project One


<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Name</th>
<th>Type</th>
<th>Practice</th>
<th>Altitude Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>D207</td>
<td>Holbeach</td>
<td>RAF Danger</td>
<td>Air to Surface Firing, Bombing</td>
<td>SFC – 23. (0 to 23,000 ft)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area</td>
<td>Demolition of Unexploded Ordnance</td>
<td>SFC – 5. (0 to 5,000 ft)</td>
</tr>
<tr>
<td>D306</td>
<td>Cowden</td>
<td>RAF Danger</td>
<td>Demolition of Unexploded Ordnance</td>
<td>SFC – 5. (0 to 5,000 ft)</td>
</tr>
<tr>
<td>D307</td>
<td>Donna Nook</td>
<td>RAF Danger</td>
<td>Air to Surface Firing, Bombing, Firing</td>
<td>SFC – 20 &amp; 23. (0 to 20,000 ft &amp; 23,000 ft)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area</td>
<td>Demolition of Unexploded Ordnance</td>
<td>SFC – 5. (0 to 5,000 ft)</td>
</tr>
<tr>
<td>D308</td>
<td>Wainfleet</td>
<td>RAF Danger</td>
<td>Air to Surface Firing, Bombing, Firing</td>
<td>SFC – 23. (0 to 23,000 ft)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Area</td>
<td>Demolition of Unexploded Ordnance</td>
<td>SFC – 5. (0 to 5,000 ft)</td>
</tr>
<tr>
<td>D323A</td>
<td>Southern MDA</td>
<td>RAF Danger</td>
<td>Air Combat Training, High Energy Manoeuvres</td>
<td>5 – 66. (5,000 to 66,000 ft)</td>
</tr>
<tr>
<td>D323B</td>
<td>Southern MDA</td>
<td>RAF Danger</td>
<td>Air Combat Training, High Energy Manoeuvres</td>
<td>5 – 66. (5,000 to 66,000 ft)</td>
</tr>
<tr>
<td>D323C</td>
<td>Southern MDA</td>
<td>RAF Danger</td>
<td>Air Combat Training, High Energy Manoeuvres</td>
<td>5 – 66. (5,000 to 66,000 ft)</td>
</tr>
<tr>
<td>D323D</td>
<td>Southern MDA</td>
<td>RAF Danger</td>
<td>Air Combat Training, High Energy Manoeuvres</td>
<td>25 – 66. (5,000 to 66,000 ft)</td>
</tr>
<tr>
<td>D323E</td>
<td>Southern MDA</td>
<td>RAF Danger</td>
<td>Air Combat Training, High Energy Manoeuvres</td>
<td>25 – 66. (5,000 to 66,000 ft)</td>
</tr>
</tbody>
</table>
### Table 7.3.1 Data and Information to Inform EIA

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Name</th>
<th>Type</th>
<th>Practice</th>
<th>Altitude Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>D323F</td>
<td>Southern MDA Danger Area</td>
<td>RAF Danger Area</td>
<td>Air Combat Training, High Energy Manoeuvres</td>
<td>25 – 66. (5,000 to 66,000 ft)</td>
</tr>
<tr>
<td>D412</td>
<td>Staxton Danger Area</td>
<td>RAF Danger Area</td>
<td>Air to Air Firing SFC</td>
<td>SFC – 10. (0 to 10,000 ft)</td>
</tr>
<tr>
<td></td>
<td>Flamborough Head Submarine Exercise Area (large)</td>
<td>Navy Submarine</td>
<td>Surface and sub-surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flamborough Head Submarine Exercise Area (small)</td>
<td>Navy Submarine</td>
<td>Surface and sub-surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outer Silver Pit Submarine Exercise Area</td>
<td>Navy Submarine</td>
<td>Surface and sub-surface</td>
<td></td>
</tr>
<tr>
<td>X5309</td>
<td>Rowleston Small Arms Firing Range</td>
<td>Army Surface</td>
<td>Small Arms Firing Range SFC</td>
<td>SFC – 0.5 (Surface to 500 ft)</td>
</tr>
</tbody>
</table>

#### 7.3.1 Data and Information to Inform EIA

7.123 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- The CAA and NATS UK Integrated Aeronautical Information Publication (AIP) (CAA and NATS, 2010) and relevant CAA CAP’s, including:
  - CAP 764 CAA Policy and Guidelines on Wind Turbines (CAA, 2010a);
  - CAP 413 Radio Telephony Manual;
  - CAP 452 Aeronautical Radio Station Operators Guide;
  - CAP 437 Offshore Helicopter Landing Areas Guidance and Standards;
  - CAP 670 Air Traffic Services Safety Requirements (CAA, 2010d);
  - CAP 738 Safeguarding of Aerodromes;
  - CAP 428 Safety Standards At Unlicenced Aerodromes (Including Helicopter Landing Sites);
  - CAP 168 Licensing Of Aerodromes;
  - Lower Airspace charts South;
  - Lower Airspace charts North;
  - Upper Airspace charts South; and
  - Upper Airspace charts North.
- UK Hydrographic Office (UKHO) PEXA charts Q6401 and Q6405, as amended by Notice to Mariners 0455/2010, 4915/2006 and 5194/2005;
- NATS En-Route Ltd (NERL) ‘Self Assessment’ Primary Surveillance Radar interference zones, and consultation zones for Secondary Surveillance Radar sites, navigation aids and Air-Ground-Air (AGA) communication stations;
- General enquiries will be made to CAA, NATS and MOD, DAP, and Helicopter operators.

**Q25:** With regard to civil aviation and military activities, should any further data sources be consulted as part of the EIA process?

### 7.3.2 Method Supporting EIA

7.124 Using appropriate data sources as listed above, the following steps will be taken:
- Conduct / review radio propagation analysis to determine radars which may be affected;
- Identify radar / non-radar stakeholders;
- Determine the types of radar used and the Controllers’ situation display characteristics;
- Identify the potential radar performance impacts;
- Identify the potential operational impacts;
- Identify the potential impact on Navigational Aids;
- Through consultation with the identified stakeholders, determine the potential for Project One to impact upon their operations; and
- Potential mitigation options will be discussed with stakeholders if appropriate.

### 7.3.3 Potential Project Impacts

#### Construction Phase

7.125 Depending on the height of the equipment on the various installation vessel(s), there may be potential for the vessel(s) to be considered to be a moving physical obstruction. As long as the vessel(s) is displaying the appropriate maritime light signals for the task, it is considered unlikely that it will create an aviation hazard.

#### Operation and Maintenance Phase

7.126 The identified potential impacts on civil aviation and military activities resulting from the operation and maintenance of Project One are as follows:
- Physical obstruction to aircraft; and
- Wake turbulence on aircraft.

7.127 It will be necessary to consult with the relevant stakeholders to determine the potential for Project One to impact on their operations. Stakeholders to be consulted will include: Defence Estates (MOD), NATS, NERL & Helicopter operators.

#### Decommissioning Phase

7.128 Impacts on civil aviation and military activities during the decommissioning phase of Project One are anticipated to be similar to those identified during the construction phase.
7.3.4 Transboundary Impacts

7.129 There are no anticipated transboundary impacts.

7.3.5 Cumulative Impacts

7.130 Project One along with the presence of existing wind farms (from Round 1, Round 2 and Round 2.5) as well as future planned wind farms in the wider North Sea (i.e., Dogger Bank and East Anglia Round 3 Zones) could have a significant cumulative impact for civil aviation and military activities, particularly with regard to the helicopter routes and operations.

7.3.6 In-combination Impacts

7.131 Except for the potential of Project One impact on HMR2, it is not considered likely that there will be other significant in-combination impacts with regard to Military and Civil aviation.

7.3.7 Potential Mitigation and Monitoring

7.132 Any object greater than 150 m in height is classified as “En-Route Obstructions” in CAA (2010c), Article 219, and also in CAA (2010b), Chapter. 4 Page 21 Para. 12.1.3). Such obstacles are required to have aviation obstruction lighting installed as specified in CAA (2010a), Chapter 3, Page 3, Para. 6). Since the proposed turbines are likely to be over 150 m in height, this would be applicable.

7.133 Potential mitigation might be:

- In consultation with DAP the establishment of temporary aviation exclusion zones; and
- In-fill radar to mitigate radar interference

7.134 The requirements for potential mitigation and monitoring will be determined during the consultation stage with the Stakeholders.

7.4 Radar and Communications

7.135 Military and civil aviation rely on CNS infrastructure to support airspace and air traffic management. Military CNS has a crucial role in providing air defence surveillance for UK and the North Atlantic Treaty Organization (NATO). Subsea telecommunication cables are discussed in Section 7.256. Radar interference associated with shipping is discussed in Section 7.2.

Civil Radar

7.136 Civil airspace and air traffic surveillance and management infrastructure is comprised of the following systems which may be affected by wind farms:

- Primary Surveillance Radar (PSR);
- Secondary Surveillance Radar (SSR); and
- Aeronautical Navigation Aids (Navaids).

7.137 NERL (2010) provide ‘self assessment’ maps to enable interested parties to determine the potential for interference between turbines and NERL radar systems. These maps show that Subzone 1 is not located within range of any NERL air traffic control radar (terminal or en-route) or civil navigational aid. This is shown at Figure 7-17. While this is only indicative, it suggests that the impact on NERL radar systems is likely to be minimal or non-existent. NERL advises that consultation is required before this can be confirmed.

7.138 Propagation modelling (assuming 190 m turbines) predicts that:

- The Claxby En-Route civil Primary Surveillance Radar (PSR) is predicted to have visibility over a portion of the West of the Hornsea Zone, but not over Subzone 1. Claxby is used by NERL, NATS Aberdeen and ‘London Military’ to provide an en-route service to aircraft; and
- The Humberside International Airport (HIA) terminal radar is predicted to have visibility over a very small portion of the South West of the Hornsea Zone, but not over Subzone 1. The HIA terminal radar supports the provision of air traffic services to arriving and departing aircraft which includes helicopters from offshore infrastructure.
At approximately 35 km from shore, the western boundary of the Hornsea Zone, and therefore the location of Subzone 1 are beyond the 24 km critical range for SSR interference as stated in CAA (2010a), Chapter 5.

A wide range of systems, including Navigation Aids (Navaids) such as Instrument Landing Systems (ILS) and VHF (Very High Frequency) Omni-Directional Radio-Range/Distance-Measuring Equipment (VOR/DME), together with air-ground communications facilities, could potentially be affected by wind farm developments. However, CAA (2010d), GEN02, Technical Safeguarding of Radio Sites; Guidance Material, states that “there is sufficient empirical evidence to suggest that existing safeguarding arrangements in respect of navigation and landing aids and communication facilities provide adequate protection”.

Navaid consultation zones are not predicted to impact on Subzone 1 due to its distance from shore.

**Military Air Traffic Management**

Propagation modelling (assuming 190 m turbine height) predicts that the Hornsea Zone and therefore Subzone 1 is beyond radar line of sight of any Military Air Traffic Control Radars or Military landing aids.

**Air Defence Radars**

Military Air Defence systems are typically more complex than civil CNS systems. The MOD has a role to provide unimpeded airspace surveillance and early warning of air attack and intrusion into UK airspace. The MOD assesses the impacts of wind farms on their CNS on a case-by-case basis and therefore consultation with Defence Estates will be undertaken as part of the EIA process.

Propagation modelling (assuming 190 m turbines) predicts that the Air Defence Radar at RAF Staxton Wold (North Yorkshire, approximately 150 km west of the centre of Subzone 1) will have visibility of parts of the west of the Hornsea Zone, but not of Subzone 1 (Figure 7-18).
7.145 The Met Office is part of the MOD. The weather radar network currently consists of 16 sites. The Met Office may raise an objection for any development within 20 km of any affected weather radar. The Hornsea Zone and therefore Subzone 1 are outside of this range.

7.146 Turbines will not impact meteorological radar provided that (i) They are below the existing horizon (ii) They are not within the beam (i.e. not within radar line of sight). The meteorological radars have an operational range of up to 255 km and therefore direct line of sight to either of the radars may cause interference.

7.147 The Met Office submitted an invitation to tender for a Weather Radar Network Renewal process in June 2010 in order to increase data resolution (Met Office, 2010). Any technical improvements resulting from this will be considered during the EIA process.

7.148 Defence Estates should be consulted to determine the potential impact from Project One with regard to Met Office radar safeguarding.
Communications

7.149 Other maritime communications devices (that are not discussed elsewhere in this Scoping Report) include cellular telephones, satellite communications, Very High Frequency (VHF) radio, television, and fixed links between the shore and the offshore infrastructure in the vicinity of Project One.

7.150 There have been numerous trials and studies conducted which consider the potential impact of wind farms on communications devices. These will be considered as part of the ZEA and for each project within their EIAs.

7.151 Navaids, such as radio beacons, Automatic Identification System (AIS), Global Positioning System (GPS) and SAR specific aids are discussed in Section 7.3.

7.4.1 Data and Information to Inform EIA

7.152 An initial desk based review of literature and data sources to support the consultation phase of Project One has highlighted the following sources:

- Television transmitter locations, which can be determined by using the following link (OFCOM, 2009a):
  - http://stakeholders.ofcom.org.uk/broadcasting/guidance/tech-guidance/transmaps/

- The BBC wind farm assessment tool which provides guidance as to the potential impact of wind farms on TV reception can be found here (BBC, 2010):
  - http://www.bbc.co.uk/reception/info/windfarm_tool.shtml

- RF Measurement Assessment of Potential Wind Farm Interference to Fixed Links and Scanning Telemetry Devices, ERA Technology, March 2009 (OFCOM, 2009b);

- NATS En-Route Ltd (NERL) ‘Self Assessment’ Primary Surveillance Radar interference zones, and consultation zones for Secondary Surveillance Radar sites, navigation aids and Air-Ground-Air (AGA) communication stations (NERL, 2010); These can be found here:

Figure 7-19 RAF sites, meteorological sites and NERL radar interference areas
- The CAA and NATS UK Integrated Aeronautical Information Publication (AIP) (CAA and NATS, 2010) and relevant CAA Civil Aviation Publications (CAP’s), including:
  - CAP 764 CAA Policy and Guidelines on Wind Turbines (CAA, 2010a);
  - CAP 413 Radio Telephony Manual;
  - CAP 452 Aeronautical Radio Station Operators Guide;
  - CAP 437 Offshore Helicopter Landing Areas Guidance and Standards;
  - CAP 670 Air Traffic Services Safety Requirements (CAA, 2010d);
  - CAP 738 Safeguarding of Aerodromes;
  - CAP 428 Safety Standards At Unlicensed Aerodromes (Including Helicopter Landing Sites);
  - CAP 168 Licensing Of Aerodromes;
  - RTF Frequency Allocations for mobile installations in the UK Areas under concession; and
  - NDB Frequency Allocations for mobile installations in the UK Areas under concession
- Data for fixed links will be identified through consultation with OFCOM as well as the relevant gas companies/operators in the vicinity of Project One;

7.4.2 Methods Supporting EIA

7.153 Using appropriate data sources as listed above, the following steps will be taken:

- Civil Air Traffic Control (ATC) radar, Military Air Defence radar and Meteorological radar:
  - Conduct/Review radio propagation analysis to determine radars which may be affected;
  - Identify radar stakeholders;

Q26: With regard to radar and communications, should any further data sources be consulted as part of the EIA process?
determine the types of radar used and the controllers’ situation display characteristics;
  o identify the potential radar performance impact; and
  o through consultation with the identified stakeholders, determine the potential for project one to impact upon their operations.

- communications:
  o identify relevant communications stakeholders through established mechanisms;
  o where published, use the appropriate assessment method or trials reports for each communication type to identify the potential technical impact; and
  o through consultation with the identified stakeholders, determine the potential for project one to impact upon their operations.

7.4.3 Potential Project Impacts

Construction Phase

7.154 There are no anticipated impacts on radar and communications resulting from the construction phase of project one.

Operation and Maintenance Phase

7.155 The identified potential impacts on radar and communications resulting from the operation and maintenance of project one are as follows:

- PSR interference;
- SSR interference;
- VHF communications interference;
- Satellite communications interference; and
- Fixed terrestrial link interference.

7.156 It will be necessary to use appropriate assessment methods and consultation with the identified stakeholders to determine the potential for project one to impact upon their operations.

7.157 Stakeholders to be consulted will include: Defence Estates (MOD), NATS, NERL and Helicopter operators, OFCOM, BBC, Arqiva, JRC and Atkins.

Decommissioning Phase

7.158 There are no anticipated impacts on radar and communications during the decommissioning phase of project one.

7.4.4 Potential Transboundary Impacts

7.159 There are no anticipated transboundary impacts.

7.4.5 Potential Cumulative Impacts

7.160 Given the proximity of project one with the Dogger Bank and East Anglia Round 3 Zones, together with the consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms, there is the potential for cumulative impacts on radar and communications to occur, these will be assessed during the EIA process.

7.4.6 Potential In-combination Impacts

7.161 From a Radar, Aviation and Communications perspective, there is considered to be some potential for in-combination effects resulting from other activities and industries, including the oil and gas industry. Further information and analysis to be gathered during the EIA process will determine the magnitude of impact.
7.4.7 Potential Mitigation and Monitoring

7.162 There are a number of mitigation techniques which can reduce or remove the impact of wind farm interference on Air Defence radar. Such discussions will be conducted using appropriate evidence and analysis, through Defence Estates.

7.163 The requirements for potential mitigation and monitoring will be determined during the consultation stage with the stakeholders.

7.5 Ordnance

7.164 There is the potential for unexploded ordnance (UXO) to be present within the Project One boundary, due to the level of activity in this part of the North Sea during both World Wars. It is possible that there are mines (as part of the East Coast Mine Barrage) in the western half of the Project One boundary which is located within a British Declared Area. Site specific survey results will be required to determine the exact location of any UXO. In addition to mines, there is the potential for torpedoes, high explosive bombs and other munitions.

7.165 The Project One boundary is out of range of coastal batteries, however projectiles fired from naval vessels may be encountered but not in any great numbers. The cable route corridor linking Subzone 1 to the mainland has the potential to pass through areas historically utilised for armaments training. Consequently, it is likely that related munitions will be present within the cable route corridor. It is also likely that many such munitions may have migrated in and out of this area given the strong currents.

7.166 Several potential sources of explosive ordnance contamination have been identified in this east coast offshore region including British and German sea mines, unexploded air-delivered bombs and anti-aircraft projectiles, historic Naval firing ranges (in the potential cable route area), ship wrecks, torpedoes and depth charges, and ammunition dumping grounds.

7.167 The North Sea is known to have been mined during both WWI and WWII by the UK and Germany, and it is likely that unrecorded German mine laying activities also took place, delivered either by air, submarines or E-Boats. Mines are still encountered by dredgers and fishermen around the British coastline (BACTEC, 2010). Defensive minefields were typically deployed around UK coastal waters by British forces with the East Coast Mine Barrage of 1939 comprising up to 100,000 mines along the entire eastern coast of the UK. Twelve of the constituent mine alleys of this Barrage were found to be within the Project One boundary and the wider Hornsea Zone, comprising an estimated 2-3,000 mines across the entire area.

7.168 Secondary sources also detail extensive German mining of the Humber estuary and deeper waters from 1939 and a wreck recorded within the Zone is detailed to have been sunk by a mine in March 1941. The magnitude of mine laying off the east coast is further supported by the find of 200 loose enemy mines washed up on south Yorkshire beaches, attributed to the autumn gales of 1939 ripping them from their moorings and also the mine related sinking of eleven recorded vessels.

7.169 Establishing the locations of all mines at a research stage is not wholly possible since offensively laid mines, in particular, were not generally laid in declared barrages and sometimes singly or in very small numbers. Therefore it has not been possible to accurately determine numbers and types of mines within the Project One boundary.

7.170 While some air delivered bombing of east coast cities took place during WWI the threat from air delivered bombs of this period is low. However during WWII bombing raids were carried out on towns, cities, infrastructure, and key military installations, including RAF airfields and Royal Navy bases. Aerial attacks on shipping (both naval and armed merchant) were also carried out in the North Sea with high concentrations of attacks in the Humber estuary and coastal areas by both the German and Allied air forces. A proportion of the bombs would have failed to function as designed (the typical failure rate was 10%) and may be encountered on the seabed within the Project One boundary. However, the total quantity of weapons dropped within the Project One boundary would not have been high.

7.171 Unexploded high explosive bombs are occasionally encountered at sea off the UK coastline and if present within the Zone, could pose a significant threat to works. A recent example is a 500 kg high explosive bomb which washed up on a beach at Felixstowe and another bomb which washed up on Humber coastline (BACTEC, 2010)).
7.172 Records also indicate that if a Luftwaffe pilot did not find his intended target or came under fighter or Anti-Aircraft Artillery (AAA) attack, he would often drop his bomb load before returning to base – an occurrence known as a ‘tip and run’. The area of the North Sea, within which Project One is located, was in close proximity to the flight paths for bombers aiming for industrial targets further to the west such as Hull, Manchester and Liverpool and it is possible that the Project One area could have been at risk from such ‘tip and run’ incidents.

7.173 No naval firing range areas are in close proximity to Subzone 1 however six overlapping firing areas were located in the Humber estuary and may impact on the cable route corridor. Unexploded munitions from these ranges which come to rest on the seabed can migrate significant distances due to currents, tides and fishing activities. As a consequence, it is conceivable that items of ordnance from these ranges and Naval training activities may have moved offshore into Subzone 1.

7.174 Many vessels (both Military and Merchant Navy/civilian) were sunk during WWI and WWII, predominantly as a result of U-boat activity and offensive/defensive mining. Many of these vessels, particularly those in use by the military and responsible for the transportation of ordnance and live explosives, can still pose a threat to modern-day intrusive works. In general, the risk of munitions contamination is lower in the vicinity of military related wrecks than for dump sites and weapons ranges, since the munitions tend to be enclosed and immobile within the wrecks, and typically unfused during transportation.

7.175 Eleven wrecks within the wider Hornsea Zone are labelled ‘dangerous’; of which one is listed as an aircraft. Three submarines are listed and described as ‘non-dangerous’. However, it is possible that these vessels contained UXO when they sank. Two of these submarines were mined in 1915 and are therefore WWI era vessels. There is also one trawler wreck that is recorded sunk by German bombing on 1 June 1940.

7.176 Both torpedoes and depth charges were deployed around the UK during WWI and WWII, however not in high numbers. Torpedoes that failed to detonate would sink to the seabed with their warheads intact when they ran out of fuel and several have been recovered from the waters around the UK in recent years. Such devices have the potential to be present within Project One. However, the risk of encountering unexploded torpedo warheads is not considered to be high as they were commonly deployed in relatively small numbers. Typically, the warheads would contain up to 300 kg of explosives. Depth charges were also used off the coast of England during WWII, but to a much lesser extent than torpedoes.

7.177 There are two submarine exercise areas in close proximity to Subzone 1 at the north-east and north-west corners of the wider Hornsea Zone. It is possible that live or inert ordnance related to submarine exercises in these areas could have been fired or migrated into the Project One boundary. There is also a small naval depth charge exercise area within 3 km of the east edge of the Hornsea Zone and again the possibility that live depth charges were deployed and have subsequently migrated into the Project One boundary cannot be discounted.

7.178 Following the end of WWII large quantities of surplus munitions needed to be disposed of quickly and safely and, at the time, sea dumping was the only practical method. The main UK disposal site was Beaufort’s Dyke between south-west Scotland and Northern Ireland and no charted ammunition dumping grounds were identified within or in close proximity to the Project One boundary.

7.5.1 Data and Information to Inform EIA

7.179 Data from a report by BACTEC (BACTEC, 2010), detailed historical research for an Explosive Ordnance Threat Assessment including accessing military records and archived material held in the public domain and in the MoD. Material from the following sources was consulted as part of this study:

- The National Archives, Kew;
- United Kingdom Hydrographic Office (UKHO), Taunton; and
- Open sources such as published books, local historical records and the internet.
7.5.2 Methods Supporting EIA

7.180 A comprehensive desk based assessment (DBA), using all available data sources as described above will be undertaken. In accordance with CIRIA guidelines the BACTEC (2010) UXO DBA carried out research, analysed the evidence and considered the risks that Hornsea Zone has been contaminated with unexploded ordnance. It also considered the fact that such items remained in the Hornsea Zone; that they could be encountered during the construction maintenance and decommissioning of Project One and the consequences that could result. Risk mitigation measures, appropriate to the assessed level of risk and site conditions, were recommended.

7.181 A risk assessment methodology will be adopted, addressing the following issues:

- The risk that Project One is contaminated with unexploded ordnance;
- The risk that unexploded ordnance remains on site within Project One;
- The risk that ordnance may be encountered during the construction, operation and decommissioning of Project One;
- The risk that ordnance may be initiated; and
- The consequences of initiating or encountering ordnance.

7.182 General and, as far as possible, site specific factors will be considered including:

- Military history of the region;
- Official and unofficial munitions dumping sites;
- Official and unofficial weapon ranges;
- Wrecks of Military warships/submarines;
- Wrecks of merchant ships possibly carrying munitions as cargo;
- Defensive or offensive minefields;
- Evidence of aerial bombing; and
- Torpedoes and depth charges.

7.183 Since the assessment is based on historical evidence, the accuracy and comprehensiveness of the wartime records is difficult or impossible to verify. As a result conclusions as to the exact location, quantity and nature of the ordnance threat can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence.

7.5.3 Potential Project Impacts

7.184 Typically the impact of the development on the receptor (in this case the ordnance) is assessed. With regards ordnance this would simply be identification of UXO and its removal by detonation. In this case, however, the potential impact of the receptor on the development also needs to be identified.

Construction Phase

7.185 The identified potential impacts of UXO on the construction of Project One are as follows:

- There is the potential that construction activities could disturb unknown UXO, especially within the cable route corridor. Such an occurrence could lead to significant impacts to the health and safety of construction works and for damage to construction equipment and vessels.
- With regard to the impacts of encountering or initiating ordnance, the initiation of a small item of ordnance such as a small calibre projectile at depth during intrusive works is likely to result in damage to plant and potentially injury to personnel. The initiation of a
larger weapon such as a high explosive bomb or sea mine during borehole or piling works could have severe consequences in terms of both damage and loss of life.

- Unlike borehole or piling operations where the initiation of an item of ordnance is likely to be at depth and at distance from operatives, the initiation of even a small item of ordnance during dredging operations for cabling has the potential to be severe.

**Operation and Maintenance Phase**

7.186 The identified potential impacts of UXO on the operation and maintenance of Project One are as follows:

- Changes in hydrodynamic regime as a result of the turbine foundations and scour protection within Subzone 1 could result in the exposure and remobilisation of previously covered ordnance.

**Decommissioning Phase**

7.187 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.

7.5.4 **Potential Transboundary Impacts**

7.188 Potential transboundary impacts resulting from ordnance are unlikely; however the interaction between changes in physical processes and this receptor will be considered within the EIA process.

7.5.5 **Potential Cumulative Impacts**

7.189 Potential cumulative impacts resulting from ordnance are unlikely; however the interaction between changes in physical processes and this receptor will be considered within the EIA process.

7.5.6 **Potential In-combination Impacts**

7.190 Potential in-combination impacts resulting from ordnance are unlikely; however the interaction between changes in physical processes and this receptor will be considered within the EIA process.

7.5.7 **Potential Mitigation and Monitoring**

7.191 Explosive Ordnance Safety and Awareness Briefings should be given to all personnel. A specialised briefing is an essential component of the Health & Safety Plan for Project One and conforms to requirements of CDM Regulations 2007. All personnel working on Project One should be instructed on the identification of UXO, actions to be taken to alert site management and to keep people and equipment away from the hazard. Posters and information of a general nature on the UXO threat should be held in the site office for reference and as a reminder.

7.192 The Provision of Unexploded Ordnance Site Safety Instructions should be written instructions containing information detailing actions to be taken in the event that unexploded ordnance is discovered. They are to be retained and will both assist in making a preliminary assessment of a suspect object and provide guidance on the immediate steps to be taken in the event that ordnance is believed to have been found.

7.193 Prior to installation of project components (piles, foundations cable etc.) a high resolution non-intrusive geophysical survey will be considered to locate seabed anomalies which may be ordnance related (such as sea mines and torpedoes) and therefore cause a significant threat to intrusive works associated with the installation of the wind turbines, micro siting of turbines would be considered should ordnance be located coincident with proposed turbine locations.

7.6 **Maritime Archaeology and Cultural Heritage**

7.194 Project One lies in an area of potentially high archaeological value within which archaeological and palaeoenvironmental evidence, potentially covering the full span of human occupation of the UK from c.850,000 years ago to the present, may be preserved.
The archaeology of the Project One area can be divided into three broad categories: submerged prehistoric archaeology; maritime or shipwreck archaeology; and aviation or aircraft archaeology.

Archaeological sites and materials can be expected to be more or less randomly spread across the entire Project One development area with concentrations of sites and materials possible at locations of more intensive past human use.

Onshore archaeology and cultural heritage considerations are discussed within Section 8.5.

**Prehistoric archaeology and landscapes**

The seabed of the southern North Sea basin, which encompasses the Project One boundary, is an important palaeolandscape within north-west Europe (Figure 7-20). As a landscape which at a number of times in the past has been exposed as dry land due to sea level falls driven by climate change, the region probably acted not just as a land bridge between the UK and mainland Europe, but was also inhabited at various stages by hominin settlers, most recently during the Mesolithic.

‘Hominin’ is a new term used to describe what used to be call a hominid; a creature that paleoanthropologists have agreed is human or a human ancestor. This includes all of the Homo species (Homo sapiens, H. ergaster, H. rudolfensis), all of the Australopithecines (Australopithecus africanus, A. boisei, etc.) and other ancient forms like Paranthropus and Ardipithecus.
since c.850,000 years before present (BP) and until the end of the Mesolithic c.4,500 BP, there is the potential for the survival of archaeological sites and material in the Project One area dating to the:

- Lower Palaeolithic during the Cromerian period (c.700,000 to 478,000 BP);
- Lower Palaeolithic during the Wolstonian period (c.350,000 to 170,000 BP);
- Middle and Upper Palaeolithic during the Devensian period (c.40,000 BP to 24,000 BP); and
- Late Upper Palaeolithic and Mesolithic during the Devensian late-glacial and early Holocene periods (c.13,000 BP to 5,500 BP).

7.201 The processes mentioned above not only dictated the potential for prehistoric human activity in the Project One area but also influenced the preservation of the archaeological evidence of this activity. Although no prehistoric remains are currently known from this area, the Offshore Energy SEA (DECC, 2009a) suggests that Mesolithic material, for example, should be expected in and around the large relict lagoon which filled the Outer Silver Pit, the southern edge of which falls within the Project One boundary. Outer Silver Pit would in the past have dominated the palaeolandsapes of the southern North Sea, featuring a significant drainage basin, resources including a lake or marine outlet with an extensive coastline, numerous estuaries and salt marsh (Gaffney et al. 2007) and make it a prime location for archaeology and the study of possible maritime resource use.

7.202 In addition to direct archaeological evidence of the human occupation of the Project One area, the buried sediments below the seabed may also preserve palaeoenvironmental data which can be used to develop an understanding of the wider natural environment within which early humans would have lived.

Maritime Losses

7.203 Estimates of the number of maritime casualties around the UK coast vary substantially, but ‘best guesses’ put the number between 100,000 and 500,000, suggesting the potential for an average of between 8 and 40 wrecks for every mile of coastline. The majority of these wrecks are likely to be located close to the coast with fewer, in relative terms, likely to be found within Subzone 1.

7.204 Boat remains and shipwrecks within the Project One area may be expected to range in date from late Mesolithic (c.8,000 BP), when the area was undergoing marine transgression, to the present. Since the mid-Holocene marine transgression, all human activity in the Project One area has been maritime in nature, and the shipwrecks will reflect the commercial use (trade and fisheries) and naval importance of the North Sea within the context of north-western Europe, particularly since the early medieval period.
Aircraft losses

7.205 Thousands of military and civilian aircraft have been lost in UK waters since the advent of powered human flight in the early 20\textsuperscript{th} century. The bulk of these losses occurred during World War II, but aircraft losses at sea span the entire period of aviation history.

7.206 Although records of aircraft losses at sea are extensive, they are seldom tied to accurate positions. Aircraft remains on the seabed are also often ephemeral and not easily discernable in geophysical surveys. Recently, numerous aircraft wrecks have been discovered during aggregate dredging operations and survey work associated with offshore renewable energy development around the UK (Wessex Archaeology, 2008), and it is increasingly clear that these remains not only survive on the seabed, but are widespread.

7.207 All military aircraft crash sites are automatically protected under the Protection of Military Remains Act 1986, and may not be disturbed without a licence; those within the Project One boundary will be identified and considered during the EIA process.

7.6.1 Data and Information to Inform EIA

7.208 As part of the archaeological assessment a systematic search will be undertaken of all readily available and relevant historic environment sources and archives. This will include:

- The UK Hydrographic Office (UKHO) Wrecks Database (record of wrecks and obstructions), and a review of cartography, historic charts and sailing directions held by the UKHO;
- Information held by English Heritage on wrecks designated under the terms of the Protection of Wrecks Act 1973;
- Marine archaeological records held in the English Heritage National Monuments Record;
- Ministry of Defence (MOD) - information on protected wreck remains and military losses;
- Records held with the Receiver of Wreck (RoW) (Maritime and Coastguard Agency);
- Relevant Strategic Environmental Assessment (SEA) reports (DECC, UK Offshore Energy SEA (DECC, 2009a) and Archaeological Baseline; SEA 5 (DECC, 2009e));
- Information and collections held in national and local museums;
Records held with the Archaeology Data Service (ADS);
- Marine Environment Data information Network (MEDIN); and
- BGS regional guide and previous work in the area.

7.209 Other sources will include accessible published sources and grey literature, external marine historic environment specialists, and local dive groups in the area. Data collected in site specific geophysical and geotechnical surveys will also be used.

7.210 In addition to the data sources above, the following stakeholders/bodies will also be consulted:
- English Heritage Maritime Team;
- Humber Archaeology Partnership;
- North East Lincolnshire Council Archaeologist;
- Lincolnshire County Archaeologist;
- MOD (protected remains and military losses); and
- Receiver of Wreck (MCA);

7.211 The assessment will be conducted in line with industry best practice and the relevant offshore renewables and marine historic environment guidance, this includes:
- Institute for Archaeologists (IfA) Code of Practice and Standard and Guidance for Archaeological Desk-based Assessment (IfA 2008);
- COWRIE (2007b) Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore renewable Energy (2007) (COWRIE/Oxford Archaeology); and

Q28: With regard to maritime archaeology and cultural heritage, should any further data sources be consulted as part of the EIA process?

7.6.2 Methods Supporting EIA

7.212 The archaeological assessment of the potential impacts on the marine historic environment of the development of Project One will comprise the following elements, which will be used to inform the EIA process:
- An archaeological baseline study;
- An archaeological review of geophysical data; and
- An archaeological review of geotechnical data.

7.213 This work will reflect best practice and will be carried out in accordance with the guidance listed above.

7.214 The archaeological baseline study aims to identify all known sites and features of cultural heritage interest within the Project One boundary. In addition, the baseline study will consider broader regional histories and data to aid in establishing the potential for presence of currently unrecorded archaeological sites and materials, such as relict submerged landscapes and associated deposits.

7.215 The baseline study will consist of a literature review and interrogation of the available archaeological data sources. The baseline review will include consultation with the
stakeholders listed above. In addition, the geophysical survey and available geotechnical data will be subject to archaeological review in order to confirm the presence of known sites and features and identify any previously unknown sites, features and artefacts of archaeological interest. Drop-down video survey data may also provide information about the nature and extent of targets of cultural heritage interest identified during the geophysical marine survey and review of geotechnical data.

7.216 The archaeological baseline study will be used as the basis for the assessment of impacts. Together the project elements outlined above will be used to compile the archaeological EIA for Project One and propose measures to mitigate any adverse impacts of the development on the archaeological record, including currently unknown sites and material within the area.

7.217 The archaeological assessment of impacts will consider the impacts of the direct, indirect, cumulative and in-combination effects of the development on known and potential archaeological receptors. Known sites, features and artefacts will be categorised according to their importance, and thus sensitivity and the magnitude of impacts on these sites and features will be assessed.

7.6.3 Potential Project Impacts

Construction Phase

7.218 The identified potential impacts on archaeological sites, features and artefacts resulting from the construction of Project One are as follows:

- Damage to archaeological sites, features and artefacts resulting from construction activities, including the installation of foundations for turbines, the meteorological mast and the offshore substation; the laying of inter-array cables and export cables; and the placement of scour protection.

Operation and Maintenance Phase

7.219 The identified potential impacts on archaeological sites, features and artefacts resulting from the operation and maintenance of Project One are as follows:

- Potential seabed scour around turbine foundations and remedial works on inter-array and export cables, and changes to the sediment regime within the area resulting from the development. Some impacts may be beneficial, for instance the burial of sites and features by increased sedimentation.

Decommissioning Phase

7.220 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.

7.6.4 Potential Transboundary Impacts

7.221 Potential transboundary impacts on marine archaeology are unlikely; however the interaction between changes in physical processes and this receptor will be considered within the EIA process.

7.6.5 Potential Cumulative Impacts

7.222 Given the proximity of Project One with the Dogger Bank and East Anglia Round 3 Zones, together with the consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms, there is the potential for cumulative impacts to occur, these will be assessed during the EIA process.

7.223 Possible impacts may include effects within the Project One boundary such as the effect of multiple piles through a relict prehistoric landscape surface or deposit. Impacts outside the Project One boundary may include the effects of several developments within the same region on the archaeological record. There may also be cumulative impacts upon the setting of features, although this is considered unlikely.
7.6.6 In-combination Impacts
7.224 In-combination impacts will be assessed, potential in-combination impacts between Project One and other activities / industries exist, specifically:
- Future oil and gas exploration;
- Cable and pipelines laying;
- Commercial fishing; and
- Aggregate extraction and dredging.

7.6.7 Potential Mitigation and Monitoring
7.225 There are various mechanisms for mitigating development impacts on the archaeological record. In line with both international and national policies which dictate a presumption in favour of preservation *in situ*, sites and features of cultural heritage interest within the Project One area should be subject to as little disturbance as possible. The aim of mitigation measures will thus be to minimise the impact on cultural heritage assets through the appropriate siting of infrastructure and works.

7.226 Mitigation measures usually involve avoidance (the implementation of exclusion zones and design alterations), reduction (the introduction of measures to deal with unexpected discoveries during works), or offsetting (excavation and recording of a site before an impact occurs).

7.227 The preferred mitigation for archaeological sites is avoidance. To achieve this turbines and cables may be micro-sited to avoid identified sites and exclusion zones implemented, within which no construction activities may take place. The implementation of mitigation measures may be managed and monitored through a formal archaeological mitigation strategy, agreed with English Heritage and the relevant Local Authority Archaeologist, and often referred to as a Written Scheme of Investigation (WSI).

7.228 The procedures for reporting and dealing with unexpected archaeological discoveries made during construction will be set out in an appropriate protocol as part of the development of mitigation measures for the project.

7.7 Landscape, Seascape and Visual Amenity
7.229 The Project One boundary overlaps three Historic Seascape Character Areas, lying mainly within Well Bank and marginally within Well Bank Flats and Well Hole. The character of Well Bank is dominated by navigation (the area is named after a gravel bank which poses a hazard to navigation), commercial fishing and commercial shipping.

7.7.1 Data and Information to Inform EIA
7.230 The following data sources will be use to inform the offshore assessment of seascape and visual impacts:
- Admiralty Chart data;
- Information about weather conditions from the National Meteorological Office;
- English Heritage Historic Seascape Character Areas (http://www.english-heritage.org.uk/professional/research/landscapes-and-areas/characterisation/historic-seascape-character/);  
- Zone of theoretical visibility (ZTV) maps plotted for the proposed development;
- National, regional and local planning policy, in terms of policies which are relevant to seascape or visual impacts; and
- Information about the proposed development and the construction process which can be made available.

Relevant Guidance
7.231 Relevant guidance, which will be followed, is listed below:
- Landscape Institute:
To assess the impact of the proposed turbines and offshore infrastructure for Project One on landscapes, seascapes, areas designated for their landscape importance and views, a study area with a radius of 35 km from the edge of the proposed site would usually be considered. However the location of Subzone 1 is approximately 104 km from the nearest coastline. At this distance, due to the curvature of the earth and the limits of human visual acuity, the turbines and offshore substations will not be visible. There will therefore be no impact on
onshore landscape or visual receptors. As such the assessment of impacts on landscape character, designated landscapes and onshore views resulting from the offshore components of Project One can be scoped out of the EIA.

Q30: Are you in agreement that it is reasonable to scope these landscape seascape and visual amenity topics out of the EIA process?

7.233 The impact of proposed turbines and offshore substations within Subzone 1 on seascapes and offshore views will be assessed using a 35 km radius study area. Locations within this study area will be assessed to examine impacts on seascape and visual. Existing seascape infrastructure and development which may be already present, such as oil or gas platforms, will be considered as part of the existing baseline conditions. Ferry routes, shipping lanes and inhabited rigs will be taken into consideration as potential visual receptors.

7.234 Climatic and atmospheric conditions will be taken into account within the assessment of likely visual impacts. Further research will be needed to assess how visibility conditions will affect visual impacts. The approach will consider the visual significance limits recommended to apply to offshore wind farms. The distances quoted in the DTI (2005b). *Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report*, together with the predicted level of significance of visual impacts, are:

- <13 km – possible major visual impact;
- 13-24 km – possible moderate visual impact, and
- >24 km – possible minor visual impact.

7.235 It is recognised that this varies according to the nature of the proposed site, the weather conditions, and to the technology proposed, in particular the height and size of the turbines.

7.236 Impacts will be assessed in accordance with the Landscape Institute and the Institute of Environmental Management and Assessment (Second Edition 2002). *Guidelines for Landscape and Visual Impact Assessment*.

7.237 The work will be informed and illustrated through the preparation of Zones of Theoretical Visibility (ZTVs), noting that the curvature of the earth is taken to be the limit of the ZTV for the purpose of the modelling exercise, and that it is recognised that atmospheric haze and the diminishing of visibility due to distance will reduce this to about 35 km radius from the nearest turbine, which will be explored further as part of site surveys for the EIA. ZTVs will be modelled to show the extent of theoretical visibility of both the tips and hubs of the proposed turbines and the offshore substations, across the 35 km radius study area. These will be produced in accordance with Scottish Natural Heritage (2006). *Visual Representation of Wind Farms Good Practice Guidance*.

7.238 Alongside the ZTVs, a series of maps will be produced showing the distribution of historic seascapes character areas (English Heritage), and the location of viewpoints and other sensitive receptors in relation to the ZTV. These maps will inform the assessment of potential impacts upon these areas.

7.239 Key viewpoints will be agreed with the local authorities and Natural England. These will be illustrated by generating wireframes of proposed turbines for Project One from each viewpoint. These viewpoints will be used as an assessment tool in order to inform examination and description of impacts upon offshore visual amenity and views. Up to ten locations will be examined.

7.240 Potential viewpoint locations include:

- Rosyth to Zeebrugge ferry (currently operates as freight-only ferry);
- Newcastle Upon Tyne to IJmuiden passenger ferry;
- Kingston-upon-Hull to Rotterdam passenger ferry;
- Shipping routes; and
- Offshore rigs.
7.7.3 Potential Project Impacts

7.241 As discussed the distance of Subzone 1 from the British coastline means that there will be no impact on onshore landscape or visual receptors. As such the assessment of impacts on landscapes, designated areas and onshore views resulting from the offshore components of Project One can be scoped out.

Construction Phase

7.242 The identified potential impacts on seascapes and visual amenity resulting from the construction of Project One are as follows:

▪ During construction there will be short term seascape and visual impacts from machinery/equipment and activities including assembly of turbines and installation of infrastructure.

Operation and Maintenance Phase

7.243 The identified potential impacts on seascapes and visual amenity resulting from the operation and maintenance of Project One are as follows:

▪ Visual receptors on passenger ferries and shipping channel routes are likely to experience a change in view for a short period of time. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral; and

▪ The seascape is likely to experience direct, adverse impacts in character areas within which the turbines and substations for Project One are located.

Decommissioning Phase

7.244 The identified potential impacts on seascapes and visual amenity resulting from the decommissioning of Project One are likely to reverse those impacts identified for the operation and maintenance phase.

7.245 Other impacts are likely to be similar to those reported during construction.

7.7.4 Potential Transboundary Impacts

7.246 Visual receptors on passenger ferries and shipping channel routes between the UK and non-UK EEZ are likely to experience a change in view for a short period of time. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral.

7.7.5 Potential Cumulative Impacts

7.247 For the cumulative assessment a study area of 60 km from the edge of the proposed site would usually be considered (as advised by Scottish Natural Heritage (2005). Cumulative Effects of Wind Farms). However there are no other proposed wind farms within 60 km of Subzone 1. The closest scheme is the Dogger Bank Zone, located 74.84 km north of Subzone 1. Westernmost Rough (95.75 km) and the Humber Gateway (89.71 km) schemes are located approximately 10 km off the coast of Withernsea and 90 km from Subzone 1. As such cumulative assessment can be scoped out for Project One.

7.7.6 In-combination impacts

7.248 For the in-combination assessment a study area of 60 km from the edge Subzone 1 will be considered. The visual and seascape impacts arising from Project One will be considered in-combination with other industrial sector developments within the study area, including, the oil and gas industry.

7.7.7 Potential Mitigation and Monitoring

7.249 The main form of mitigation available is the layout of the turbines within the Blocks, as well as the extent of the Blocks across Subzone 1. The orientation and ordered design of the layout...
may reduce the level of significance of impacts, although it is recognised that seabed conditions, shipping routes and physical process such as tidal currents, wave and wind climate will be a key consideration in determining the layout.

7.250 Mitigation will also be achieved by the proposed colour of the turbines and any ancillary structures.

7.8 Airborne Noise and Vibration

7.251 A description of airborne noise sources and the location of airborne noise sensitive receptors in relation to the offshore components of Project One are considered in this section. Underwater noise and vibration is considered with in the Fish and Shellfish Ecology and Marine Mammals Sections (Section 6.3 and Section 6.5 respectively).

7.252 Airborne noise sources include the construction noise associated with the development of Project One and the operational noise once the development is complete.

7.253 Airborne noise sensitive receptors include coastal towns and cities. The coastal towns and cities in the Humber region are accustomed to an intermittent level of noise from existing sources of shipping and industrial activities. Towns further up the coast, such as Scarborough, Filey, Bridlington, Hornsea, Withernsea, Grimsby and Mablethorpe may not experience the same noise levels.

7.8.1 Potential Project Impacts

7.254 The offshore components of Project One will be located at least 100 km from these land-based receptors. The effect of airborne noise (construction and operational) on land based receptors will be low due to the attenuation of noise over the large distances involved. Noise is extremely unlikely to result in significant impacts. However, potential impact of airborne noise resulting from construction, operation and maintenance and decommissioning of the wind farms will be considered within the EIA process.

7.8.2 Potential Transboundary Impacts

1.27. The offshore components of Project One will be located at least 39.6 km from the UK EEZ boundary. The effect of airborne noise (construction and operational) will be low due to the attenuation of noise over the large distances involved. Noise is extremely unlikely to result in significant transboundary impacts and will therefore transboundary impacts resulting from airborne noise and vibration will be scoped out of the EIA.

7.8.3 Potential Cumulative Impacts

7.255 Although the location of offshore components of Project One will be sufficiently distant from any land based receptors for impacts in relation to airborne noise to be unlikely, there remains the potential for cumulative impacts from Project One along with other wind farm developments, specifically for offshore receptors e.g., oil and gas platform personnel. Potential cumulative impacts of airborne noise will be considered within the EIA process.

7.8.4 Potential In-combination Impacts

7.256 Although the location of Project One is sufficiently distant from any land based receptors for impacts in relation to airborne noise to be unlikely, there remains the potential for in-combination impacts from Project One along with other projects and activities, specifically for offshore receptors e.g., oil and gas platform personnel. Potential in-combination impacts of airborne noise will be considered within the EIA process.

7.9 Infrastructure and Other Marine Users

Aggregate Areas

7.257 There are no aggregate areas within Subzone 1, although Application Area 506 and Option/Prospecting Areas 490 and 490 are located 3.8 km directly south of Subzone 1. Further inshore from Subzone 1, are four licence areas, three application areas and one prospecting area located within the cable route corridor (Figure 7-22). Dredging application areas are those which have been submitted to The Crown Estate and are the precursors to fully licensed aggregate extraction areas, as such these will be avoided during cable routing.
Recreation

7.258 There are no known diving or bathing activities that take place within Subzone 1. There is the possibility of recreational sea angling, bathing and other water sport activities within the cable route corridor, especially inshore.

Waste disposal and dumping grounds

7.259 The location of disposal sites within the vicinity of Project One are shown in Figure 7-23. There are no disposal sites within Subzone 1. The nearest open disposal site is located within the Hornsea Zone, approximately 40 km west of Subzone 1. Within the cable route corridor there are one open and two closed disposal sites offshore, within the Humber Estuary there are a further six open and seven closed disposal sites and four dumping grounds.
7.260 Since 1994, the dumping at sea of most forms of industrial waste has been prohibited, with the disposal of sewage sludge phased out in 1998. Dredged waste from excavated ports and navigation channels now forms the majority of the remaining material eligible for disposal at sea.

7.261 Licensed waste sites for the disposal of dredged material are located inshore along the coast. Table 7-6 describes these disposal sites and the approximate quantity of material deposited.

Table 7-6  Marine disposal sites inshore from Project One, licensed in 2006

<table>
<thead>
<tr>
<th>Origin (waterway name)</th>
<th>Type of area dredged</th>
<th>Dredging operation type</th>
<th>Total quantity (tonnes dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humberside Coast</td>
<td>Harbour</td>
<td>Maintenance</td>
<td>4,229</td>
</tr>
<tr>
<td>Humber River (4 sites)</td>
<td>Harbour</td>
<td>Maintenance</td>
<td>710,166</td>
</tr>
<tr>
<td>Humber River</td>
<td>Harbour, Estuary and Sea</td>
<td>Maintenance</td>
<td>2,029,737</td>
</tr>
<tr>
<td>Humber River (2 sites)</td>
<td>Harbour and Estuary</td>
<td>Maintenance</td>
<td>457,227</td>
</tr>
<tr>
<td>Humber River</td>
<td>Estuary</td>
<td>Maintenance</td>
<td>13,706</td>
</tr>
</tbody>
</table>

7.262 Chemical weapons and munitions have been dumped at sea since the end of WWI. The UK Offshore Energy SEA does not report any chemical munitions disposal sites in the Regional Sea encompassing the Hornsea Zone and the Project One boundary. Admiralty charts 1187, 1190 and 1191 were also consulted as part of this report and do not indicate any charted ammunition dumping grounds within or in close proximity to the Project One Boundary.

**Offshore Wind Farms**

7.263 The southern North Sea has previously been a focus for offshore wind farm development during TCE leasing Rounds 1, 2 and 2.5. The development has been focused in this region as it provides suitable water depths compared to more remote areas. Table 7-7 lists the constructed, in construction and offshore wind farms that are in the consenting and development processes as shown in Figure 7-24.
### Table 7-7 UK offshore wind farms in the southern North Sea

<table>
<thead>
<tr>
<th>Offshore Wind Farm Site Name</th>
<th>The Crown Estate Leasing Round</th>
<th>MW</th>
<th>Status (August 2010)</th>
<th>Distance to Hornsea Zone (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogger Bank Zone</td>
<td>3</td>
<td>9000</td>
<td>In development</td>
<td>66</td>
</tr>
<tr>
<td>East Anglia Zone</td>
<td>3</td>
<td>7200</td>
<td>In development</td>
<td>44</td>
</tr>
<tr>
<td>Hornsea Zone</td>
<td>3</td>
<td>4000</td>
<td>In development</td>
<td>0</td>
</tr>
<tr>
<td>Lynn &amp; Inner Dowsing</td>
<td>1</td>
<td>194.4</td>
<td>Operational</td>
<td>65</td>
</tr>
<tr>
<td>Scroby Sands</td>
<td>1</td>
<td>60</td>
<td>Operational</td>
<td>131</td>
</tr>
<tr>
<td>Greater Gabbard</td>
<td>2</td>
<td>504</td>
<td>Under Construction</td>
<td>195</td>
</tr>
<tr>
<td>Sheringham Shoal</td>
<td>2</td>
<td>315</td>
<td>Under Construction</td>
<td>74</td>
</tr>
<tr>
<td>Lincs</td>
<td>2</td>
<td>270</td>
<td>Approved</td>
<td>65</td>
</tr>
<tr>
<td>Docking Shoal</td>
<td>2</td>
<td>540</td>
<td>Submitted (s36)</td>
<td>70</td>
</tr>
<tr>
<td>Dudgeon</td>
<td>2</td>
<td>560</td>
<td>Submitted (s36)</td>
<td>60</td>
</tr>
<tr>
<td>Humber Gateway</td>
<td>2</td>
<td>300</td>
<td>Submitted (s36)</td>
<td>20</td>
</tr>
<tr>
<td>Race Bank</td>
<td>2</td>
<td>620</td>
<td>Submitted (s36)</td>
<td>55</td>
</tr>
<tr>
<td>Westermost Rough</td>
<td>2</td>
<td>240</td>
<td>Submitted (s36)</td>
<td>19</td>
</tr>
<tr>
<td>Triton Knoll</td>
<td>2</td>
<td>1200</td>
<td>In development</td>
<td>37</td>
</tr>
<tr>
<td>Galloper</td>
<td>2.5</td>
<td>504</td>
<td>In development</td>
<td>213</td>
</tr>
</tbody>
</table>

### Other renewable installations

#### 7.264 There is a tidal power generation device located 1 km from the south bank of the Humber. The Pulse Tidal Scheme completed its piling works in May 2008 and has a total capacity of 0.15 MW.

#### 7.265 The Pulse Tidal deployed the 100 kW "Pulse-Stream 100" (PS100) in 2009. The location was chosen due to the shallow water (9 m) and ease of working conditions. The PS100 began
generating electricity in May 2009, and the power is exported to Millennium Chemicals, a large plant on the south bank of the estuary.

**Subsea cables and pipelines**

7.266 There are no subsea cables within Subzone 1. The nearest subsea cable is located 10.5 km east of Subzone 1. There are two pipelines within the north-east of Subzone 1 running between the Topaz and Schooner gas fields. The offshore cable route will cross a number of existing pipelines. Pipelines and cables within the vicinity of Project One are shown in Figure 7-25.

![Figure 7-25 Locations of subsea cables and pipelines within the vicinity of Project One](image)

**Oil and gas**

7.267 There is one existing gas field (Topaz) with associated gas infrastructure within the footprint of Subzone 1, located in the north-east corner and consisting of two pipelines (methanol and gas), a number of appraisal and exploration wells, and a well head structure. There are also a small number of plugged and abandoned wells within Subzone 1 (Figure 7-26).

7.268 The cable route will also have to pass over or near to a number of currently exploited gas fields and therefore within the vicinity of their associated infrastructure. Particularly heavily developed fields within the cable route corridor include the West Sole (including tie-ins from the Hyde and Hoton fields), Amethyst, Mercury and Helvellyn fields (Figure 7-26).
Figure 7-26  Suspended wells and gas fields located within the vicinity of the Project One area

Figure 7-27  Surface, subsurface and wells located within the vicinity of the Project One area
7.269 There are five licensed blocks within Subzone 1 (48/4a, 48/5, 49/1a, 49/2a, 49/2b) along with the 26th round conditional award licence block 49/2c and a significant number of licensed blocks along the cable route corridor (Figure 7-28).

7.270 The Rough field within the cable route corridor is currently used as a natural gas storage field. No other gas storage fields have been identified at this time.

Figure 7-28  Current licensed blocks located within the vicinity of the Project One area

Figure 7-29  Underground coal gasification
7.271 There is currently one licensed underground coal gasification field located within the Humber estuary and two fields within the application process, located to the north and south of the Humber estuary. These fields are located within the cable route corridor.

7.9.1 Data and Information to Inform EIA

7.272 The following list identifies the key guidance, information and data sources that will inform the assessment of infrastructure and other marine users assessment within ES:

- The Crown Estate (2010b). Active Dredge Zones for the Humber Region. Available online at: [http://www.thecrownestate.co.uk/dredge_areas_statistics](http://www.thecrownestate.co.uk/dredge_areas_statistics);
- The Crown Estate (2010d). Licensed Dredging Areas for the Humber Region. Available online at: [http://www.thecrownestate.co.uk/dredge_areas_statistics](http://www.thecrownestate.co.uk/dredge_areas_statistics);
- The Crown Estate (2010c). Application Areas for the Humber Region. Available online at: [http://www.thecrownestate.co.uk/dredge_areas_statistics](http://www.thecrownestate.co.uk/dredge_areas_statistics);
- The Crown Estate (2010f). Option or Prospecting Areas for the Humber Region. Available online at: [http://www.thecrownestate.co.uk/dredge_areas_statistics](http://www.thecrownestate.co.uk/dredge_areas_statistics);
- SeaZone (2010). GIS PEXA areas and offshore munitions disposal sites;
- Oil and Gas UK website ([http://www.oilandgasuk.co.uk/](http://www.oilandgasuk.co.uk/));
- UKDEAL website ([https://www.ukdeal.co.uk/dp/jsp/PleaseLoginDeal.jsp](https://www.ukdeal.co.uk/dp/jsp/PleaseLoginDeal.jsp))
- Seafish Marine Services ([http://www.seafishmarineservices.com/](http://www.seafishmarineservices.com/));
- COWRIE Data Management and Stewardship for UK Marine Renewables ([http://data.offshorewind.co.uk/](http://data.offshorewind.co.uk/));
- RYA ([http://www.rya.org.uk/Pages/Home.aspx](http://www.rya.org.uk/Pages/Home.aspx));
- Local councils;
- CEFAS ([http://www.cefas.co.uk/](http://www.cefas.co.uk/));
- Local websites promoting activities in the cable route area;
- The Crown Estate ([http://www.thecrownestate.co.uk/](http://www.thecrownestate.co.uk/)); and
- Sea angling press and clubs.

Q32: With regard to infrastructure and other marine users, should any further data sources be consulted as part of the EIA process?
7.9.2 Methods Supporting EIA

7.273 Infrastructure and other users will be assessed as follows:

- Define the study area for the assessment;
- Complete a baseline assessment for the following topics in the study area, specifically placing them within a spatial context to identify areas of potential overlap with Project One:
  - Aggregates;
  - Recreation;
  - Waste disposal and dumping grounds;
  - Offshore wind farms;
  - Other renewable installations;
  - Subsea cables and pipelines; and
  - Oil and gas.
- Identify potential significant impacts for each phase of Project One and assess the significance (see Section 3.5);
- Identify mitigation and monitoring measures; and
- Assess the significance of residual impacts, taking into account the mitigation measures identified.

7.274 Throughout the assessment consultation with other sea users will be undertaken to inform the EIA.

7.9.3 Potential Project Impacts

Construction Phase

7.275 The identified potential impacts on infrastructure and other marine users resulting from the construction of Project One are as follows:

- The export cable route may have implications for recreational activities, such as increased collision risk between leisure and waterspout craft and construction vessels / plant and the displacement of activities from areas during the construction phase;
- There is the potential of contaminated sediment being disturbed during cable installation and re-introduced into the water column should the cable route pass through previously closed disposal sites; and
- Potential to impact on existing oil and gas pipelines and infrastructure through cable laying, this will include a number of pipeline and cable crossings.

Operation and Maintenance Phase

7.276 The identified potential impacts on infrastructure and other marine users resulting from the operation and maintenance of Project One are as follows:

- The development of Project One has the potential to cause changes to seabed composition, bathymetry and hydrodynamics by increasing scour. These physical processes are considered in Section 5.2. This effect has the potential to impact the aggregate dredging industry if the size of sediment particles within an aggregate licence area alters as a result of the construction of Project One;
- Project One may impact on the future exploration for oil and gas within Subzone 1 by restricting future seismic surveys, exploration drilling and development activities; and
- Subzone 1 and the cable route may impact on the future exploitation of gas fields and have implications for the possible future use of depleted fields for natural gas storage or Carbon Capture and Storage (CCS) projects.
Decommissioning Phase

7.277 Impacts arising during decommissioning are expected to be similar to those experienced during the construction phase.

7.9.4 Potential Transboundary Impacts

7.278 There are no transboundary impacts anticipated for infrastructure and other marine users.

7.9.5 Potential Cumulative Impacts

7.279 Given the proximity of Project One with the Dogger Bank and East Anglia Round 3 Zones, together with the consented Round 2 wind farms (some of which are currently being constructed) and operational Round 1 wind farms, there is the potential for cumulative impacts to occur, these will be assessed during the EIA process. Particular attention will be given to dredging and use of ports and harbours for construction, operation and maintenance works.

7.9.6 Potential In-combination Impacts

7.280 In-combination impacts will be assessed, potential in-combination impacts on infrastructure and other marine users between Project One and other activities / industries will be assessed within the EIA process. Specific activities and industries to be considered include:

- Future oil and gas exploration;
- Cable and pipelines laying;
- Commercial fishing; and
- Aggregate extraction and dredging.

7.9.7 Potential Mitigation and Monitoring

7.281 Potential mitigation may be required for the cable route crossings over existing pipelines and cables through consensus of legal crossing agreements. Monitoring of these crossings will also be required.

7.282 Cable routeing should avoid current disposal sites where possible, where this is not a feasible option it may be possible, through consultation with the relevant authorities, to move the site.
8 ONSHORE ENVIRONMENT

8.1 The precise locations of the onshore components of Project One within the onshore study area are less well defined than the offshore components, where the location of Subzone 1 is established. It is intended to define the locations of these components through the EIA and consultation processes commencing with this scoping exercise. The location of the onshore grid connection point is fixed by the connection agreement entered into with NGET.

8.2 The onshore environment is defined for the purposes of this scoping report as all land and foreshore above the Mean High Water Spring (MHWS) mark. The onshore boundary of Project One is shown in Figure 8-1.

8.3 The key constraints pertaining to the Onshore Environment include:

- Terrestrial ecology and nature conservation (Figure 8-1);
- Historic environment - Archaeology and cultural heritage (Figure 8-1);
- Landscape, seascape and visual amenities (Figure 8-1);
- Water resources;
- Flood risk;
- Geology, soils, agriculture and land use (Figure 8-1);
- Traffic and transport infrastructure (Figure 8-1);
- Air quality;
- Noise and vibration; and
- Recreation, tourism and socio-economics (Figure 8-1).

8.4 These issues are discussed in the following sections.

Figure 8-1 Key onshore environmental constraints.
8.1 Geology, Soils, Agriculture and Land Use

North of the Humber

8.5 The land use to the north of the Humber is predominantly agricultural, with two small towns, and a number of villages and farmsteads. The majority of farmland is agricultural Grade 2, with a small pocket of Grade 1 land in the south, both of which are considered Best and Most Versatile in the agricultural land classification. Bands of Grade 3 land occur along the coast, and in small patches inland. The main urban areas are the coastal town of Withernsea, and Hedon on the outskirts of Kingston Upon Hull.

8.6 The area north of the Humber contains three geological SSSIs: Dimlington Cliff, a key site for Quaternary stratigraphy; Kelsey Hill Gravel Pits, a representative exposure of a sequence of Ice Age (Pleistocene) deposits typical to this area; and, Roos Bog, an important Quaternary site providing a continuous record of vegetation history and environmental change in Holderness over the last 13,000 years. All three sites are also identified as being of national importance in the Geological Conservation Review (GCR).

South of the Humber

8.7 Agricultural land quality to the south of the Humber is dominated by Grade 3 land, with some bands of Grade 2 agricultural land. An area of Grade 1 agricultural land is situated close to the mouth of the Humber, to the north of the village of North Somercotes. The large urban area of Grimsby lies on the edge of the Humber Estuary, to the north of which lies the industrialised area of Immingham Docks.

8.8 Kirmington Pits, a geological SSSI, lies approximately 8 km to the southwest of Grimsby. The site, one of the most important Quaternary sites in eastern England, contains a complex sequence of glacial and interglacial deposits up to 30 m thick within a buried channel.

8.1.1 Data and Information to Inform EIA

8.9 The following data sources will be reviewed to inform the assessment process:

- Ordnance Survey (Southampton, 1983) Soil Survey of England and Wales;
- Agricultural Land Classification of England 1:250,000 (Defra, accessed via www.magic.gov.uk);
- Ordnance survey maps;
- British Geological Survey 1:50,000 scale geological map (England and Wales, Bedrock and Superficial Deposits); and
- Details of Geological Sites of Special Scientific Interest and Regionally Important Geological and Geomorphological Sites (Natural England).

Q33: With regard to geology, soils, agriculture and land use, should any further data sources be consulted as part of the EIA process?

8.1.2 Method Supporting EIA

8.10 The presence of best and most versatile land (including soil resource issues) is important when considering the sustainability of development proposals as set out in paragraph 28 of Planning Policy Statement 7 (Office of the Deputy Prime Minister, now Communities and Local Government, 2004). This accords with the Government’s expectation that a “high level of protection” is to be afforded to all natural resources as evidenced by the guidance in Planning Policy Statement 1 on sustainable development (Office of the Deputy Prime Minister, now Communities and Local Government, 2005).

8.11 A desk-based study of agricultural land affected by the development would be undertaken, supplemented by field survey where appropriate to determine the agricultural land classification of the areas affected. The characteristics of each soil association (type) affected by the development will be established and interpreted for the assessment of construction impacts and suitable soil handling techniques.
8.12 Agri-environment schemes affected by the onshore components of Project One will be reviewed, alongside relevant planning policy providing protection to agricultural land.

8.13 Potentially affected Geological SSSIs and Regionally Important Geological and Geomorphological Sites will be identified through desk-based study.

8.14 The assessment methodology focuses on impacts on farming and geological SSSIs to concentrate on potentially significant impacts.

8.1.3 Potential Project Impacts

Construction Phase
8.15 Potential impacts could include:

- Damage to, or severance of, access to designated geological sites – where geological receptors comprise geological Sites of Special Scientific Interest (SSSI) and regionally important geological and geomorphological sites.
- The majority of land which would potentially be affected by Project One is under arable cultivation, potential impacts include:
  - Soil loss or structural damage;
  - Changes to soil composition and structure;
  - Changes to existing land quality and agricultural productivity of soils;
  - Temporary disruption to farming operations during construction;
  - Temporary disruption to land drainage systems during construction; and
  - Potential for transmission of agricultural pests and diseases.

Operation and Maintenance Phase
8.16 During operation, the onshore cable system and substation/converter station are not anticipated to have an adverse impact on soils, farming or other land use.

8.17 The potential impacts during maintenance are considered to be similar to those previously described during construction phase.

Decommissioning Phase
8.18 The potential impacts during decommissioning are considered to be similar to those previously described during construction phase.

8.1.4 Potential Transboundary Impacts
8.19 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.1.5 Potential Cumulative Impacts
8.20 The cumulative impact assessment will consider impacts from the onshore components of Project One alongside the construction, operation and maintenance and decommissioning of other grid connection works in the surrounding area. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.1.6 Potential In-combination impacts
8.21 The in-combination assessment will consider impacts arising from the construction, operation and maintenance and decommissioning of the onshore components of Project One alongside

Q34: Do you agree with this approach or should other land uses also be covered in the assessment? If so which?
other coastal development (e.g., related to ports, oil and gas industries, industrial development). The impacts would be similar to the potential project impacts identified above: damage or loss of soil resources and geological sites, temporary disruption to farming practices and land drainage, alterations to land quality and an increased risk of the transmission of agricultural pests and diseases.

8.1.7 Potential Mitigation and Monitoring

8.22 Mitigation measures for impacts on soil, agriculture and land use may include:
- Where possible, areas of best and most versatile land will be avoided during identification of the cable route;
- Minimising any risk to the integrity of soil resources and land quality during the construction and reinstatement process, handling soils in accordance with best practice; and
- Avoiding designated geological and geomorphological sites.

8.2 Water Resources

8.23 Water resources comprise of a number of potentially sensitive receptors, namely:
- Surface waters, including rivers, streams and drainage ditches;
- Groundwater and springs;
- Abstractions of surface water or groundwater;
- Ecological receptors directly and indirectly associated with water features; and
- Other users of the identified water features, such as recreational users.

8.24 Flood risk associated with Project One is considered in a separate section below.

North of the Humber

8.25 A number of small rivers drain the area north of the Humber from north east to south west.

8.26 No part of the study area to the north of the Humber is within a groundwater source protection zone although the whole area lies within a Principal Bedrock aquifer and contains a small number of superficial deposit aquifers (category Secondary A10).

8.27 A large part of the area to the north of the Humber lies within a nitrate vulnerable zone.

South of the Humber

8.28 The only large water body lying within the area to the south of the Humber is Covenham Reservoir, providing potable water to Grimsby. Louth Canal runs to the east of the reservoir, linking Louth to the south with Tetney Lock in the north. A number of small rivers flow south west to north east through the area, draining the agricultural land.

8.29 A large proportion of the area to the south of the Humber is within a groundwater source protection zone, with only the far south east section lying outside such a designation. The whole area lies within a Principal Bedrock aquifer and contains a small number Secondary A superficial deposit aquifers.

8.30 With the exception of built up areas within and to the south of Grimsby, the whole of the area to the south of the Humber lies within a nitrate vulnerable zone.

8.2.1 Data and Information to Inform EIA

- The following data sources will be reviewed to inform the assessment process:

---

Q35: Do you agree with the listed sensitive water resource receptors? Are any omitted? Or should any be removed from the list?
- Groundwater Source Protection Zones (Environment Agency, 2010d);
- Principal and secondary aquifers (superficial deposits and bedrock) (Environment Agency, 2010e);
- British Geological Survey (1977) Hydrogeological Map of England and Wales (scale 1:625,000); and
- Current Ordnance Survey 1:10000, 1:25000 and 1:50000 scale mapping.

Q36: With regard to water resources’, should any further data sources be consulted as part of the EIA process?

8.2.2 Method Supporting EIA

8.31 The onshore study area for Project One will comprise the landfall point, substation/converter station, cable route corridor and surrounding areas as appropriate. It will also include any surface water features and groundwater resources elsewhere, which are hydraulically connected to the development area and may, therefore, be potentially affected. The extent of the onshore study area will be refined once specific landfall and cable route options are identified and will consider the nature of the water environment and the associated receptors potentially affected by the development.

8.32 A detailed baseline study will be carried out to establish the current conditions of the water environment. This will comprise a desk study and a site visit. Information will be drawn from a variety of sources, including published information and maps relating to hydrology, water quality, and hydrogeology, and any information received during consultation.

8.33 The assessment of impacts to water resources will be undertaken using a source-pathway-receptor model and a risk based assessment. This will be based on combining assessments of both the likelihood and consequence of any potential impact in line with the Institute of Environmental Management and Assessment (IEMA) guidance. This approach embraces principles of the Water Framework Directive (WFD).

8.34 The evaluation of the significance of potential impacts on the water environment will be assessed in accordance with the EIA methodology set out in Section 3.5. Where appropriate, criteria such as the Environment Agency’s water quality ratings, ecological designations and groundwater vulnerability will be drawn upon in order to define the sensitivity of the water environment.

8.2.3 Potential Project Impacts

Construction Phase

8.35 The identified potential impacts on water resources resulting from the construction of Project One are as follows:

- Sediment mobilisation in site runoff from exposed soil surfaces during construction;
- Contamination of surface water features or groundwater by oils, lubricant and fuels originating from construction vehicles or store areas;
- Impacts on the quality of private water supplies;
- Changes to groundwater movement; and
- Longer term impacts on abstraction for private water supplies, particularly any supplies dependent on groundwater.

Operation and Maintenance Phase

8.36 The identified potential impacts on water resources resulting from the operation and maintenance of Project One are as follows:

- Contamination of surface water features or groundwater by oils, lubricant and fuels originating from operational and maintenance vehicles or store areas; and
- Risk of contaminated water run-off from hard-standing areas entering nearby watercourses and potentially impacting the quality of private water supplies.

**Decommissioning Phase**

8.37 The potential impacts during decommissioning are considered to be similar to those previously described during construction phase.

8.2.4 Potential Transboundary Impacts

8.38 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.2.5 Potential Cumulative Impacts

8.39 The cumulative impact assessment will consider impacts from the onshore components of Project One alongside the construction, operation and maintenance and decommissioning of other grid connection works in the surrounding area. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.2.6 Potential In-combination impacts

8.40 The in-combination assessment will consider impacts arising from the construction and operation of the onshore components of Project One alongside the construction, operation and maintenance and decommissioning of other coastal development e.g., related to ports, oil and gas industries, industrial development. The impacts would be similar to the potential project impacts identified above: sediment mobilisation, contamination, alteration of groundwater flows and impacts on private water supplies.

8.2.7 Potential Mitigation and Monitoring

8.41 The cable route, and any potential overhead line infrastructure, will be designed to take water resources into account where practicable, for example ensuring infrastructure is located at least 20 m from watercourses where possible.

8.42 Pollution control measures will be put into place during the construction phase of the development in order to minimise the risk posed to receiving surface water features. Details of appropriate actions are contained in the Environment Agency’s Pollution Prevention Guidance notes 1 and 5, General Guide to the prevention of pollution and Works in, near, or liable to affect watercourses, respectively. Measures that will be considered include:

- Minimising areas of exposed soil;
- Temporary storm water management system;
- Provision of specific bunded storage area; and
- Development of pollution incident reaction plan.

8.3 Air Quality

**North of the Humber**

8.43 Air quality in East Riding of Yorkshire is good, with air quality monitoring (East Riding of Yorkshire Council, 2009) indicating that there is no risk of exceeding any Air Quality Objective at any location of relevant exposure within the council area. There are no Air Quality Management Areas (AQMAs) (areas requiring improvement) in the council area.

**South of the Humber**

8.44 Objectives for all local air quality monitoring pollutants are being met in the part of North Lincolnshire Council within the onshore area of search, according to the most recent progress report (North Lincolnshire Council, 2009a), with some improvements noted including a decrease in nitrogen dioxide concentrations at Killingholme. There are no Air Quality Management Areas within the area of search.
8.45 The main sources of air pollution in North East Lincolnshire are road traffic emissions, and other emissions generated by the operation of the Port of Immingham and Grimsby. Pollutant emissions from the Port of Immingham include road traffic emissions (including a high volume of HGV traffic) from the main access roads to the docks (the A1173 Kings Road and A160 Humber Road) and other port-related emissions (coal storage, shipping, the Humber and Lindsey oil refineries in North Lincolnshire, and other industrial processes linked to the port activities). Consequently AQMAs have been identified in both Immingham (for particulate matter) and Grimsby (for nitrogen dioxide).

8.46 Part of West Lindsey also falls within the west of the area of search. Within these district air quality objectives for all pollutants are being met (West Lindsey District Council, 2010).

8.47 East Lindsey is a predominantly rural area, with the main source of air pollution arising from road traffic emissions from major roads, notably the A16, A158 and A52. No AQMAs have been identified since air quality is generally good (East Lindsey District Council, 2010).

8.3.1 Data and Information to Inform EIA

8.48 Air quality data in the UK are available from a range of sources including national monitoring networks operated by Defra, local monitoring surveys and assessments carried out by local authorities (as part of their requirements set out under Part IV of the Environment Act 1995), and national modelling reported in the UK Air Quality Archive11.

8.3.2 Method Supporting EIA

8.49 Research indicates that potentially significant effects from construction related dust and vehicle emissions are limited to an area 200 m from the emission source (Highways Agency, 2007). Therefore, the study area will include sensitive receptors, such as residential properties, that are within 200 m of the construction working area and roads where changes in traffic flows have the potential to cause significant air quality effects, based on guidance in the UK Design Manual for Roads and Bridges (DMRB) (Highways Agency, 2010).

8.50 Due to the likely limited nature of the potential impacts of Project One and the availability of existing baseline air quality data, no site specific air quality monitoring surveys are proposed. Relevant data will be collected through a desk-based review of the existing data sources described above.

8.51 The primary air quality issue associated with construction phase dust emissions is loss of amenity and/or nuisance caused by, for example, soiling of buildings, vegetation and washing and reduced visibility. There is no formally recognised methodology for determining these effects and no statutory environmental quality standards for which to compare levels of deposited dust or concentrations in air. The usefulness of numerical criteria to determine effects from construction dust is limited as the perception of loss of amenity or nuisance is affected by a wide range of factors such as character of the locality and sensitivity of receptors. Because of this, assessment methodologies that are based on a qualitative approach are advocated in a range of guidance, including that produced by the Buildings Research Establishment (BRE) (Kukadia et al., 2003) and Communities and Local Government (ODPM, 2005). Therefore, a qualitative approach will be adopted for the assessment. Key stages in the assessment will be the identification of potential dust raising activities, the locations and types of sensitive receptors and resources and any other existing exacerbating or controlling factors such as meteorological conditions and screening.

8.52 Air quality impacts associated with decommissioning will be assessed following the same methodology.

8.53 If the potential exists for significant change in traffic flows as a consequence of construction or decommissioning or significantly increased levels of road traffic pollutants caused by traffic congestion or increased traffic flows on diversionary routes, local air quality effects will be assessed consistent with the screening methodology set out in the Design Manual for Roads

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11 UK Air Quality Archive, available at www.airquality.co.uk
and Bridges (DMRB) (Highways Agency, 2010) and accompanying assessment tool. Where relevant, predicted pollutant concentrations will be compared with air quality objectives set out in the UK Air Quality Strategy (Defra et al., 2007) and the Air Quality Standards Regulations 2010.

8.3.3 Potential Project Impacts

**Construction Phase**

8.54 Project One has the potential to affect local air quality during the construction phases through the generation of dust and emissions of combustion related pollutants from on-site plant/vehicles and off-site road traffic. The key pollutant likely to be produced by earth moving activities is particulate matter, comprising dust and finer particle fractions including PM$_{10}$. Plant and vehicle exhaust emissions are associated with a range of air pollutants, the most important in respect of air quality being NO$_2$ and PM$_{10}$.

**Operation and Maintenance Phase**

8.55 No potentially significant sources of emissions to air will exist during the operation of the proposed development. Substations and converter stations do not give off emissions and, as such, no direct impact would be anticipated. During operation the proposed substation/ converter station and cable route will only require limited access for maintenance and monitoring tasks, and it is considered that the impact of this on air quality will be negligible. It is proposed that this issue is scoped out of the EIA process.

**Decommissioning Phase**

8.56 The proposed development has the potential to affect local air quality during the decommissioning phases through the generation of dust and emissions of combustion related pollutants from on-site plant/vehicles and off-site road traffic.

8.3.4 Potential Transboundary Impacts

8.57 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.3.5 Potential Cumulative Impacts

8.58 Significant cumulative air quality impacts associated with the development with other grid connection construction or decommissioning activities are considered to be unlikely. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.3.6 Potential In combination impacts

8.59 In combination impacts arising from the proposed development alongside other projects within the area from other industries/activities e.g., port development, industrial development, other coastal infrastructure associated with oil and gas activities are considered to be unlikely. However, the potential for in-combination impacts to occur will be assessed as part of the EIA process.
8.3.7 Potential Mitigation and Monitoring

8.60 Best practice guidance provides mitigation measures based on the level of risk identified at construction sites (Mayor of London, 2006)\(^\text{12}\). The following mitigation measures will be considered, appropriate to the level of risk identified:

- Minimise dust generating activities;
- Machinery and dust causing activities to be located away from sensitive receptors;
- Site personnel to be fully trained;
- Trained and responsible manager on site during working times to maintain logbook and carry out site inspections;
- Use water as dust suppressant where applicable;
- Re-vegetate earthworks and exposed areas;
- All vehicles to switch off engines when not in operation – no idling vehicles;
- Effective vehicle cleaning;
- Any loads entering and leaving site to be covered;
- Control site runoff of water / mud;
- On-road vehicles to comply to set emission standards; and
- Non Road Mobile Machinery (NRMM) to use ultra low sulphur diesel (ULSD) where available.

8.4 Terrestrial Ecology and Nature Conservation

8.61 For scoping purposes, terrestrial ecology is characterised through the main nature conservation designations.

**North of the Humber**

8.62 The main nature conservation designations to the north of the Humber include the Humber Flats, Marshes and Coast Special Protection Area (SPA), Humber Estuary Special Area of Conservation (SAC), Ramsar Site, Site of Special Scientific Interest (SSSI), and Spurn Head, which is designated as a National Nature Reserve (NNR).

8.63 Along the coast to the north of Spurn Head lies The Lagoons SSSI, which also falls within the Humber Flats, Marshes and Coast SPA and Ramsar site (see Figure 8-1).

**South of the Humber**

8.64 South of the Humber contains SPA, SAC, Ramsar and SSSI designations, Donna Nook and Saltfleetby Theddlethorpe NNRs. They extend along the coastline from Horse Shoe Point in the north to beyond the onshore Study Area to the south.

8.65 Further inland lies Tetney Blow Wells SSSI, a site managed as a Nature Reserve by Lincolnshire Wildlife Trust.

8.66 Small pockets of ancient woodland to the southwest of Grimsby and Immingham, and three Local Nature Reserves (LNRs) lie within 1 km of the outskirts of Grimsby (Bradley and Dixon Woods LNR, Cleethorpes LNR and Cleethorpes Country Park LNR).

8.67 Although at this time there are no proposed or candidate SPAs or SACs which may be affected by the onshore elements of Project one, consultation will be undertaken with Natural

\(^{12}\) This guidance has been produced by the Mayor of London, in association with the Air Pollution Planning and the Local Environment (APPLE) working group, comprising participants from the Greater London Authority and the Association of London. The BPG is designed to inform the planning process within London boroughs and assist developers in understanding the methods to control dust and emissions from construction and demolition activities. Although the proposed scheme is not located within London, the approach described in the BPG is considered to be appropriate for assessment of dust emissions.
England to determine whether any candidate or potential sites are to be identified during the EIA.

### 8.4.1 Data and Information to Inform EIA

8.68 International, national and local designated sites for landfall and cable route corridors have already been reviewed to support this scoping phase. Data sources include:

- Site notifications and further details of SACs, SPAs, Ramsar Sites, SSSIs, NNRs and Ancient Woodland provided by Natural England (2010); and
- Details of Local Nature Reserves, Sites of Nature Conservation Importance, Local Wildlife Sites and BAP habitats, also provided by Natural England (2010).

8.69 In addition, the following data sources will be reviewed to inform the EIA process:

- Biological records from the North and East Yorkshire Ecological Data Centre and Lincolnshire Environmental Records Centre;
- Ecological records from the Humber Industrial Nature Conservation Association;
- Ordnance survey map data;
- The National Biodiversity Network (NBN) Gateway (www.searchnbn.net); and
- National and local planning policy, where relevant to terrestrial ecology.

### 8.4.2 Methods Supporting EIA

8.70 A detailed desk-study will be undertaken during the EIA process, drawing on the data sources highlighted above, to establish the existing terrestrial ecological baseline potentially affected by the onshore components of Project One.

8.71 The onshore study area considered extends approximately 2 km from potential landfall sites, substation/converter station and cable route corridors (Figure 8-1). The extent of the onshore study area will be refined once specific landfall and cable route options are identified. Existing records of terrestrial fauna, flora and habitats held by the North and East Yorkshire Ecological Data Centre and Lincolnshire Environmental Records Centre will be reviewed, together with other published and unpublished information sources. The desk-study will also include consultation with relevant stakeholders and key groups, including Natural England, RSPB, Yorkshire Wildlife Trust and Lincolnshire Wildlife Trust to determine the survey methodologies and data sources.

8.72 After a preferred cable route has been identified through the robust consideration of alternatives within the study area boundary, an extended Phase 1 Habitat Survey will be undertaken in accordance with the standard method (JNCC, 2003) at the preferred landfall and substation/converter station sites and along the preferred cable route corridor to supplement and update the baseline. The Phase 1 Habitat Survey provides a nationally recognised means of classifying and mapping habitats, and highlighting areas and aspects requiring additional detailed survey. Sightings of protected species, signs of such species, and habitat that may support such species will be noted.

8.73 Depending on findings from preliminary studies and site visits, together with advice received from stakeholders, subsequent targeted surveys that may be considered include:

- Rare and scarce plants survey – arable field margins are identified within the UK Biodiversity Action Plan (BAP) as one of the highest priority habitats, containing 12 of the 62 flowering plants selected for most urgent action;
- Hedgerow surveys, undertaken in accordance with the Hedgerow Regulations 1997;
- National Vegetation Classification (NVC) in targeted areas;
- Micro-habitat assessment of sensitive areas such as sand dunes, which will include elements of species assemblage, structure and substrate stability.

Q41: With regard to terrestrial ecology and nature conservation, should any further data sources be consulted as part of the EIA process?
• Invertebrate surveys – undertaken in summer with particular emphasis on ancient woodlands, more diverse grassland communities and aquatic habitats;
• Bird surveys – a Common Bird Census, the optimum survey period for which is April-June, and breeding bird and wintering wildfowl surveys as required;
• Reptile surveys – undertaken between April – June and September;
• Great crested newt surveys undertaken mid-March – early June (with half the surveys between mid April – Mid May); and
• Mammal surveys – including, otter, water vole, badger, bat (offshore considerations for bats are discussed in Section 6.6), hare, dormouse undertaken at appropriate times of year.

8.74 All survey methodologies will be agreed with Natural England, if the surveys are required.
8.75 Data gathered through the desk-based study and subsequent surveys will be used to support the EIA. The EIA will be carried out in accordance with the Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the United Kingdom (2006) and other relevant guidance as appropriate.

8.4.3 Potential Project Impacts

8.76 A number of potential impacts have been identified from activities involving cable trenching, construction of substation/converter station foundations and any overhead line infrastructure (if required) and decommissioning of above ground infrastructure. These may include:

Construction Phase
8.77 The identified potential impacts on terrestrial ecology and nature conservation designations resulting from the construction of Project One are as follows:
• Temporary displacement of species as a result of construction activities;
• Potential habitat and species loss as a result of land-take for the new substation/converter station;
• Disturbance to habitats or species as a result of noise, vibration, lighting and construction activities associated with onshore cable route corridor and onshore jointing pit;
• Severance and habitat fragmentation, for example, through disruption to bat foraging routes caused by hedgerow removal as a result of cable trenching; and
• Temporary discharge of pollutants may have adverse impacts habitats and species during onshore construction works.

Operation and Maintenance Phase
8.78 The identified potential impacts on terrestrial ecology and nature conservation designations resulting from the operation and maintenance of Project One are as follows:
• Permanent displacement of species as a result of land-take for the new substation/converter station; and
• Disturbance to habitats or species as a result of noise from maintenance activities.

Decommissioning Phase
8.79 The identified potential impacts on terrestrial ecology and nature conservation designations resulting from the decommissioning of Project One are as follows:
• The potential impacts during decommissioning are considered to be similar to those previously described during construction; and
8.80 There may also be opportunities for habitat management and enhancement.

8.4.4 Potential Transboundary Impacts

8.81 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.4.5 Potential Cumulative Impacts

8.82 The onshore components of Project One alongside the construction, operation and maintenance, and decommissioning of other grid connection works within 10 km of the grid connection route may result in cumulative impacts on terrestrial ecology. Smart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts. Such impacts are likely to be similar to the potential Project One impacts identified above: habitat loss, loss of plant or animal species, disturbance, severance and fragmentation. These will be assessed through the EIA process.

8.4.6 Potential In-combination Impacts

8.83 Construction and operation of the onshore components of Project One alongside the construction, operation and decommissioning of other coastal development in the area (for example, related to ports, oil and gas industries, and industrial development) could result in in-combination impacts. In-combination impacts are likely to be similar to the potential project impacts identified above, and will be assessed through the EIA process.

8.4.7 Potential Mitigation and Monitoring

8.84 Once the survey work has identified the presence and extent of habitats and species potentially affected by the construction, operation, maintenance and decommissioning of Project One, appropriate mitigation measures that can be built into the design of the development will be identified, avoiding or reducing adverse impacts where possible. In addition, measures to enhance terrestrial ecology will also be identified.

8.85 Mitigation measures may include:

- Avoidance of designated nature conservation sites and features identified as ecologically important during scheme design;
- Seasonal constraints to construction operations, for example, to avoid disturbance of breeding birds;
- Sediment traps to avoid sediment laden run off from exposed ground polluting local watercourses;
- Appointment of a site-based environmental clerk of works, in consultation with the determining authority, to oversee the construction phase;
- Any construction access tracks to be located and fabricated using materials to minimise generation of runoff and/or drainage requirements, particularly during heavy rain;
- Implementation of pollution prevention measures to avoid pollution of watercourses; and
- Regular monitoring on site to ensure effectiveness of mitigation measures.

8.86 Species specific mitigation will be identified as appropriate following survey work and the results of the impact assessment.

8.5 Archaeology and Cultural Heritage

8.87 The archaeological evidence for the earliest periods of the human occupation was destroyed by the last Devensian ice sheet and only a few finds dating from the Palaeolithic are known within the region.

8.88 However, since the early Holocene the area around the modern Humber Estuary has been a focus of human activity and settlement. The region is well known for its early Mesolithic sites.
such as Starr Carr in the Vale of Pickering, dating from around 9,500 to 6,300 BC. This was followed by the Neolithic, which saw the appearance of the first farmers in Holderness and Lincolnshire.

8.89 Sea levels reached roughly its current stand c. 3,500 BP and resulted in the accretion of alluvium from this time onwards in the Humber estuary. Much of the alluvium visible today was deposited during the Roman period (43 – 410 AD).

8.90 The pollen record for the region shows a thinning of the woodland canopy, which is indicative of clearances for farming and settlements from as early as the Bronze Age and Iron Age. This evidence for an increasing human population is supported by the discovery of several Bronze Age logboats (at North Ferriby, Appleby and Brigg), which also suggests that the Humber Estuary was an important transport artery for the region.

8.91 Archaeological sites can be expected to range in date from the Mesolithic to the modern era. Rapid erosion and cliff collapse in the region eroded out many archaeological material from the Bronze and Iron Ages to modern monuments (largely deposited on the beach and in the intertidal zone).

8.92 The sections below describe the features of highest environmental value to the north and south of the Humber.

**North of the Humber**

8.93 To the north of the Humber Estuary (see Figure 8-1) are several Listed Buildings including churches, farmhouses and windmills, which are typically located within the small scattered settlements such as Roos, Easington, Hollym and Holmpton. Parts of Hedon, a medieval town, are designated as a Scheduled Ancient Monument (SAM). A further SAM is located on the north bank of the Humber Estuary, called Paull Point Battery, consisting of a coastal artillery battery and submarine mining establishment.

**South of the Humber**

8.94 The pattern is similar to the south of the Humber Estuary (see Figure 8-1) with scattered Listed Buildings located within the small settlements. For example, St Mary's Church in Covenham St Mary, a farmhouse at North Thoresby and the Church of St Edmund in Rilby. Grimsby's industrial heritage is also reflected in features such as the listed West Lock to Royal Dock. Key archaeological features include Thornton Abbey Augustinian monastery and the site of a medieval nunnery near Brocklesbury.

**8.5.1 Data and Information to Inform EIA**

8.95 An initial review of the main heritage designations, including nationally designated sites, listed buildings and Conservation Areas has been undertaken as part of initial landfall and cable route corridor studies. Data sources include:

- Details of Listed Buildings, Scheduled Ancient Monuments, Battlefields, Registered Parks and Gardens, World Heritage Sites and historical air photographs from the National Monument Record;
- Historic Environment Records and Conservation Areas from Lincolnshire County Council, North Lincolnshire Council, North East Lincolnshire Council, Hull City Council and the Humber Archaeological Partnership; and
- Historic mapping including tithe maps and 1st addition Ordnance Survey maps and historic charts held by the United Kingdom Hydrographic Office.

Q43: With regard to archaeology and cultural heritage, should any further data sources be consulted as part of the EIA process?

**8.5.2 Methods Supporting EIA**

8.96 A detailed desk-based archaeological assessment will be carried out in accordance with the Institute of Archaeologists Standards and Guidelines for desk-based assessments. The desk-based study shall include a review of information from the National Monument Record, Historic Environment Record, list descriptions for every listed building and MAGIC
Other primary and secondary documentary resources will be sourced from the British Library, the County Records office, the Archaeology Data Service website (www.ads.ahds.ac.uk) and historic maps of the area. In addition a walk-over will be carried out by a suitably qualified and experienced archaeologist. All designated historic assets within the Project One study area will be visited.

The desk-based study will consider Grade I and II listed buildings, conservation areas, Scheduled Ancient Monuments, and Registered Parks and Gardens within 5 km of the proposed substation/converter station and within 500 m of the centre of each cable route corridor, Grade II listed buildings within 2.5 km of the proposed substation/converter station and within 500 m of the centre of each cable route corridor, and below ground archaeological remains within a 1 km radius of the proposed substation/converter station and within 500 m of the centre of each cable route corridor.

Consideration will be given as to whether intrusive archaeological evaluation and non-intrusive geo-physical surveys are appropriate. This consideration will be based on the results of the desk-based study.

The significance of potential impacts will be assessed by taking into account the potential magnitude of impacts (e.g., a high magnitude impact could involve the total loss of a heritage asset) and the sensitivity of heritage assets. The sensitivity of heritage assets will depend on factors such as the condition of the site and the perceived heritage value/importance of the site. The sensitivity of the receptor (heritage asset) is defined by its importance in terms of national, regional or local statutory or non-statutory protection and grading of the asset.

The sensitivity of heritage assets, together with the magnitude of change, defines the significance of the impact. A matrix led approach, guided by professional judgement, will be used to identify impact significance.

### 8.5.3 Potential Project Impacts

#### Construction Phase

The identified potential impacts on archaeology and cultural heritage resulting from the construction of Project One are as follows:

- Direct impacts involving physical alteration or destruction of heritage assets as a result of cable trenching or construction of substation/converter station foundations and any potential overhead line infrastructure;
- Potential temporary impacts on historic monuments and buildings from noise and vibration during construction; and
- Indirect impacts involving an effect on the setting of a heritage asset, such as a scheduled ancient monument, listed building or a conservation area from above ground substation/converter station and/or any potential overhead line infrastructure.

#### Operation and Maintenance Phase

The identified potential impacts on archaeology and cultural heritage resulting from the operation and maintenance of Project One are as follows:

- No permanent impacts are anticipated on archaeology and cultural heritage during operation and maintenance activities.

#### Decommissioning Phase

The potential impacts during decommissioning are considered to be similar to those previously described during the construction phase.

### 8.5.4 Potential Transboundary Impacts

No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.
8.5.5 Potential Cumulative Impacts

8.106 There is no set guidance on the assessment of cumulative impacts upon heritage assets. The cumulative assessment will consider cumulative impacts with other grid connection infrastructure projects. The visual impact of multiple projects will be assessed within the Landscape and Visual Chapter.

8.107 Smart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.108 Cumulative ZTVs will be used in order to gain a theoretical picture of visibility of the above ground elements of relevant projects on designated historic assets. Impacts could arise where a substantial percentage of a view, considered to represent the ‘setting’ of a feature, is affected by a number of projects.

8.5.6 Potential In-combination impacts

8.109 The assessment of in-combination impacts will consider impacts of the onshore infrastructure alongside other projects within the area from other industries/activities e.g., port development, industrial development, other coastal infrastructure for example associated with oil and gas activities.

8.5.7 Potential Mitigation and Monitoring

8.110 Direct impacts on the historic environment will be avoided where possible in the identification of a preferred cable route corridor. If features are present in close proximity, adoption of construction practices to minimise the width of disturbance or to avoid surface disturbance may be employed.

8.111 Where archaeological remains cannot be avoided, detailed investigations may be needed prior to construction, or at the start of the construction period to record any remains.

8.6 Landscape, Seascape and Visual Amenity

8.112 Figure 8-2 indicates national landscape character areas, which are reflective of the type of features present. Areas designated for their landscape importance are shown previously in Figure 8-1.

Figure 8-2 National Character Areas
Landscape Character Assessment of East Riding of Yorkshire

8.113 Onshore infrastructure relevant to this scoping study is defined by the study area boundary presented in Figure 8-2. The coastline consists of flat or gently undulating topography with much of it consisting of glacial till cliffs, which creates a large scale landscape covered by open farmland and coastal farmland with little woodland cover. The main industrial areas of the northern Humber Estuary are centred on the city of Hull. Settlement is formed of scattered small villages and the larger settlements of, Hornsea and Withernsea. Key features and locations along the coastline include:

- Spurn Head Heritage Coast;
- Hornsea, Withernsea and scattered villages;
- Trans Pennine Trail; and
- National Cycle Network Route 65.

8.114 Further inland the flat and gently undulating topography continues across a low lying landscape. Farmland is interlaced with numerous dykes, water courses and water bodies. There are many public footpaths through the area. Settlements increase in scale to the larger towns of Driffield, Beverley, Heddon and the city of Kingston Upon Hull on the north edge of the Humber Estuary.

Landscape Character Assessment of North Lincolnshire

8.115 Much of the North Lincolnshire coastline is relatively low lying which extends further inland towards the Lincolnshire Wolds which morph slowly into gently undulating but more hilly topography. The south estuary edge is a landscape of flat topography, the coastal industrial area is to be found at the town of Barton upon Humber with farmland further inland.

Landscape Character Assessment of North East Lincolnshire

8.116 The topography of North East Lincolnshire is predominantly low lying at the coast which gently rises further inland towards the hills of the Lincolnshire Wolds. The south estuary edge is a landscape of flat topography, the coastal industrial areas are to be found at the towns of Immingham, Grimsby and Cleethorpes. Key features and locations in this area include:

- Industrial development is present at Killingholme, Immingham and Great Coates (Pyewipe Industrial Estate);
- Settlements comprise the town of Grimsby and clustered villages set back from the estuary edge;
- National Cycle Network Route 1;
- Public footpaths throughout the area; and
- Cleethorpes.

Landscape Character Assessment of North East Lincolnshire

8.117 The mouth of Humber Estuary is characterised by its wide areas of sand flats that extend along the East Lindsey Coastline. Inland, topography is relatively flat consisting of a farmed landscape with little woodland cover that is interlaced with numerous canals, dykes, drains and streams. Settlements consist of regular small villages and individual properties. Wind farms are present at Mablethorpe and Conisholme Fen. Key features and locations in this area include:

- Lincolnshire Wolds Area of Outstanding Natural Beauty;
- Public footpaths throughout the area;
- Villages including Saltfleetby; and
- Public viewpoints and parking areas along the coast.
8.6.1 Data and Information to Inform EIA

The following data sources will be use to inform the assessment of landscape and visual impacts:

- Ordnance Survey map data (including the location of key tourist destinations, and concentrations of visual receptors);
- Landscape designations across the area (see Figure 8-1);
- Relevant landscape character assessments;
- Information about weather conditions from the local meteorological office;
- Aerial photography;
- Natural England’s National Character Areas and the online Database of Landscape Character Assessments in England;
- National, regional and local planning policy, in terms of policies which are relevant to landscape, seascape or visual impacts; and
- Information about the proposed development and the construction process which can be made available.

Relevant Guidance

Relevant guidance from the Landscape Institute and Natural England will be followed:

- Countryside Agency/Scottish Natural Heritage (2003). Landscape Character Assessment Series Topic Paper 9: Climate change and natural forces, the consequences for landscape character. Countryside Agency and Scottish Natural Heritage; and

8.6.2 Method Supporting EIA

Key viewpoints will be agreed with the local authorities and Natural England. These viewpoints will be used as an assessment tool in order to inform examination and description of impacts upon visual amenity and views.

A number of viewpoint locations will be considered, focussing on the substation/converter station (with a radius of 5 km from the substation/converter station), the underground grid connection route (1 km radius and along the length of the route), any stretches of possible
overhead line (between 2 km and 10 km radius depending on the nature and height of overhead line infrastructure), and consider sensitive visitor destinations.

8.122 The number of viewpoints and their locations will be selected following determination of the preferred landfall point and cable route. North Killingholme village may be a potential viewpoint to assess the impact of the substation/converter station.

8.123 The significance of onshore landscape and visual impacts will be judged by considering the nature and sensitivity of the existing landscape, and visual receptors, against the proposed magnitude of change (e.g. nature, scale, layout and proximity of the proposed project).

8.124 Impacts will be assessed in accordance with the Landscape Institute and the Institute of Environmental Management and Assessment (Second Edition 2002). Guidelines for Landscape and Visual Impact Assessment.

8.125 The work will be informed and illustrated through the preparation of ZTVs for the proposed substation/converter station and any potential overhead sections of grid infrastructure. ZTVs will be modelled to show the extent of theoretical visibility, across the study area. Impacts across the onshore study area will be reported, focusing upon significant impacts.

8.126 Alongside the ZTVs, a series of maps will be produced showing the distribution of landscape character areas, designated landscapes and the location of viewpoints and other sensitive receptors in the study area. These maps will inform the assessment of potential impacts upon these areas.

8.6.3 Potential Project Impacts

Construction Phase

8.127 The identified potential impacts on landscape, seascape and visual amenity resulting from the construction of Project One are as follows:

 The jointing pit will be underground and as such is not likely to give rise to any permanent impacts unless valuable landscape features are displaced and not mitigated. During construction there are likely to be minor visual impacts;

 Underground sections of the grid connection are not likely to give rise to any permanent impacts unless valuable landscape features are lost or displaced and not mitigated. Limited stretches of overhead lines, if selected, could give rise to locally significant impacts depending on the route and sensitivity of the landscape and receptors. During construction there may be direct landscape and visual impacts due to the displacement of landscape features and the presence of construction activity in views; and

 The substation/converter station at Killingholme will be within an existing industrial area and as such is not likely to give rise to any permanent significant impacts. During construction there are unlikely to be significant impacts due to the industrial nature of the area and screening provided by existing structures.

Operation and Maintenance Phase

8.128 The identified potential impacts on landscape, seascape and visual amenity resulting from the operation and maintenance of Project One are as follows:

 The substation/converter station at Killingholme will be within an existing industrial area and as such is not likely to give rise to any significant visual impacts. No impacts are anticipated during this phase of the project; and

 Underground sections of the grid connection are not likely to give rise to any permanent impacts. Limited stretches of overhead lines, if selected, could give rise to locally significant impacts depending on the route and sensitivity of the landscape and receptors.

Decommissioning Phase

8.129 The identified potential impacts on landscape, seascape and visual amenity resulting from the decommissioning of Project One are as follows:
At the time of decommissioning, onshore infrastructure will be retained if it can be used for another purpose. If this is not possible then above ground features will be removed including any stretches of overhead line that may exist. The underground cable system would be isolated and left in place to avoid unnecessary environmental disturbance. It is assumed at this stage that substation/converter station plant will be dismantled, with any buildings demolished and removed from site, with any landscaping works remaining in place;

- During decommissioning there will be short term landscape and visual impacts from machinery/equipment and activities on the site including dismantling of plant, demolition of buildings and removal from site. Impacts are likely to be less adverse than those reported during construction as the underground cable is likely to remain in place; and

- Following decommissioning there is unlikely to be any residual impact on the landscape or visual receptors.

8.6.4 Potential Transboundary Impacts

8.130 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.6.5 Potential Cumulative Impacts

8.131 Construction, operation and maintenance and decommissioning of the onshore components including other grid connection works of Project One could result in cumulative impacts. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.132 The Landscape and Visual Impact Assessment (LVIA) will assess cumulative impacts within a corridor centred on any potential overhead line infrastructure (the corridor would be between 4 km and 20 km wide depending on the nature and height of overhead line infrastructure) and within the substation/converter station study area (a 5 km radius around the substation/converter station).

8.133 Cumulative landscape and visual impacts from underground cables are unlikely to occur and this element is to be scoped out of the cumulative assessment.

8.6.6 Potential In-combination impacts

8.134 Construction, operation and maintenance and decommissioning of the onshore components of Project One including other similar development in the area (for example, related to ports, oil and gas industries, and industrial development) could result in in-combination impacts. These are only likely to occur for the substation/converter station and if sections of overhead line are used, and will be assessed within the study areas as per the cumulative methodology.

8.6.7 Potential Mitigation and Monitoring

8.135 Mitigation measures will include avoidance of sensitive features through siting and design, and considering planting to replace any vegetation which may need to be removed. Typical good construction practice to reduce adverse impacts (hoarding, maintaining a tidy site, topsoil stripping and storage etc) will also be employed as appropriate.

8.136 Mitigation may be monitored on site by an environmental clerk of works.

8.137 Specific mitigation for the grid connection route may include:

- Avoidance of sensitive landscape features including historic features, historic parks and gardens, woodlands and river corridors;

- Restoration of displaced landscape features including woodland, hedgerows, fences and walls; and

- Any potential overhead sections of the grid connection should where possible avoid prominent landscape features, follow a direct line, avoid crossing skylines and avoid
convergence with other overhead lines and where applicable make use of routes through industrial zones, in line with National Grid’s Holford Rules (National Grid, updated).

8.138 Specific mitigation for the substation/converter station may include tree planting and earthworks to provide screening, and sensitive choice of materials for the substation/converter station building.

8.7 Flood Risk

North of the Humber

8.139 The Environment Agency’s flood risk map (2010a) indicates that large areas to the north of the Humber Estuary are at risk of flooding from rivers or sea, with only some sections protected by flood defences. The affected areas are adjacent to the Humber Estuary, extending to between 3 km and 5 km inland.

South of the Humber

8.140 A large proportion of the area to the south east of Grimsby is at risk of flooding from rivers or sea, with only some areas protected by defences. This is mirrored along the extent of the Humber Estuary to the north west of Grimsby. The substation/converter station location at the Killingholme Power Station lies outside the areas identified as being at risk from flooding depicted on the Environment Agency’s flood risk map (2010a), therefore, this area has a low probability of flooding.

Q46: Should the issue of flood risk be considered separately from Water Resources?

8.7.1 Data and Information to Inform EIA

8.141 The following data sources will be reviewed to inform the assessment process:

- Environment Agency flood maps (2010a);
- Previous flood risk assessments or reports in the area;
- Ordnance survey maps; and

Q47: With regard to flood risk, should any further data sources be consulted as part of the EIA process?

8.7.2 Method Supporting EIA

8.142 The initial step in the assessment of flood risk is the desk-based collection of baseline data and consultation with the Environment Agency and local water authorities. This desk-study will include consideration of maps and published information, followed by a walkover survey to ascertain the current site conditions.

8.143 A Flood Risk Assessment (FRA) for the proposed substation/converter station may be prepared, to take into account the impact that increasing the area of hard standing may have on the surface water run-off regime. As noted above, the site falls outside of those areas identified as being at risk from flooding. However, if the development footprint exceeds 1 ha, a FRA will be required in line with Planning Policy Statement 25 (PPS25): Development and Flood Risk (Communities and Local Government, 2010), the Government’s spatial planning policy on assessing the appropriateness of developments in the context of flood risk. This will look at vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flooding risk elsewhere.

8.144 A FRA may also be undertaken to investigate the effect of the cable route corridor on flood risk. The latter would include the identification of watercourses and the potential impacts of any crossing points (including potential impacts on the functional floodplain). The FRAs, if required, would be carried out according to best practice guidance, as provided in PPS25.
8.7.3 Potential Project Impacts

**Construction Phase**

8.145 The identified potential impacts on flood risk resulting from the construction of Project One are as follows:

- Temporary changes to natural surface water drainage patterns and run-off rates, and resultant potential for flooding on, or arising from construction of above ground infrastructure.

**Operation and Maintenance Phase**

8.146 The identified potential impacts on flood risk resulting from the operation and maintenance of Project One are as follows:

- Permanent increase in surface run-off from as a result of increased impermeable surface areas, and resultant potential for flooding on, or arising from above ground infrastructure; and
- Temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from maintenance of above ground infrastructure.

**Decommissioning Phase**

8.147 The identified potential impacts on flood risk resulting from the decommissioning of Project One are as follows:

- Temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from the decommissioning of above ground infrastructure.

8.7.4 Potential Transboundary Impacts

8.148 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.7.5 Potential Cumulative Impacts

8.149 The cumulative impact assessment will consider impacts from the onshore component of Project One alongside the construction, operation and maintenance and decommissioning of other grid connection works in the surrounding area. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.7.6 Potential In-combination impacts

8.150 The in-combination assessment will consider impacts arising from the construction, operation and maintenance and decommissioning of the onshore component of Project One alongside other coastal development (e.g., related to ports, oil and gas industries, industrial development). The impacts would be similar to the potential project impacts identified above, namely temporary and permanent alterations to surface run-off and water drainage patterns, resulting in changes to flood risk.

8.7.7 Potential Mitigation and Monitoring

8.151 Appropriate measures will be put in place to mitigate potential adverse impacts on flood risk. For example, through use of sustainable drainage techniques, ensuring that the development will not lead to an increased risk of flooding, either onsite or downstream.
8.8 Traffic and Transport

North of the Humber

8.152 The main transport route in the area to the north of the Humber Estuary is the A1033 from Kingston Upon Hull to Withernsea via Patrington. The remainder of the roads are Class B and minor roads. The area does not contain a railway line and the nearest is Kingston Upon Hull, which is the location of an international ferry port, linking with Rotterdam and Zeebrugge.

South of the Humber

8.153 The area to the south of the Humber contains a number of road and rail transport links. The main road artery is the dual carriageway A180, which runs from Scunthorpe located to the west of the area via Immingham to Grimsby. Extending out from Grimsby to the south east, south and south west are single carriageway A roads, the A1031, A16 and A46 respectively. The A1031 follows the coast from Grimsby to Mablethorpe. The main railway line also runs from Scunthorpe to Grimsby, with branch lines serving the Immingham Docks and a number of small villages in the northern part of the area. The railway line does not extend to the south of Grimsby.

8.8.1 Data and Information to Inform EIA

8.154 Baseline road traffic information will be sought from the Local Highways Authority to identify the current capacity of the affected road network. In areas where data does not currently exist, information will be supplemented by further traffic surveys. Baseline data on railway lines and services will be obtained from OS mapping, Network Rail and Train Operating Companies.

8.8.2 Method Supporting EIA

8.155 Baseline studies will identify potential road network constraints and inform potential routes for delivery and construction and decommissioning vehicles. The Local Highways Authority will be consulted during this period to ascertain any potential issues with the proposed access routes. The location of railway lines and potential disruption to rail services as a result of cable route construction under railway lines will be assessed.

8.156 Transport movements associated with the onshore works will be identified, followed by a desk-top review to identify the key locations where transport issues may be raised. A site visit of access routes and key locations may be carried out if required, and the Local Highways Authority consulted.

8.157 A desk-top study will be undertaken to ascertain the likely potential disruption to rail services as a result of cable route construction under railway lines.

8.158 The assessment of impacts on the local road network will assess the flows predicted as a result of construction of Project One against existing baseline flows. The scope and duration of predicted impacts will be quantified in terms of phases of delivery, construction and operation.

8.159 The assessment will be based on the following guidance:
- The Department for Transport (March 2007). Guidelines on Transport Assessments; and

8.160 The impact assessment methodology will be agreed in consultation with the Local Highways Authority (LHA) and will determine the criteria by which impact on the road network will be assessed and measured.

8.161 An assessment of the potential impact of disruption to rail services as a result of cable route construction under railway lines will be undertaken in consultation with Network Rail.
8.8.3 Potential Project Impacts

Construction Phase

8.162 The identified potential impacts on traffic and transport resulting from the construction of Project One are as follows:

- The proposed development has the potential to affect the local road network during the construction phase through delivery of machinery, concrete, cabling, aggregate and sand, and through the arrival and departure of construction workers;
- Depending upon the change in traffic flows predicted to occur as a result of the proposed development, potential impacts that will be assessed are: severance, driver delay, pedestrian delay, pedestrian amenity, fear and intimidation, and accidents and safety; and
- Project One also has the potential to result in temporary delays to public transport services as a result of cable route construction under railway lines or impacts on road networks.

Operation and Maintenance Phase

8.163 The identified potential impacts on traffic and transport resulting from the operation and maintenance of Project One are as follows:

- Although routine maintenance visits will require vehicles to access the landfall site and substation/converter station during operation, it is not anticipated that these will have a significant impact on the local traffic or transport during the operation of the onshore project infrastructure.

Decommissioning Phase

8.164 The potential impacts during decommissioning are considered to be similar to those previously described during construction.

8.165 Traffic will be generated during the decommissioning stages, although to a lesser extent than during the construction phase.

8.8.4 Potential Transboundary Impacts

8.166 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.8.5 Potential Cumulative Impacts

8.167 Significant cumulative traffic and transport impacts associated with the development with other grid connection construction activities are considered to be unlikely. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

8.8.6 Potential In-combination Impacts

8.168 In-combination impacts arising from the proposed development alongside other projects within the area from other industries/activities e.g., port development, industrial development, other coastal infrastructure for example associated with oil and gas activities are considered to be unlikely. However, the potential for in-combination impacts to occur will be assessed as part of the EIA process.

8.8.7 Potential Mitigation and Monitoring

8.169 A Traffic Management Plan (TMP) will be prepared for the construction and decommissioning phases of the onshore development. The TMP will include mitigation measures aimed at controlling environmental impacts that could occur during construction, for example:

- Co-ordinated timing of site deliveries to ensure that disruption to local residents and other highway users is reasonably minimised;
• Construction vehicles and site personnel will be instructed to use only the approved access routes to the site; and
• Following discussion and agreement with the local highway authority, appropriate information and signs will be provided on the approaches to the proposed site access.

8.170 Where practicable, measures will be implemented to minimise delays to rail services as a result of cable route construction under railway lines such as timing construction work to avoid peak travel times.

8.9 Noise and Vibration

North of the Humber

8.171 In line with the rural nature of this area, North of the Humber ranks highly in terms of tranquillity according to the Campaign for the Protection of Rural England (CPRE) tranquillity maps of England.

South of the Humber

8.172 The rural parts of South of the Humber also rank highly in terms of tranquillity. However, the urban and industrial nature of the Humber Estuary means that areas around Immingham, Cleethorpes and Grimsby are rated as less tranquil.

8.9.1 Data and Information to Inform EIA

8.173 CPRE tranquillity maps provide a high level indication of the noise environment.

Q49: With regard to noise and vibration, should any further data sources be consulted as part of the EIA process?

8.9.2 Method Supporting EIA

8.174 Site surveys will be used to identify key groups of sensitive receptors in the areas around the proposed landfall, substation/converter station and cable route corridor.

8.175 In assessing the impact of construction and decommissioning noise and vibration, it is usual to accept that the associated works are of a temporary nature. The principal UK guidance on construction noise is contained in BS5288:2009 “Code of practice for noise and vibration control on construction and open sites”. Predictions of construction and decommissioning noise will be made referencing typical activity emission levels and likely variations in noise levels at surrounding receiver locations within 300 m of the cable route, using the methodology set out in BS5228:2009. This assessment will identify if and when predicted noise levels may be above standard guideline limits, particularly taking into account the rural character of much of the cable routes and the different construction activities used throughout the construction programme. Construction noise management procedures will also be determined. Consideration will also be given to the potential impact of construction traffic on sensitive receptors in the area where a significant change in flow is predicted during construction.

Q50: Do you agree with the extent of the study area for noise sensitive receptors?

8.9.3 Potential Project Impacts

Construction Phase

8.176 The identified potential impacts of noise and vibration resulting from the construction of Project One are as follows:

• Noise and vibration from activities carried out on the surface along the cable route (mainly moving and excavation);
• Noise and vibration from construction activities at the substation/converter station site including landscaping;
Noise and vibration from directional drilling and/or tunnelling activities;
Noise and vibration from off-site vehicle and plant equipment movement on the public road network; and
Noise and vibration from the operation of mobile and static plant equipment and heavy goods vehicles servicing the cable construction corridor and substation/converter station, delivering or removing materials (including spoil and fill) and plant.

Operation and Maintenance Phase
8.177 The identified potential impacts of noise and vibration resulting from the operation and maintenance of Project One are as follows:

- There are unlikely to be any noise and vibration effects relating to operational or maintenance traffic but operational noise effects may arise from the operation of the substation/converter station. Should the substation/converter station site be located in proximity to residential properties (which is unlikely given the proposed connection location at Killingholme power station), an assessment would be required to determine whether operational noise emissions would be likely to have significant environmental effects including potentially audible transformer ‘hum’ at a frequency of 100 Hz.

Decommissioning Phase
8.178 The potential impacts during decommissioning are considered to be similar to those previously described during the construction phase.

8.9.4 Potential Transboundary Impacts
8.179 No transboundary impacts are anticipated and have therefore been scoped out of the EIA process.

8.9.5 Potential Cumulative Impacts
8.180 Significant cumulative noise impacts associated with the development with other grid connection construction or decommissioning activities are considered to be unlikely. SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce impacts.

Potential In-combination Impacts
8.181 In-combination impacts arising from the proposed development alongside other projects within the area from other industries/activities e.g., port development, industrial development, other coastal infrastructure and oil and gas activities are considered to be unlikely. However, the potential for in-combination impacts to occur will be assessed as part of the EIA process.

8.9.6 Potential Mitigation and Monitoring
8.182 The following best practicable means of noise and vibration control will be utilised where appropriate:
- Selection of the most appropriate methods and plant to minimise the level and duration of noise and vibration generated;
- Sensitive location of static plant items;
- Screening and/or enclosure of temporary generators and other noisy plant items;
- Adequate maintenance/lubrication of plant items;
- Shut down of engines when not in use;
- Specification of appropriate access points, haul routes and vehicle standing areas to minimise waiting times and the use of reverse alarms;
- Restriction of vehicle movements to acceptable times;
- Monitoring of noise and vibration; and
- Careful routeing and speed limits for HGVs.
8.183 The need for mitigation associated with the substation/converter station will be considered, and options could include bunding or screening.

8.10 Socioeconomics, Recreation and Tourism

8.10.1 General Description

Socioeconomics

8.184 This section considers the socio-economic environment of the ‘socio-economic hinterland’ which is referred to as the ‘study area’. The study area includes those Local Authority (LA) areas which are most likely to be affected by Project One in relation to socio-economics and tourism. These LA areas include:

- East Riding;
- Kingston upon Hull;
- North Lincolnshire;
- North East Lincolnshire;
- East Lindsey; and
- West Lindsey.

8.185 The population of the hinterland was approximately 1.15 million in 2009, around 2% of the total population of England. The area’s population has grown in line with the rest of England over the last two decades. However, within the study area, population growth rates have varied considerably; East Riding of Yorkshire and East and West Lindsay have seen growth of more than 15% since 1989 whereas Hull and North East Lincolnshire have experienced very low or negative population growth (Table 8-1).

<table>
<thead>
<tr>
<th>Area of interest</th>
<th>2009 population</th>
<th>1989 - 2009 population change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of interest</td>
<td>1,146,900</td>
<td>8.5%</td>
</tr>
<tr>
<td>England</td>
<td>51,809,700</td>
<td>9.0%</td>
</tr>
</tbody>
</table>

8.186 A slightly lower proportion of the working age population within the study area are economically active compared to England as a whole. In particular, East Lindsay and Kingston upon Hull have higher numbers of economically inactive people than the study area or England average. This is reflected in the fact that Kingston upon Hull has a much higher claimant count (5% of the working age population) compared to the study area as a whole or England (Table 8-2).

<table>
<thead>
<tr>
<th>Working age population</th>
<th>% economically active</th>
<th>% economically inactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>724,900</td>
<td>75.2</td>
</tr>
<tr>
<td>England</td>
<td>33,422,700</td>
<td>76.6</td>
</tr>
</tbody>
</table>

8.187 Overall, the level of employment in the study area has increased by 5% between 1998 and 2008, more slowly than the 9% growth experienced in England as a whole. This is mainly explained by the greater reliance on the manufacturing sector in the study area. In 2008, this reliance was still more pronounced in the study area, accounting for 24% of employment compared to 16% in England as a whole.

8.188 The largest sources of employment in the study area mirror the sources found at an English level - the public sector, retail, business activities and tourism related activities. However, there are a number of sectors in the study area which are ‘over-represented’ locally. These
are industries which are more important for the study area compared to their importance to England as a whole. Such industries include heavy manufacturing of metals, chemicals products and oil and gas. Other sectors which are over-represented include food and drink manufacturing and fishing.

8.189 There are a number of important elements of the study area’s infrastructure which are likely to be directly affected by the development of Project One. This includes the ports of Grimsby, Immingham, Hull and Goole. The Port of Immingham’s masterplan (ABP, 2010) recognises that “the South Humber Bank provides excellent opportunities to site manufacturing and assembly services and the existing port facilities have capacity to service the associated shipping requirements”. These port facilities are well placed to potentially benefit from the Project One development.

Recreation and Tourism

8.190 Tourism can be measured approximately by using business data for selected industries. Using Visit Britain’s (Visit Britain, 2010) definition of which sectors make up tourism\(^{13}\), more than 33,000 people work in the tourism industry within the study area (7% of all employees) and there are a total of almost 4,000 business units involved in the tourism industry. According to Visit England (Visit Britain, 2009) research, there were a total of almost 20 million trips to Yorkshire & Humber and the East Midlands in 2009, with an associated total spend of £2.5 billion (Table 8-3).

\(\text{Table 8-3 Value of tourism in 2009, Yorkshire & Humber and East Midlands}\)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Yorkshire &amp; Humber</th>
<th>East Midlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of trips (millions)</td>
<td>10.6</td>
<td>7.8</td>
</tr>
<tr>
<td>Number of bed nights (millions)</td>
<td>29.6</td>
<td>21.9</td>
</tr>
<tr>
<td>Total spend (£ million)</td>
<td>1,540</td>
<td>1,051</td>
</tr>
</tbody>
</table>

North of the Humber

8.191 The coastline to the north of the Humber attracts tourists to the various caravan parks and holiday chalet developments, in particular around Withernsea and Easington.

8.192 Spurn Head is a popular area for recreation, with Spurn Point National Nature Reserve and Spurn Heritage Coast attracting people for bird watching, sea fishing and walking. The Spurn Bird Observatory is also located at Spurn Head.

8.193 There is no contiguous footpath along the coast, but Public Rights Of Way (PROW) follow the coast in places (including along the length of Spurn Head), or lead to the coast. There is also a network of PROW through inland agricultural land which covers much of the area. The Trans Pennine Trail and National Cycle Network Route 65 (Figure 8-1) also cross the area to the north of the Humber.

8.194 East Riding of Yorkshire Council is developing a Hornsea Seafront development and investment plan. Whilst this is primarily focused on Hornsea itself, which is beyond the onshore infrastructure area of search, the potential for a cycle link from Hornsea south to Withernsea is under consideration as part of this initiative.

8.195 The north bank of the Humber is also accessible for recreation, with a PROW running from the car park at Easington Bank to Welwick Bank, and footpaths running from Hedon, a medieval town, to the north bank of the Humber and along the estuary mouth.

South of the Humber

8.196 To the south of the Humber Estuary, Cleethorpes is a key tourist area. It is a traditional and popular seaside town, with hotel accommodation and several caravan and holiday parks. Attractions include the seafront, pier and beaches. Along the coast to the south of Cleethorpes, there are several National Nature Reserves, with visitor information, parking and beach access, including Donna Nook and Saltfleetby Theddlethorpe.

\(^{13}\) Includes hotels, camping sites etc, restaurants, bars, activities of travel agencies etc, library, archive and museums etc, sporting activities, other recreational activities
8.197 A Public Right of Way (PROW) runs along the southern bank of the Humber Estuary from Goxhill Haven south along the Estuary shoreline as far as Killingholme. A further footpath continues from Immingham Dock as far as the northern developed edge of Grimsby. The coast to the south of Cleethorpes also has good access, with a footpath running from the southern edge along stretches of the coast to the south.

8.198 In the west of the area of search (see Figure 8-1) lies the eastern edge of the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB). The countryside, villages and market towns of the AONB attract visitors for walking and sight-seeing. The Wanderlust Way is located within the eastern edge of the AONB. It is a 20 mile walking route passing through the small villages, woods and farmland of the AONB. The remainder of the area of search is also accessible for recreation via various PROW.

8.199 In terms of the economy of the area (based on data for the East Midlands region, within which the majority of the area south of the Humber falls) the unemployment rate was 7.3% (as at June 2010). The region has an above-average proportion of residents employed in routine occupations requiring a low level of skills or qualifications, 13% in 2008 compared with 11% in the UK as a whole.

8.10.2 Data and Information to Inform EIA

8.200 There is no specific guidance for assessing the impact of offshore wind farms on socio-economics or tourism. However, the socio-economic and tourism impact assessments will draw on a range of sources. Table 8-4 lists the key socio-economic and tourism topics which will be covered by the baseline assessment, the measures used to assess the topics and the data sources which will be used.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Measure</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Population</td>
<td>ONS Mid-year population estimates</td>
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<tr>
<td></td>
<td>Population structure:</td>
<td>ONS Mid-year population estimates</td>
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<tr>
<td></td>
<td>- sex</td>
<td></td>
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<tr>
<td></td>
<td>- age</td>
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<td></td>
<td>- working age</td>
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<td></td>
<td>Dependency ratios</td>
<td>ONS Mid-year population estimates</td>
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<tr>
<td></td>
<td>Changes over time</td>
<td>ONS Mid-year population estimates</td>
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<tr>
<td></td>
<td>Population projections</td>
<td>ONS Sub-national population projections</td>
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<tr>
<td>Industry</td>
<td>Main sectors by businesses:</td>
<td>Annual Business Inquiry</td>
</tr>
<tr>
<td></td>
<td>- size</td>
<td></td>
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<td></td>
<td>- change over time</td>
<td></td>
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<td></td>
<td>- location quotients</td>
<td></td>
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<tr>
<td></td>
<td>Main sectors by number of employees:</td>
<td>Annual Business Inquiry</td>
</tr>
<tr>
<td></td>
<td>- size</td>
<td></td>
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<td></td>
<td>- change over time</td>
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<td>- location quotients</td>
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<td></td>
<td>Key employers</td>
<td>Existing regional baseline studies; consultations</td>
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<tr>
<td></td>
<td>Enterprise ‘birth’ and ‘death’ rates</td>
<td>ONS Business demography</td>
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<tr>
<td></td>
<td>Business survival rates</td>
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<td>GVA of main industrial sectors</td>
<td>ONS Regional GVA estimates</td>
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<td>Shrinking or expanding sectors?</td>
<td>ONS Regional GVA estimates Annual Business Inquiry</td>
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<td></td>
<td>- compare change in GVA and employment</td>
<td></td>
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<tr>
<td>Topic</td>
<td>Measure</td>
<td>Sources</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Employment and economic activity</td>
<td>Economic activity:</td>
<td>Annual Population Survey</td>
</tr>
<tr>
<td></td>
<td>- economically active – FT, PT, self-employment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- economically inactive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Occupational breakdown</td>
<td>Annual Population Survey</td>
</tr>
<tr>
<td></td>
<td>Earnings per employee</td>
<td>Annual Survey of Hours and Earnings</td>
</tr>
<tr>
<td></td>
<td>GVA per employee</td>
<td>Online National Statistics/Scottish Annual Business Statistics</td>
</tr>
<tr>
<td>Transport and commuting</td>
<td>Review of transport infrastructure</td>
<td>Desk research and consultations (to be identified as study progresses)</td>
</tr>
<tr>
<td></td>
<td>Commuting and travel patterns</td>
<td>2001 Census</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ferry operators</td>
</tr>
<tr>
<td>Tourism and leisure</td>
<td>Review of existing attractions</td>
<td>Desk research and consultations (to be identified as study progresses)</td>
</tr>
<tr>
<td></td>
<td>Tourist numbers</td>
<td>Visitor Attraction Monitor data, RDAs, Visit England.</td>
</tr>
<tr>
<td></td>
<td>Value of tourism</td>
<td></td>
</tr>
</tbody>
</table>

8.201 In addition to the baseline sources, a number of regional level and national level resources will be used in assessing the potential socio-economic and tourism impacts of Project One:

- **National level reports and resources:**
  - BWEA (2009). UK Offshore Wind: Charting the Right Course: Building the Offshore Wind Supply Chain;
  - The Crown Estate (2010g). A Guide to an Offshore Wind Farm;
  - Renewables East (2005). Scroby Sands Supply Chain Analysis;
  - Scottish Government (2008). The economic impacts of wind farms on Scottish tourism; and

- **Regional resources include:**
  - East Lindsey District Council (2010). Core Strategy Options Paper;
  - East Midlands Regional Assembly. The East Midlands Energy Challenge – Regional Energy Strategy;
8.202 Further information including PROWs, bathing beaches, Country Parks, and tourist infrastructure such as caravan parks will be considered within the EIA process.

8.10.3 Methods Supporting EIA

8.203 The socio-economic assessment will consist of the following stages:

- Socio-economic baseline assessment for areas affected;
- A review of the socio-economic impact literature, existing evidence and relevant regional and national reports;
- Consultations with project developers and other relevant stakeholders; and
- Development of an economic impact model.

8.204 The socio-economic baseline assessment will cover:

- Population;
- Employment and economic activity;
- Industry;
- Infrastructure;
- Quality of life;
- Income and wealth;
- Tourism and leisure;
- Fishing; and
- Commercial shipping.

8.205 The baseline provided in the socio-economics and tourism ES chapter will identify and assess the existing socio-economic characteristics of the study area. This will include an assessment of the level of tourism activity and also a review of the existing facilities and services which will be directly relevant to the development, for instance the port facilities in

Q51: With regard to recreation, socioeconomics and tourism, should any further data sources be consulted as part of the EIA process?
the study area. Alongside the baseline, the ES chapter will also include an assessment of the economic benefits which are likely to accrue to the area in terms of employment and Gross Value Added (GVA).

8.206 Consultations will take place with key local industry representatives, ports and harbours and the developers themselves to explore how any adverse impacts can be minimised while ensuring that any positive effects are maximised.

8.207 In addition to the sources listed above, the individual Commercial Fisheries, Ports, Shipping and Navigation and Landscape, Seascapes and Visual Amenity assessments will also provide important inputs to the socio-economics baseline assessment.

8.208 Following this the potential socio-economic impacts will be identified and assessed. The key output of this will be an estimate of the number of net jobs associated with Project One and the economic contribution that Project One makes to the local economy, as measured by its net GVA impact. The economic impact model will consider the impacts associated with the different stages of the development (construction, operation, maintenance and decommissioning) and make an assessment of the direct and indirect employment and GVA generated by each stage of the project.

8.209 In addition to the direct and indirect employment and GVA associated with Project One, an assessment of the impact that Project One has on tourism (both onshore and offshore), oil and gas industry commercial fishing and shipping will be undertaken. This will be undertaken through examining the results from other EIA baseline reports and consultation with stakeholders. The results will be mainly qualitative and reported in terms of their potential significance of impact14.

8.10.4 Potential Project Impacts

8.210 The potential impacts of the construction, operation and maintenance of a project of this scale are potentially significant at both a local and national scale.

Construction Phase

8.211 The identified potential impacts on the socioeconomics of the study area resulting from the construction of Project One are as follows:

- Increased direct employment of local people and associated GVA;
- Increased expenditure through local businesses involved in the project’s supply chain may generate indirect employment and GVA through economic multiplier effects;
- Disruption to tourism and other businesses, particularly during the construction phase;
- Potential upgrades to port infrastructure may allow for new business opportunities;
- Knock on effects on housing, local services and infrastructure associated with any large scale influx of new workers;
- Temporary disruption to the recreational use of publicly accessible spaces (e.g., beaches), recreational facilities and businesses which may be temporarily disrupted through access route diversions, as a result of construction work;
- Temporary disruption to public rights of way (PROW) closures and diversions may be necessary in which case they will be undertaken in consultation with the Council’s Rights of Way department; and
- Indirect impacts arising from changes in amenity, for example from noise, dust or changes in views.

8.212 Offshore impacts may accrue to commercial fisheries, ferries, other commercial shipping and leisure yachts. The assessment of these impacts will build upon the individual Commercial Fisheries, Ports, Shipping and Navigation and Landscape, Seascapes and Visual Amenity assessments being undertaken in parallel with the socio-economic assessment. Potential impacts could include:

14 See definition described in Section 3.5
- Increased steaming time for vessels;
- Loss of access to fishing grounds; and
- Disruption to traditional shipping routes.

**Operation and Maintenance Phase**

8.213 Impacts arising during operation and maintenance phase are expected to be similar to those experienced during the construction phase.

**Decommissioning Phase**

8.214 Impacts arising during the decommissioning phase are expected to be similar to those experienced during the construction phase with the exception of increased steaming time for vessels, loss of access to fishing grounds and disruption to traditional shipping routes as these impacts are likely to be reverse through the decommissioning of Project One.

**8.10.5 Potential Transboundary Impacts**

8.215 There is potential for transboundary impacts to occur given the scale of Project One. Examples of potential transboundary effects include the impacts on foreign ships and fishing fleets and the potential impact on overseas economies through the purchase of key Project One inputs from companies based outside the UK. Reference will be made to the commercial fisheries section of the EIA in assessing transboundary impacts with regard to socio-economics. These effects will be captured in the economic impact assessment.

**8.10.6 Potential Cumulative Impacts**

8.216 The predicted socio-economic and tourism impacts resulting from the construction, operation and maintenance and decommissioning of Project One could, alongside the presence of the future potential projects within the Hornsea Zone as well as other Round 3 Zones in the North Sea, generate potential for a cumulative impact.

8.217 For example, cumulative impacts may arise in relation to employment and local supply chain involvement in the industry. If sufficient offshore wind farms are brought forward and consented, this will present a strong business case for local businesses to invest in the skills or capital needed to become involved in the market. This is unlikely to occur for one opportunity (i.e., Project One) but with more developments in the pipeline, there may be sufficient scale to allow businesses to make the necessary investments.

8.218 SMart Wind are working closely with National Grid to ensure that any upgrading works required by National Grid specific to the 1 GW grid connection agreement for Project One will be taken into consideration, and mitigation measures will be recommended to avoid or reduce negative impacts.

**8.10.7 Potential In-combination Impacts**

8.219 In-combination impacts are the effects that arise from different industry sectors within the same region or Zone on sensitive receptors\(^{15}\). For example, local boat owners diversifying to provide trips to the wind farm for service and maintenance.

8.220 The assessment of both cumulative and in-combination effects will be a ‘live’ and ongoing process, incorporating information from other EIA surveys and monitoring surveys and input from stakeholders. The potential for in-combination impacts to occur will be assessed as part of the EIA process.

**8.10.8 Potential Mitigation and Monitoring**

8.221 Potential mitigation strategies may include:

- Making use of local facilities such as ports and harbours, maximising the involvement of local businesses in the supply chain for Project One and employing and/or training local people to work at various project stages;

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\(^{15}\) The Crown Estate (2010), Round 3 zone appraisal and planning A strategic approach to zone design, project identification and consent
- Directional drilling and/or tunnelling and other good construction practices to avoid disruption to coastal areas used for recreation;
- Temporary diversions of PROW; and
- Good construction practices along the cable trench to avoid disruption of tourism and recreation e.g. measures to control noise, dust and traffic (described further in relation to these topic specific assessments).
9 ENVIRONMENTAL STATEMENT CONTENTS

9.1 This section sets out the proposed structure of the ES. The ES will include a clear description of all the aspects of the proposed development, including, onshore and offshore elements, timescales at the construction, operation and decommissioning stages.

9.2 It is anticipated that detailed specialist reports will be made available as a separate technical appendices. A separate Non Technical Summary (NTS) of the information contained within the ES will be produced.

9.3 It is proposed that the contents of the ES will be divided into the following sections:

- Non Technical Summary
- Section 1: Background
  - Section 1.1: Background
  - Section 1.2: Definition of Study Area
  - Section 1.3: Statement of Need
  - Section 1.4: Alternatives
  - Section 1.5: Consultation
  - Section 1.6: Report Structure
- Section 2: Legislative Context
- Section 3: Description of the Proposed Development
- Section 4: Assessment Methodology
- Section 5: Offshore Baseline Environment, Potential and Predicted Impacts and Mitigation
  - Section 5.1: Introduction
  - Section 5.2: Physical Environment
    - Section 5.2.1: Marine Geology
    - Section 5.2.2: Physical Processes
    - Section 5.2.3: Water Quality
    - Section 5.2.4: Air Quality
    - Section 5.2.5: Airborne Noise and Vibration
    - Section 5.2.6: Underwater Noise and Vibration
  - Section 5.3: Biological Environment
    - Section 5.3.1: Nature Conservation Designations
    - Section 5.3.2: Benthic and Epibenthic Ecology
    - Section 5.3.3: Fish and Shellfish Ecology
    - Section 5.3.4: Ornithology
    - Section 5.3.5: Marine Mammals
    - Section 5.3.6: Bats
  - Section 5.4: Human Environment
    - Section 5.4.1: Commercial Fisheries
    - Section 5.4.2: Ports, Shipping and Navigation
    - Section 5.4.3: Civil Aviation and Military Activities
- Section 5.4.4: Radar and Communications
- Section 5.4.5: Ordnance
- Section 5.4.6: Maritime Archaeology and Cultural Heritage
- Section 5.4.7: Seascapes and Visual Amenity
- Section 5.4.8: Infrastructure and Other Marine Users

- Section 6: Onshore Baseline Environment, Potential and Predicted Impacts and Mitigation
  - Section 6.1: Introduction
  - Section 6.2: Physical Environment
    - Section 6.2.1: Geology, Soils, Agriculture and Land Use
    - Section 6.2.2: Water Resources
    - Section 6.2.3: Air Quality
  - Section 6.3: Biological Environment
    - Section 6.3.1: Terrestrial Ecology and Nature Conservation
  - Section 6.4: Human Environment
    - Section 6.4.1: Archaeology and Cultural Heritage
    - Section 6.4.2: Landscape, Seascapes and Visual Amenity
    - Section 6.4.3: Flood Risk
    - Section 6.4.4: Traffic and Transport
    - Section 6.4.5: Noise and Vibration
    - Section 6.4.6: Socioeconomics, Recreation and Tourism

- Section 7: Summary of Effects and Mitigation Measures
- Section 8: Summary of Residual Impacts
- Section 9: Information to Support Appropriate Assessment
- (References)
- Technical Appendices
10 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS, MITIGATION AND MONITORING

This is the summary table presenting all the potential environmental impacts requiring assessment. The table correlates with the Scoping Report headings. Where there is the potential for a transboundary impact an * is given at the end of the sentence.

Table 10-1 Summary of potential impacts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geology</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Temporary increase in suspended sediment could change sediment composition (locally);</td>
<td></td>
</tr>
<tr>
<td>▪ Changes to, removal of, or creation of large-scale seabed features such as sandwaves and megaripples; and</td>
<td></td>
</tr>
<tr>
<td>▪ Changes in sediment transport pathways and deposition could change bathymetry, locally affecting navigation.</td>
<td></td>
</tr>
<tr>
<td><strong>Operation and Maintenance Phase</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Changes to hydrodynamics as a result of turbine structures have the potential to impact bathymetry, seabed features and sediment distribution; and</td>
<td></td>
</tr>
<tr>
<td>▪ There are no anticipated significant impacts to geology.</td>
<td></td>
</tr>
<tr>
<td><strong>Decommissioning Phase</strong></td>
<td></td>
</tr>
<tr>
<td>▪ The potential impacts during decommissioning are considered to be similar to those for the construction phase.</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Processes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Temporary disturbance to sediments caused by jack-up barge legs or vessel anchor;</td>
<td></td>
</tr>
<tr>
<td>▪ Temporary interference with seabed morphology caused by jack-up barge spud cans (base of the legs);</td>
<td></td>
</tr>
<tr>
<td>▪ Temporary disruption to flow around jack-up barge legs;</td>
<td></td>
</tr>
<tr>
<td>▪ Increased suspended sediment dependent on method of installation;</td>
<td></td>
</tr>
<tr>
<td>▪ Scour around foundations causing increased suspended sediment concentrations;</td>
<td></td>
</tr>
<tr>
<td>▪ Suspension and deposition of sediment plumes which may cause a change in sediment composition locally;</td>
<td></td>
</tr>
<tr>
<td>▪ Interference with seabed morphology; and</td>
<td></td>
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</tbody>
</table>
### Project One – Environmental Impacts Requiring Assessment

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation and Maintenance Phase</strong></td>
<td></td>
</tr>
<tr>
<td>- Increased suspended sediment during cable laying and trenching.</td>
<td></td>
</tr>
<tr>
<td>- Temporary disturbance to sediments caused by jack-up barge legs or vessel anchor;</td>
<td></td>
</tr>
<tr>
<td>- Temporary interference with seabed morphology caused by jack-up barge spud cans;</td>
<td></td>
</tr>
<tr>
<td>- Disruption to flow around jack-up barge legs;</td>
<td></td>
</tr>
<tr>
<td>- Alteration of current flow around foundations;</td>
<td></td>
</tr>
<tr>
<td>- Alteration of flow downstream of foundations (known as wake effects);</td>
<td></td>
</tr>
<tr>
<td>- Alteration of wave regime due to dispersion of energy, possibly affecting both wave height and direction;</td>
<td></td>
</tr>
<tr>
<td>- Alteration of suspended sediment concentrations and sediment pathways (collectively known as sediment transport) due to the above factors;</td>
<td></td>
</tr>
<tr>
<td>- Interference with seabed morphology (potential impact on navigation channels);</td>
<td></td>
</tr>
<tr>
<td>- Exposure of cable if laid within sandwave fields; and</td>
<td></td>
</tr>
<tr>
<td>- Interference with seabed morphology.</td>
<td></td>
</tr>
<tr>
<td><strong>Decommissioning Phase</strong></td>
<td></td>
</tr>
<tr>
<td>- The potential impacts during decommissioning are considered to be similar to those for the construction phase.</td>
<td></td>
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</tbody>
</table>

### Water Quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td>- Potential to release of contaminants bound in sediments*;</td>
<td></td>
</tr>
<tr>
<td>- Increased suspended sediment concentrations*;</td>
<td></td>
</tr>
<tr>
<td>- Increased turbidity leads to a reduction in light penetration, which can affect primary production*;</td>
<td></td>
</tr>
<tr>
<td>- Increased turbidity could interfere with the hunting and feeding efficiency of a wide range of animals including fish, birds and marine mammals*; and</td>
<td></td>
</tr>
<tr>
<td>- Potential for the accidental release of contaminants into marine environment during construction activities through spillage or leakage of contaminants from vessels and/or other plant*.</td>
<td></td>
</tr>
<tr>
<td><strong>Operation and Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Project One – Environmental Impacts Requiring Assessment</td>
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</tr>
<tr>
<td></td>
<td>- During operation the alteration to tidal current flows and waves caused by the physical presence of the wind turbines on the seabed may result in changes in seabed scour and deposition, affecting turbidity*; and</td>
</tr>
<tr>
<td></td>
<td>- Potential for the accidental release of contaminants into marine environment during maintenance activities through spillage or leakage of contaminants from vessels and/or other plant*.</td>
</tr>
<tr>
<td>Decommissioning Phase</td>
<td>- The potential impacts during decommissioning are considered to be similar to those for construction*.</td>
</tr>
<tr>
<td>Air Quality</td>
<td><strong>Operation and Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>- No likely significant construction or operation air quality effects are anticipated.</td>
</tr>
<tr>
<td>Offshore and Onshore Nature Conservation Designations</td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>- Temporary displacement of species*;</td>
</tr>
<tr>
<td></td>
<td>- Temporary disturbance of species*;</td>
</tr>
<tr>
<td></td>
<td>- Temporary reduction in food availability through the displacement / disturbance of prey species*;</td>
</tr>
<tr>
<td></td>
<td>- Direct injury to species*;</td>
</tr>
<tr>
<td></td>
<td>- Severance and habitat fragmentation*;</td>
</tr>
<tr>
<td></td>
<td>- Direct damage to or loss of habitats*; and</td>
</tr>
<tr>
<td></td>
<td>- Permanent displacement of species as a result of land-take or habitat loss*.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>- Displacement of species*;</td>
</tr>
<tr>
<td></td>
<td>- Disturbance of species*;</td>
</tr>
<tr>
<td></td>
<td>- Reduction in food availability through the displacement / disturbance of prey species*;</td>
</tr>
<tr>
<td></td>
<td>- Severance and habitat fragmentation*; and</td>
</tr>
<tr>
<td></td>
<td>- Direct injury to species*.</td>
</tr>
<tr>
<td>Benthic and Epibenthic Ecology</td>
<td>Project One – Environmental Impacts Requiring Assessment</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Decommissioning Phase</strong></td>
<td>▪ The potential impacts during decommissioning are considered to be similar to those for the construction phase*.</td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td>▪ The permanent loss of existing seabed habitats under foundations, scour protection and as a result of scour around the structures;</td>
</tr>
<tr>
<td></td>
<td>▪ Temporary loss of habitats under jack-up barges;</td>
</tr>
<tr>
<td></td>
<td>▪ Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures;</td>
</tr>
<tr>
<td></td>
<td>▪ Increased suspended sediments and smothering from resuspension of sediments during cable trenching, vessel anchoring, piling and or drilling*;</td>
</tr>
<tr>
<td></td>
<td>▪ Change to water quality from accidental release of contaminants*;</td>
</tr>
<tr>
<td></td>
<td>▪ Noise and vibration disturbance from piling and vessel movements having physiological and behavioural impacts on benthos*;</td>
</tr>
<tr>
<td></td>
<td>▪ Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations and associated structures*; and</td>
</tr>
<tr>
<td></td>
<td>▪ Re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance*.</td>
</tr>
</tbody>
</table>

**Operation and Maintenance**

▪ The deployment and presence of artificial hard substrate structures and associated increase in colonisation of benthic species adapted to hard surfaces*;  |
▪ Change to water quality from accidental release of contaminants during servicing and maintenance*;  |
▪ Noise and vibration disturbance from operational turbines having physiological and behavioural impacts on benthos*;  |
▪ Changes in sediment transport and deposition patterns as a result of the presence of turbines and associated structures*;  |
▪ Local effects on benthic community structure caused by the reduction/elimination of commercial trawling within the area*;  |
▪ Changes in the hydrodynamic regime leading to changes in seabed sediment distribution, grain size, structure with changes to resultant benthic habitat*; and |
### Parameter

**Project One – Environmental Impacts Requiring Assessment**

<table>
<thead>
<tr>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decommissioning Phase</strong></td>
</tr>
<tr>
<td>- Electromagnetic fields from inter-array and export cabling causing a disturbance to benthic and epibenthic species*.</td>
</tr>
<tr>
<td>- The removal of artificial hard substrate structures and associated benthic species adapted to hard surfaces*;</td>
</tr>
<tr>
<td>- Temporary loss of habitats under jack-up barges during the decommissioning phase;</td>
</tr>
<tr>
<td>- Seabed disturbance from decommissioning activities, along with associated increased suspended sediments and smothering*;</td>
</tr>
<tr>
<td>- Change to water quality/accidental release of contaminants from vessels and plant undertaking decommissioning*;</td>
</tr>
<tr>
<td>- Noise and vibration disturbance from vessels and decommissioning activity having physiological and behavioural impacts on benthos*;</td>
</tr>
<tr>
<td>- Changes in sediment transport and deposition patterns as a result of the removal of turbines and associated structures*;</td>
</tr>
<tr>
<td>- Local effects on benthic community structure caused by the reinstatement of the area for commercial trawling*;</td>
</tr>
<tr>
<td>- Sediment disturbance may result in some re-introduction of synthetic compounds, heavy metals or hydrocarbons if these are trapped within the substrate*; and</td>
</tr>
<tr>
<td>- Changes in the hydrodynamic regime from the removal of structures leading to changes in seabed sediment distribution, grain size, structure with changes to resultant benthic habitat*.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Fish and Shellfish Ecology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td>- The permanent loss of existing seabed habitats for under foundations, scour protection and as a result of scour around the structures*;</td>
</tr>
<tr>
<td>- Temporary loss of habitats under jack-up barges*;</td>
</tr>
<tr>
<td>- Seabed disturbance from cable trenching, piling, drilling and the physical presence of structures and associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity*;</td>
</tr>
<tr>
<td>- Change to water quality from accidental release of contaminants*;</td>
</tr>
<tr>
<td>- Noise and vibration disturbance from piling and vessel movements having physiological and behavioural impacts on fish and shellfish species, including temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species*;</td>
</tr>
</tbody>
</table>
### Project One – Environmental Impacts Requiring Assessment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Impact Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acoustic surveys</strong></td>
<td>that are conducted in the pre-construction phase may disturb fish and shellfish spawning*;</td>
</tr>
<tr>
<td><strong>Changes in sediment transport and deposition patterns</strong></td>
<td>as a result of the presence of turbine foundations and associated structures impacting on seabed spawning habitat*;</td>
</tr>
<tr>
<td><strong>Changes to water quality</strong></td>
<td>from the re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance*; and</td>
</tr>
<tr>
<td><strong>Increased habitat complexity</strong></td>
<td>due to introduction of hard substrate in the form of foundations and scour*.</td>
</tr>
</tbody>
</table>

#### Operation and Maintenance Phase

- Noise and vibration disturbance from servicing vessel movements having physiological and behavioural impacts on fish and shellfish species, including disruption to migratory pathways fish and shellfish species*;
- Changes in sediment transport and deposition patterns as a result of the presence of turbine foundations and associated structures impacting on seabed spawning habitat*;
- Local effects on fish and shellfish community structure caused by the reduction/elimination of commercial trawling within the area*; and
- Electromagnetic fields from inter-array and export cabling causing a disturbance to fish and shellfish species*.

#### Decommissioning Phase

- Temporary loss of habitats under jack-up barges undertaking decommissioning*;
- Seabed disturbance from decommissioning activities, along with associated increased suspended sediments leading temporary disruption to migratory pathways and feeding activity*;
- Change to water quality/accidental release of contaminants from vessels and plant undertaking decommissioning*;
- Noise and vibration disturbance from decommissioning activities having physiological and behavioural impacts on fish and shellfish species, including temporary disruption to migratory pathways of salmonids, lamprey and other migratory fish and shellfish species*;
- Changes in sediment transport and deposition patterns as a result of the removal of turbine foundations and associated structures impacting on seabed spawning habitat*;
- Changes to water quality from the re-introduction of synthetic compounds, heavy metals or hydrocarbons from sediment disturbance*;
- Local effects on fish and shellfish community structure caused by the reinstatement of the area for commercial
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>trawling*; and</td>
</tr>
<tr>
<td></td>
<td>- Decreased habitat complexity due to the removal of artificial hard substrate structures and associated benthic species adapted to hard surfaces*.</td>
</tr>
<tr>
<td>Ornithology</td>
<td></td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Disturbance and displacement of birds resulting from the presence of construction vessels and other associated plant*; and</td>
</tr>
<tr>
<td></td>
<td>- Reduction in prey availability through the disturbance and displacement of fish and other prey*.</td>
</tr>
<tr>
<td><strong>Operation and Maintenance Phase</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Displacement of birds resulting from the presence the of turbines within the Blocks*;</td>
</tr>
<tr>
<td></td>
<td>- Direct collision of birds with the turbines within the Blocks*;</td>
</tr>
<tr>
<td></td>
<td>- Barrier to daily movements and migration as a result of the turbines within the Blocks*;</td>
</tr>
<tr>
<td></td>
<td>- Disturbance and displacement of birds resulting from the presence of service and maintenance vessels*; and</td>
</tr>
<tr>
<td></td>
<td>- Reduction in prey availability through the disturbance and displacement of fish and other prey*.</td>
</tr>
<tr>
<td><strong>Decommissioning Phase</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The potential impacts during decommissioning are considered to be similar to those for the construction phase*.</td>
</tr>
<tr>
<td>Marine Mammals</td>
<td></td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Temporary disturbance and displacement of marine mammals resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities*;</td>
</tr>
<tr>
<td></td>
<td>- Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities*;</td>
</tr>
<tr>
<td></td>
<td>- Potential physical damage, masking effects, and disturbance resulting from the noise and vibration from piling, vessels, cable trenching and other construction activities*; and</td>
</tr>
<tr>
<td></td>
<td>- Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during construction activities*.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Project One – Environmental Impacts Requiring Assessment</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Operation and Maintenance Phase** | ▪ Disturbance and displacement of marine mammals resulting from the noise and vibration from servicing and maintenance vessels*;  
▪ Temporary effects on the distribution and abundance of prey species due to habitat disturbance and direct prey disturbance resulting from the noise and vibration from servicing and maintenance vessels*;  
▪ Potential physical damage, masking effects, and disturbance resulting from the noise and vibration servicing and maintenance vessels*;  
▪ The introduction of artificial hard substrates and underwater structures will colonised by sessile animals and algae, and may enrich the local biomass and may also excluded certain commercial fishing activities from within Subzone 1, resulting in an increase in food availability*; and  
▪ Potential increase in vessel strike between vessels and marine mammals as a result of increased vessel activity during service and maintenance activities*. |
| **Decommissioning Phase** | ▪ The potential impacts during decommissioning are considered to be similar to those for the construction phase*. |
| **Bats**       | **Construction Phase**  
▪ Potential disturbance to roosts or important foraging areas (onshore)*.                                                                                                    |
| **Operation and Maintenance Phase** | ▪ Collision of bats with turbines within the Blocks*; and  
▪ Potential for barotrauma*. |
| **Decommissioning Phase** | ▪ The potential impacts during decommissioning are considered to be similar to those for the construction phase*. |
| **Commercial Fisheries**       | **Construction Phase**  
▪ Short term exclusion from established fishing grounds resulting from safety zones placed around construction vessels and plant*;  
▪ Exclusion from fishing grounds may lead to temporary increases in fishing effort in other areas that may already be |

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* Additional notes and references may be required for a complete understanding of the impacts.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>heavily exploited*;</td>
</tr>
<tr>
<td></td>
<td>▪ Noise and vibration from piling and construction vessels and plant may displace fish and shellfish populations from the area and therefore decrease fish numbers within the area*; and</td>
</tr>
<tr>
<td></td>
<td>▪ Potential loss of fishing gear as a result of the construction activities*.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ The cable infrastructure, turbine foundations and scour protection poses a potential risk to fishing vessels, particularly to mobile vessels that trawl or dredge across the seabed as a result of fishing gear catching or snagging*;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential exclusion from established fishing grounds*;</td>
</tr>
<tr>
<td></td>
<td>▪ The presence of foundations and ancillary infrastructure (including any applied safety zones) will represent an obstacle to fishing activity*;</td>
</tr>
<tr>
<td></td>
<td>▪ Exclusion from fishing grounds may lead to increases in fishing effort in other areas that may already be heavily exploited*;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential displacement of, or reduction in, fish and shellfish resource with associated knock-on effect to the fishing industry through noise and vibration from servicing and maintenance vessels and activities and also the potential impacts on elasmobranch species due to electromagnetic fields (EMF) emissions from submarine cables*;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential to provide refugia for target species*;</td>
</tr>
<tr>
<td></td>
<td>▪ Exclusion of certain types of fishing activity, such as beam trawling and demersal trawling and scallop dredging, may have localised benefits with the potential to benefit fishing grounds located adjacent to the site via recruitment from Subzone 1*; and</td>
</tr>
<tr>
<td></td>
<td>▪ Increased navigational risk and longer steaming distances.</td>
</tr>
<tr>
<td></td>
<td><strong>Decommissioning Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Impacts arising during decommissioning are expected to be similar to those for the construction phase.</td>
</tr>
<tr>
<td></td>
<td><strong>Ports, Shipping and Navigation</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ An increased number of vessels within Subzone 1 during the construction phase will influence the rate of vessel-to-vessel encounters and hence the collision risk.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
</tbody>
</table>
### Project One – Environmental Impacts Requiring Assessment

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Collision risk between vessels and structures;</td>
<td></td>
</tr>
<tr>
<td>• Potential for the structures to produce radar reflections, blind spots, shadow areas or adverse effects;</td>
<td></td>
</tr>
<tr>
<td>• Potential for structures to block or hinder the view of other vessels under way on any route*;</td>
<td></td>
</tr>
<tr>
<td>• Potential for structures to block or hinder the view of the coastline from vessels*;</td>
<td></td>
</tr>
<tr>
<td>• The distances travelled by merchant vessels could be affected, requiring vessels to travel greater distances*;</td>
<td></td>
</tr>
<tr>
<td>• The cable route may impact on merchant ships dragging anchor or emergency anchoring in the vicinity of the cable(s) *;</td>
<td></td>
</tr>
<tr>
<td>• Potential compass deviation effects of the magnetic fields generated by the cables;</td>
<td></td>
</tr>
<tr>
<td>• It is considered unlikely that there will be any significant recreational activities within Subzone 1 due the distance offshore; and</td>
<td></td>
</tr>
<tr>
<td>• Potential for fishing activity to be displaced to outside of Subzone 1 during operation, this will influence the rate of vessel-to-vessel encounters and hence the collision risk.</td>
<td></td>
</tr>
</tbody>
</table>

**Decommissioning Phase**

- Impacts arising during decommissioning are expected to be similar to those for the construction phase.

<table>
<thead>
<tr>
<th>Civil Aviation and Military Activities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
</tr>
<tr>
<td>• Depending on the height of the equipment on the various installation vessel(s), there may be potential for the vessel to be considered to be a moving physical obstruction. As long as the vessel(s) is displaying the appropriate maritime light signals for the task, it is considered unlikely that it will create an aviation hazard.</td>
<td></td>
</tr>
<tr>
<td><strong>Operation and Maintenance Phase</strong></td>
<td></td>
</tr>
<tr>
<td>• Physical obstruction to aircraft; and</td>
<td></td>
</tr>
<tr>
<td>• Wake turbulence on aircraft.</td>
<td></td>
</tr>
</tbody>
</table>

**Decommissioning Phase**

- Impacts arising during decommissioning are expected to be similar to those for the construction phase.

<table>
<thead>
<tr>
<th>Radar and Communications</th>
<th><strong>Construction Phase</strong></th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project One – Environmental Impacts Requiring Assessment</strong></td>
</tr>
<tr>
<td>▪ There are no anticipate impacts on civil aviation and military activities during the construction phase.</td>
</tr>
</tbody>
</table>

**Operation and Maintenance Phase**

▪ PSR interference;
▪ SSR interference;
▪ VHF communications interference;
▪ Satellite communications interference; and
▪ Fixed terrestrial link interference.

**Decommissioning Phase**

▪ There are no anticipate impacts on civil aviation and military activities during the decommissioning phase.

**Ordnance**

**Construction Phase**

▪ Potential for construction activities to disturb and initiated unknown UXO.

**Operation and Maintenance Phase**

▪ Changes in hydrodynamic regime could result in the exposure and remobilisation of previously covered ordnance*.

**Decommissioning Phase**

▪ Impacts arising during decommissioning are expected to be similar to those for the construction phase.

**Maritime Archaeology and Cultural Heritage**

**Construction Phase**

▪ Damage to archaeological sites, features and artefacts resulting from construction activities.

**Operation and Maintenance Phase**

▪ Potential changes to the sediment regime resulting in burial or exposure of archaeological sites, features and artefacts*.

**Decommissioning Phase**

▪ Impacts arising during decommissioning are expected to be similar to those for the construction phase.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landscape, Seascape and Visual Amenity</strong></td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Short term seascape and visual impacts from machinery/equipment and activities including assembly of turbines and installation of infrastructure.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Visual receptors on passenger ferries and shipping channel routes are likely to experience a change in view for a short period of time*. Impacts can be adverse or beneficial, and in some cases may be considered to be neutral; and</td>
</tr>
<tr>
<td></td>
<td>▪ The seascape is likely to experience direct, adverse impacts in character areas within the Blocks.</td>
</tr>
<tr>
<td></td>
<td><strong>Decommissioning Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ The identified potential impacts on seascapes and visual amenity resulting from decommissioning are likely to reverse those impacts identified for the operation and maintenance phase; and</td>
</tr>
<tr>
<td></td>
<td>▪ Other impacts are likely to be similar to those reported during the construction phase.</td>
</tr>
<tr>
<td><strong>Airborne Noise and Vibration</strong></td>
<td><strong>Potential Project Impacts</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Noise is extremely unlikely to result in significant impacts*.</td>
</tr>
<tr>
<td><strong>Infrastructure and Other Users</strong></td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ The export cable route may have implications for recreational activities, such as increased collision risk between leisure and waterspout craft and construction vessels / plant and the displacement of activities from areas during the construction phase;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential for contaminated sediment being disturbed during cable installation and re-introduced into the water column issues should the cable route pass through previously closed disposal sites; and</td>
</tr>
<tr>
<td></td>
<td>▪ Potential to impact on existing oil and gas pipelines and infrastructure through cable laying, this will include a number of pipeline and cable crossings.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Potential to impact the aggregate dredging industry if the size of sediment particles within an aggregate licence area alters as a result of sediment transport processes;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential impact on the future exploration for oil and gas by restricting future seismic surveys and exploration drilling;</td>
</tr>
<tr>
<td>Parameter</td>
<td>Project One – Environmental Impacts Requiring Assessment</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------------------------</td>
</tr>
</tbody>
</table>
|           | and
|           |   ▪ Potential impact on the future exploitation of gas fields with implications for the possible future use of depleted fields for natural gas storage or Carbon Capture and Storage (CCS) projects. |

**Decommissioning Phase**

▪ Impacts arising during decommissioning are expected to be similar to those for the construction phase.

<table>
<thead>
<tr>
<th>Geology, Soils, Agriculture and Land-Use</th>
<th>Construction Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Damage to or severance of access to designated geological sites – where geological receptors comprise geological Sites of Special Scientific Interest (SSSI) and regionally important geological and geomorphological sites;</td>
</tr>
<tr>
<td></td>
<td>▪ Soil loss or structural damage;</td>
</tr>
<tr>
<td></td>
<td>▪ Changes to soil composition and structure;</td>
</tr>
<tr>
<td></td>
<td>▪ Changes to existing land quality and agricultural productivity of soils;</td>
</tr>
<tr>
<td></td>
<td>▪ Temporary disruption to farming operations during construction;</td>
</tr>
<tr>
<td></td>
<td>▪ Temporary disruption to land drainage systems during construction; and</td>
</tr>
<tr>
<td></td>
<td>▪ Potential for transmission of agricultural pests and diseases.</td>
</tr>
</tbody>
</table>

**Operation and Maintenance Phase**

▪ No anticipated impacts on soils, farming or other land use resulting from the operation of the substation/converter station or cable route; and

▪ The potential impacts during maintenance are considered to be similar to those for the construction phase.

**Decommissioning Phase**

▪ The potential impacts during decommissioning are considered to be similar to those for the construction phase.

<table>
<thead>
<tr>
<th>Water Resources</th>
<th>Construction Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Sediment mobilisation in site runoff from exposed soil surfaces during construction;</td>
</tr>
<tr>
<td></td>
<td>▪ Contamination of surface water features or groundwater by oils, lubricant and fuels originating from construction vehicles or store areas;</td>
</tr>
</tbody>
</table>
### Parameter

<table>
<thead>
<tr>
<th><strong>Project One – Environmental Impacts Requiring Assessment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Impacts on the quality of private water supplies;</td>
</tr>
<tr>
<td>- Changes to groundwater movement; and</td>
</tr>
<tr>
<td>- Longer term impacts on abstraction for private water supplies, particularly any supplies dependent on groundwater.</td>
</tr>
</tbody>
</table>

**Operation and Maintenance Phase**

- Contamination of surface water features or groundwater by oils, lubricant and fuels originating from operational and maintenance vehicles or store areas; and
- Risk of contaminated water run-off from hard-standing areas entering nearby watercourses and potentially impacting the quality of private water supplies.

**Decommissioning Phase**

- The potential impacts during decommissioning are considered to be similar to those for the construction phase.

### Air Quality

**Construction Phase**

- Potential to affect local air quality during the construction phases through the generation of dust and emissions of combustion related pollutants from on-site plant/vehicles and off-site road traffic.

**Operation and Maintenance Phase**

- No potentially significant sources of emissions to air will exist during the operation of the proposed development. Substations and converter stations do not give off emissions and, as such, no direct impact would be anticipated. It is proposed that this issue is scoped out of the EIA process.

**Decommissioning Phase**

- Potential to affect local air quality during the decommissioning phases through the generation of dust and emissions of combustion related pollutants from on-site plant/vehicles and off-site road traffic.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onshore Biological Environment</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Terrestrial Ecology and Nature Conservation</strong></td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Temporary displacement of species as a result of construction activities;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential habitat and species loss as a result of land-take for the new substation/converter station;</td>
</tr>
<tr>
<td></td>
<td>▪ Disturbance to habitats or species as a result of noise, vibration, lighting and construction activities;</td>
</tr>
<tr>
<td></td>
<td>▪ Severance and habitat fragmentation; and</td>
</tr>
<tr>
<td></td>
<td>▪ Temporary discharge of pollutants may have adverse impacts on habitats and species during onshore construction works.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Permanent displacement of species as a result of land-take for the new substation/converter station; and</td>
</tr>
<tr>
<td></td>
<td>▪ Disturbance to habitats or species as a result of noise from maintenance activities.</td>
</tr>
<tr>
<td></td>
<td><strong>Decommissioning Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ The potential impacts during decommissioning are considered to be similar to those previously described during</td>
</tr>
<tr>
<td></td>
<td>construction; and</td>
</tr>
<tr>
<td></td>
<td>▪ Subsequent potential for reinstatement of habitats and species.</td>
</tr>
<tr>
<td><strong>Onshore Human Environment</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Archaeology and Cultural Heritage</strong></td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ Physical alteration or destruction of heritage assets as a result of cable trenching or construction of</td>
</tr>
<tr>
<td></td>
<td>substation/converter station foundations and any overhead line infrastructure;</td>
</tr>
<tr>
<td></td>
<td>▪ Potential temporary impacts on historic monuments and buildings from noise and vibration during construction; and</td>
</tr>
<tr>
<td></td>
<td>▪ Indirect impacts involving an effect on the setting of a heritage asset.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>▪ No permanent impacts are anticipated on archaeology and cultural heritage during operation and maintenance activities.</td>
</tr>
<tr>
<td></td>
<td><strong>Decommissioning Phase</strong></td>
</tr>
</tbody>
</table>

**Note:**
- Terrestrial Ecology and Nature Conservation
- Construction Phase
- Operation and Maintenance Phase
- Decommissioning Phase
- Temporary displacement of species
- Permanent displacement of species
- Physical alteration or destruction
- Subsequent potential for reinstatement
- Potential temporary impacts on historic monuments and buildings
- Indirect impacts involving an effect on the setting of a heritage asset.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ The potential impacts during decommissioning are considered to be similar to those for the construction phase.</td>
</tr>
</tbody>
</table>
| Landscape, Seascape and Visual Amenity | **Construction Phase**  
▪ During construction there are likely to be minor visual impacts;  
▪ During construction there may be direct landscape and visual impacts due to the displacement of landscape features and the presence of construction activity in views; and  
▪ During construction there are unlikely to be significant impacts due to the industrial nature of the area and screening provided by existing structures.  

**Operation and Maintenance Phase**  
▪ Limited stretches of overhead lines, if selected, could give rise to locally significant impacts depending on the route and sensitivity of the landscape and receptors; and  
▪ No impacts are anticipated to result from the substation/converter station during this phase of the project.  

**Decommissioning Phase**  
▪ Short term landscape and visual impacts from machinery/equipment and activities on the site. Impacts are likely to be less adverse than those reported during construction as the underground cable is likely to remain in place; and  
▪ Following decommissioning there is unlikely to be any residual impact on the landscape or visual receptors. |
| Flood Risk | **Construction Phase**  
▪ Temporary changes to natural surface water drainage patterns and run-off rates, and resultant potential for flooding on, or arising from construction of above ground infrastructure.  

**Operation and Maintenance Phase**  
▪ Permanent increase in surface run-off from as a result of increased impermeable surface areas, and resultant potential for flooding on, or arising from above ground infrastructure.; and  
▪ Temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding on, or arising from maintenance of above ground infrastructure.  

**Decommissioning Phase**  
▪ Temporary changes to natural surface water drainage patterns and run-off rates and resultant potential for flooding |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Project One – Environmental Impacts Requiring Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic and Transport</td>
<td>on, or arising from the decommissioning of above ground infrastructure.</td>
</tr>
<tr>
<td></td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>• Potential to affect the local road network during the construction phase through delivery of machinery, concrete, cabling, aggregate and sand, and through the arrival and departure of construction workers;</td>
</tr>
<tr>
<td></td>
<td>• Depending upon the change in traffic flows predicted to occur as a result of the proposed development, potential impacts that will be assessed are: severance, driver delay, pedestrian delay, pedestrian amenity, fear and intimidation, and accidents and safety; and</td>
</tr>
<tr>
<td></td>
<td>• Potential to result in temporary delays to public transport services as a result of cable route construction under railway lines or impacts on road networks.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>• It is not anticipated that these will have a significant impact on the local traffic or transport during the operation phase.</td>
</tr>
<tr>
<td></td>
<td><strong>Decommissioning Phase</strong></td>
</tr>
<tr>
<td></td>
<td>• The potential impacts during decommissioning are considered to be similar to those for the construction phase.</td>
</tr>
<tr>
<td>Noise and Vibration</td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td>• Noise and vibration from construction activities including: earth moving, excavation, landscaping, directional drilling and/or tunnelling, site vehicle and plant equipment movement on the public road network and mobile and static plant equipment and heavy goods vehicles servicing the cable construction corridor and substation/converter station, delivering or removing materials (including spoil and fill) and plant.</td>
</tr>
<tr>
<td></td>
<td><strong>Operation and Maintenance Phase</strong></td>
</tr>
<tr>
<td></td>
<td>• There are unlikely to be any noise and vibration effects relating to operational or maintenance traffic but operational noise effects may arise from the operation of the substation/converter station.</td>
</tr>
<tr>
<td></td>
<td><strong>Decommissioning Phase</strong></td>
</tr>
<tr>
<td></td>
<td>• The potential impacts during decommissioning are considered to be similar to those for the construction phase.</td>
</tr>
<tr>
<td>Socio-Economics and</td>
<td><strong>Construction Phase</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Project One – Environmental Impacts Requiring Assessment</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Tourism** | - Increased direct employment of local people and associated GVA;  
- Increased expenditure through local businesses involved in the project’s supply chain may generate indirect employment and GVA through economic multiplier effects;  
- Potential transboundary effects include the impacts on foreign ships and fishing fleets and the potential impact on overseas economies through the purchase of key Project One inputs from companies based outside the UK*;  
- Disruption to tourism and other businesses, particularly during the construction phase;  
- Potential upgrades to port infrastructure may allow for new business opportunities*;  
- Knock on effects on housing, local services and infrastructure associated with any large scale influx of new workers;  
- Temporary disruption to the recreational use of publicly accessible spaces (e.g., beaches), recreational facilities and businesses which may be temporarily disrupted through access route diversions, as a result of construction work;  
- Temporary disruption to public rights of way (PROW) closures and diversions may be necessary in which case they will be undertaken in consultation with the Council’s Rights of Way department; and  
- Indirect impacts arising from changes in amenity, for example from noise, dust or changes in views. |

**Operation and Maintenance Phase**
- Impacts arising during operation and maintenance phase are expected to be similar to those for the construction phase.

** Decommissioning Phase**
- Impacts arising during operation and maintenance phase are expected to be similar to those experienced during the construction phase with the exception of increased steaming time for vessels, loss of access to fishing grounds and disruption to traditional shipping routes as these impacts are likely to be reverse through decommissioning.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Potential Mitigation and Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology</td>
<td>▪ The spacing of the turbines may be designed to mitigate potential impact based on models. Furthermore, scour protection may be put in place to reduce scour associated sediment movement. Post-construction surveys will be used to verify the model predictions.</td>
</tr>
<tr>
<td>Physical Processes</td>
<td>▪ The physical processes model and interpretation will predict any potential changes to the seabed sediments and sediment transport due to hydrodynamic changes from the proposed turbines. As with general bathymetry changes to the spacing of the turbines at the design stage may mitigate cumulative interactions. In addition, scour protection may be put in place in order to reduce scour associated sediment movement. A post-construction survey may be used to verify the model predictions.</td>
</tr>
<tr>
<td>Water Quality</td>
<td>▪ Contamination of the water column and sediment will be managed through adherence to standard protocols; ▪ Disposal of seabed material, if required, will be in line with standard procedures, in agreement with relevant authorities and subject to a Marine Licence; ▪ Good working practices will be adopted during the construction and maintenance phase to prevent accidental spillages and loss of solid objects; and ▪ Potential accidental spillages or leakages to be mitigated by correct servicing and maintenance of all equipment, plant and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environmental Management Plans, Environment Agency Pollution Prevention Guidelines (Environment Agency, 2010) and onsite monitoring/reporting.</td>
</tr>
<tr>
<td>Air Quality</td>
<td>▪ No mitigation or monitoring proposed.</td>
</tr>
<tr>
<td>Nature Conservation Designations</td>
<td>▪ Specific details on potential mitigation and monitoring for individual receptors are given in the relevant receptor specific sections of this table.</td>
</tr>
<tr>
<td>Benthic Ecology</td>
<td>▪ No mitigation or monitoring is expected. However, if project specific survey results later reveal potential Annex I habitat, Annex II species and interest features, then these will be reported to JNCC/European Member States and monitored accordingly; ▪ Potential accidental spillages or leakages can be mitigated by correct servicing and maintenance of all equipment, plant and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environmental Management Plans, Environment Agency Pollution Prevention Guidelines (Environment Agency, 2010) and onsite monitoring/reporting.</td>
</tr>
<tr>
<td>Subject</td>
<td>Potential Mitigation and Monitoring</td>
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</tbody>
</table>
| **Fish and Shellfish Ecology** | - The inter-array and export cables could be armoured and buried at a sufficient depth to reduce electromagnetic fields (EMF);  
- During construction, 24 hour working practices may be employed so that the overall construction programme and the potential for impacts to fish communities is reduced in overall time;  
- Changes in local fish populations within the area and associated megafauna can be assessed through scientific beam trawling as part of the ecological monitoring programme;  
- For some previous projects, a buffer zone has been placed around herring spawning grounds to minimise impacts. However, buffer zones have not been employed around nursery areas, as it is assumed that juvenile herring will move away from the sound source and spawning behaviour will not be affected;  
- Potential accidental spillages or leakages can be mitigated by correct servicing and maintenance of all equipment, plant and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environmental Management Plans, Environment Agency Pollution Prevention Guidelines (Environment Agency, 2010) and onsite monitoring/reporting;  
- Monitoring requirements will be identified as part of the EIA process and agreed with the relevant competent authorities, with the degree and type required being dependent on existing baseline environmental conditions, project design and proposed construction methodology; and  
- Depending upon the foundation design chosen, soft start procedures during pile driving could be implemented to allow sensitive fish species to vacate the area, prior to higher amplitude noise being generated. |
| **Ornithology** | - Aviation and navigation lighting should be minimised to avoid attracting birds taking into account impacts on safety;  
- Subject to other constraints, wind turbines should be laid out within a site, to minimise collision risk, where the collision risk assessment shows there is a significant risk of collision;  
- Construction vessels associated with offshore wind farms should, where practicable and compatible with operational requirements and navigational safety, avoid rafting seabirds during sensitive periods;  
- The Subzone 1 survey started in March 2010 and will continue until February 2012. Potential mitigation and future monitoring will be informed by the Zone wide and Subzone 1 surveys and until the first year’s bird surveys are complete it is... |
not possible to determine what potential mitigation is most appropriate; and
- Results from the first 12 months of data will also inform further surveys that may be required, such as radar or other remote sensing techniques.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Potential Mitigation and Monitoring</th>
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<tbody>
<tr>
<td>Marine Mammals</td>
<td>- At design stages and within the EIA process, the assessment of engineering options will include consideration of the noise produced during construction and operation of Project One;</td>
</tr>
<tr>
<td></td>
<td>- During construction, 24 hour working practices may be employed so that the overall construction programme and the potential for impacts to marine mammal communities is reduced in time If piling is used, consideration will be given to engineering solutions to mask the piling noise as described in Nehls et al., (2007);</td>
</tr>
<tr>
<td></td>
<td>- Depending upon the foundation design chosen, soft start procedures during pile driving may be implemented. This enables marine mammals in the area disturbed by the sound levels to move away from the piling before significant adverse impacts are caused. Site specific guidance such as that described by JNCC (2010) would be developed regarding the use of Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) Operators;</td>
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<tr>
<td></td>
<td>- The effectiveness of acoustic harassment devices (AHDs) such as seal scarers, and pingers (both of which were employed during the construction of the Horns Reef wind farm (Tougaard et al., 2003, 2004)) should be investigated further; and</td>
</tr>
<tr>
<td></td>
<td>- In order to minimise risk of a vessel strike, a bespoke Code of Conduct for interactions between marine mammals and vessels associated with Project One will be commissioned and actively communicated to all vessels and crew.</td>
</tr>
<tr>
<td>Bats</td>
<td>- Should the impact assessment identify a potentially significant impact on bats resulting from Project One then the use of radar as a means to mitigate the impact may be considered. However, this mitigation technique has not been extensively studied and further research on its effectiveness onshore would be required prior considering deployment offshore; and</td>
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<tr>
<td></td>
<td>- Should the ES identify potential impacts to bats from onshore works, then appropriate mitigation measures may be identified in order to minimise the identified impacts.</td>
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<tr>
<td>Subject</td>
<td>Potential Mitigation and Monitoring</td>
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<tr>
<td><strong>Commercial Fisheries</strong></td>
<td> Consultation with the industry will be vital to ground truth existing data and establish the true extent of commercial fishing within Project One;</td>
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<tr>
<td></td>
<td> Appropriate cable burial (subject to ground conditions) will form the key mitigation measure to reduce the risk of cable snagging and catching by fishing gear;</td>
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<td></td>
<td> Loss or damage to gear as a result of the construction of Project One can be mitigated against through frequent communication and good management practice;</td>
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<td></td>
<td> Given the safety risk involved in fishing close to wind turbine foundations, it is unlikely that fishing gear will be operated in the close vicinity to these areas, and that any Safety Zone imposed around the installed devices will reduce the risk further. Mitigation will be developed during consultation with local operators to ensure best practice with regard to fishing vessel safety is followed;</td>
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<tr>
<td></td>
<td> A decommissioning plan will be developed that will be approved by the regulator and will ensure that any hazards to fishing activities are identified and either removed or marked on charts and reported in the relevant fisheries media; and</td>
</tr>
<tr>
<td></td>
<td> Mitigation and monitoring will be informed by the recent Ichthys Marine (2009) report on options and opportunities for marine fisheries mitigation associated with offshore wind farms.</td>
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<tr>
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<td> Distribution of information and warnings through notices to mariners and other appropriate media;</td>
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<td> Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC);</td>
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<td> Safety zones of appropriate configuration, extent and application to specified vessels;</td>
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<td></td>
<td> Designation of the site as an Area To Be Avoided (ATBA);</td>
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<td></td>
<td> Implementation of routeing measures within or near to the development;</td>
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<td> Monitoring by radar, AIS and / or closed circuit television (CCTV) or other agreed means;</td>
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<td> Appropriate means to notify and provide evidence of the infringement of safety zones or ATBAs;</td>
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<td> Any other measures and procedures considered appropriate in consultation with stakeholders (including the MCA);</td>
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<td> Creation of an Emergency Response Co-operation plan with the relevant Maritime Rescue Co-ordination Centre from construction phase onwards;</td>
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<td></td>
<td> Marking and lighting the site in accordance with General Lighthouse Authority requirements (which will include a system of routine inspection and maintenance of lights and marks);</td>
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<td></td>
<td> MCA standards and procedures for wind turbine generator shut-down in the event of a search and rescue, counter pollution</td>
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<td>Subject</td>
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<tr>
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<td>or salvage incident in or around a wind farm;</td>
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<td>▪ Turbine rotor blade tip clearance at a minimum 22 m above Mean High Water Springs;</td>
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<td></td>
<td>▪ Vessel nominated as guard vessel during construction /decommissioning activities; and</td>
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<tr>
<td></td>
<td>▪ Due to the importance of the region for shipping there is significant navigational infrastructure present within the Study Area including shipping channels, anchorage areas, buoys, precautionary areas and pilot boarding areas. Where possible and practicable, cable routes will be designed to avoid navigational infrastructure.</td>
</tr>
<tr>
<td>Civil Aviation and Military Activities</td>
<td>▪ Aviation obstruction lighting installed as specified in CAA (2010a);</td>
</tr>
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<td></td>
<td>▪ Establishment of temporary aviation exclusion zones; and</td>
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<td></td>
<td>▪ In-fill radar to mitigate radar interference.</td>
</tr>
<tr>
<td>Radar and Communications</td>
<td>▪ There are a number of mitigation techniques which can reduce or remove the impact of wind farm interference on Air Defence radar. Such discussions will be conducted using appropriate evidence and analysis, through Defence Estates. The requirements for potential mitigation and monitoring will be determined during the consultation stage with the stakeholders.</td>
</tr>
<tr>
<td>Ordnance</td>
<td>▪ Explosive Ordnance Safety and Awareness Briefings should be given to all personnel;</td>
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<tr>
<td></td>
<td>▪ All personnel working on Project One should be instructed on the identification of UXO, actions to be taken to alert site management and to keep people and equipment away from the hazard. Posters and information of a general nature on the UXO threat should be held in the site office for reference and as a reminder.;</td>
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<td></td>
<td>▪ Prior to installation of project components (piles, foundations cable etc.) a high resolution non-intrusive geophysical survey will be considered to locate seabed anomalies which may be ordnance related; and</td>
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<td>▪ Micro siting of turbines would be considered should ordnance be located coincident with proposed turbine locations.</td>
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<tr>
<td>Subject</td>
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<tr>
<td><strong>Maritime Archaeology and Cultural Heritage</strong></td>
<td>▪ Mitigation measures usually involve avoidance (the implementation of exclusion zones and design alterations), reduction (the introduction of measures to deal with unexpected discoveries during works), or offsetting (excavation and recording of a site before an impact occurs);  &lt;br&gt;▪ The preferred mitigation for archaeological sites is avoidance. To achieve this turbines and cables may be micro-sited to avoid identified sites and exclusion zones implemented, within which no construction activities may take place;  &lt;br&gt;▪ The implementation of mitigation measures may be managed and monitored through a formal archaeological mitigation strategy, agreed with English Heritage and the relevant Local Authority Archaeologist, and often referred to as a Written Scheme of Investigation (WSI); and  &lt;br&gt;▪ The procedures for reporting and dealing with unexpected archaeological discoveries made during construction will be set out in an appropriate protocol as part of the development of mitigation measures for the project.</td>
</tr>
<tr>
<td><strong>Landscape, Seascape and Visual Amenity</strong></td>
<td>▪ The main form of mitigation available is the layout of the turbines within the Blocks, as well as the extent of the Blocks across Subzone 1. The orientation and ordered design of the layout may reduce the level of significance of impacts, although it is recognised that seabed conditions and other physical process such as tidal currents, wave and wind climate will be a key consideration in determining the layout; and  &lt;br&gt;▪ Mitigation will also be achieved by the proposed colour of the turbines and any ancillary structures.</td>
</tr>
<tr>
<td><strong>Airborne noise and vibration</strong></td>
<td>▪ No mitigation or monitoring is proposed.</td>
</tr>
<tr>
<td><strong>Infrastructure and other users</strong></td>
<td>▪ Potential mitigation may be required for the cable route crossings over existing pipelines and cables. Monitoring of these crossings will also be required; and  &lt;br&gt;▪ Cable routeing should avoid current disposal sites where possible, where this is not a feasible option it may be possible, through consultation with the relevant authorities, to move the site.  &lt;br&gt;▪ Where possible, areas of best and most versatile land will be avoided during identification of the cable route;  &lt;br&gt;▪ Minimising any risk to the integrity of soil resources and land quality during the construction and reinstatement process, handling soils in accordance with best practice; and  &lt;br&gt;▪ Avoiding designated geological and geomorphological sites.</td>
</tr>
<tr>
<td><strong>Geology, Soils, Agriculture and Land Use</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Water Resources
- The cable route, and any overhead line infrastructure, will be designed to take water resources into account where practicable, for example ensuring infrastructure is located at least 20 m from watercourses where possible;
- Pollution control measures will be put into place during the construction phase of the development in order to minimise the risk posed to receiving surface water features;
- Minimising areas of exposed soil;
- Temporary storm water management system;
- Provision of specific bunded storage area; and
- Development of pollution incident reaction plan.

### Air Quality
- Minimise dust generating activities;
- Machinery and dust causing activities to be located away from sensitive receptors;
- Site personnel to be fully trained;
- Trained and responsible manager on site during working times to maintain logbook and carry out site inspections;
- Use water as dust suppressant where applicable;
- Re-vegetate earthworks and exposed areas;
- All vehicles to switch off engines when not in operation – no idling vehicles;
- Effective vehicle cleaning;
- Any loads entering and leaving site to be covered;
- Control site runoff of water / mud;
- On-road vehicles to comply to set emission standards; and
- Non Road Mobile Machinery (NRMM) to use ultra low sulphur diesel (ULSD) where available.

### Terrestrial Ecology and Nature Conservation
- Avoidance of designated nature conservation sites and features identified as ecologically important during scheme design;
- Seasonal constraints to construction operations, for example, to avoid disturbance of breeding birds;
- Sediment traps to avoid sediment laden run off from exposed ground polluting local watercourses;
- Appointment of a site-based environmental specialist, in consultation with the determining authority, to oversee the
<table>
<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>construction phase;</td>
<td>Any construction access tracks to be located and fabricated using materials to minimise generation of runoff and/or drainage requirements, particularly during heavy rain;</td>
</tr>
<tr>
<td></td>
<td>Implementation of pollution prevention measures to avoid pollution of watercourses; and</td>
</tr>
<tr>
<td></td>
<td>Regular monitoring on site to ensure effectiveness of mitigation measures.</td>
</tr>
<tr>
<td>Archaeology and Cultural Heritage</td>
<td>Direct impacts on the historic environment will be avoided where possible in the identification of a preferred cable route corridor. If features are present in close proximity, adoption of construction practices to minimise the width of disturbance or to avoid surface disturbance may be employed; and</td>
</tr>
<tr>
<td></td>
<td>Where archaeological remains cannot be avoided, detailed investigations may be needed prior to construction, or at the start of the construction period to record any remains.</td>
</tr>
<tr>
<td>Landscape, Seascape and Visual Amenity</td>
<td>Mitigation measures will include avoidance of sensitive features through siting and design, and considering planting to replace any vegetation which may need to be removed. Typical good construction practice to reduce adverse impacts (hoarding, maintaining a tidy site, topsoil stripping and storage etc) will also be employed as appropriate;</td>
</tr>
<tr>
<td></td>
<td>Mitigation may be monitored on site by an environmental clerk of works;</td>
</tr>
<tr>
<td></td>
<td>Avoidance of sensitive landscape features including historic features, historic parks and gardens, woodlands and river corridors;</td>
</tr>
<tr>
<td></td>
<td>Restoration of displaced landscape features including woodland, hedgerows, fences and walls;</td>
</tr>
<tr>
<td></td>
<td>Any overhead sections of the grid connection should where possible avoid prominent landscape features, follow a direct line, avoid crossing skylines and avoid convergence with other overhead lines and where applicable make use of routes through industrial zones, in line with National Grid’s Holford Rules (National Grid, undated); and</td>
</tr>
<tr>
<td></td>
<td>Specific mitigation for the substation/converter station may include tree planting and earthworks to provide screening, and sensitive choice of materials for the substation/converter station building.</td>
</tr>
<tr>
<td>Flood Risk</td>
<td>Use of sustainable drainage techniques, ensuring that the development will not lead to an increased risk of flooding, either onsite or downstream.</td>
</tr>
</tbody>
</table>
## Traffic and Transport
- Co-ordinated timing of site deliveries to ensure that disruption to local residents and other highway users is reasonably minimised;
- Construction vehicles and site personnel will be instructed to use only the approved access routes to the site;
- Following discussion and agreement with the local highway authority, appropriate information and signs will be provided on the approaches to the proposed site access; and
- Where practicable, measures will be implemented to minimise delays to rail services as a result of cable route construction under railway lines such as timing construction work to avoid peak travel times.

## Noise and Vibration
- Selection of the most appropriate methods and plant to minimise the level and duration of noise and vibration generated;
- Sensitive location of static plant items;
- Screening and/or enclosure of temporary generators and other noisy plant items;
- Adequate maintenance/lubrication of plant items;
- Shut down of engines when not in use;
- Specification of appropriate access points, haul routes and vehicle standing areas to minimise waiting times and the use of reverse alarms;
- Restriction of vehicle movements to acceptable times;
- Monitoring of noise and vibration; and
- Careful routeing and speed limits for HGVs.

## Socio-Economics and Tourism
- Potential mitigation strategies could involve making use of local facilities such as ports and harbours, maximising the involvement of local businesses in the supply chain for Project One and employing and/or training local people to work at various project stages;
- Directional drilling and other good construction practices to avoid disruption to coastal areas used for recreation;
- Temporary diversions of PROW; and
- Good construction practices along the cable trench to avoid disruption of tourism and recreation e.g. measures to control noise, dust and traffic (described further in relation to these topic specific assessments).
11 CONSULTATION

11.1 Overview

11.1 It is acknowledged that communication with stakeholders is one of the most important parts of any new project, and a key process of the EIA. SMart Wind have therefore developed a consultation strategy at this initial stage of the project, to ensure that relevant stakeholders such as statutory consultees and other interested parties, including the public, have the chance to comment. In doing so this will allow SMart Wind to incorporate concerns within the decision making process and ensure that initial design proposals provide the most sustainable option for all involved.

11.2 The consultation process ensure that;

- The groups and individuals interested in or affected by the proposed development are identified;
- Information issued is accurate, understandable, issued at the appropriate time and does not overwhelm recipients;
- Dialogue is held between those affected by the decisions and those responsible for making the decisions;
- The information provided by the public and consultees is incorporated within the final decision making process and final decision; and
- Feedback is provided to all consultees, including the public, explaining the actions taken and how the final decision has been influenced by the process.

11.3 This Scoping Report forms the required material for submission to the IPC for the purposes of requesting a Scoping Opinion under Regulation 8(3) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. Before adopting that opinion the Commission must (under Regulation 8(6)) consult the consultation bodies, meaning a body prescribed under Section 42(a) of the Planning Act 2008 and listed in column 1 of the table set out at Schedule 1 to the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the APFP Regulations) where the circumstances set out in column 2 are satisfied and each authority that is within Section 43 of the Planning Act (local authorities for the purposes of Section 42(d)).

11.4 SMart Wind has engaged in pre-application informal consultation in order to produce this Scoping Report. An outline consultation undertaken to date is given in section 11.2.

11.5 As part of the EIA process SMart Wind will undertake a stakeholder engagement process including; local exhibitions, drop in sessions, workshops, a telephone advice line, citizen panels, internet, media (radio, newspapers, brochures and pamphlets); and consultation with parish, town and community councils.

11.6 A preliminary list of organisations that SMart Wind intend to consult with through EIA process is given in Appendix 1 and includes those statutory and non-statutory bodies referred to under the Planning Act 2008. This list in Appendix 1 is not definitive or binding and other organisations will be added as they are brought to SMart Wind’s attention.

11.2 Summary of Consultation to Date

11.7 In preparing this Scoping Report, preliminary consultation has been conducted in order to establish a working relationship and inform about the development process. An outline of the consultation to date is given below:

- Royal Society for the Protection of Birds (January, 2010);
- Joint Nature Conservation Committee (January, 2010);
- National Federation of Fishermen's Organisations (April, 2010; November 2010);
- Oil and gas workshop including the Crown Estate, ConocoPhilips, Centrica, GDF Suez, E.ON Ruhrgas and RWDEA (May, 2010);
The Infrastructure Planning Commission (September, 2010);
- East Lindsey District Council (September, 2010);
- North East Lincolnshire Council (September, 2010);
- East Riding of Yorkshire Council (September, 2010);
- Department for Transport (October, 2010);
- National Grid (November 2010);
- Associated British Ports (November 2010);
- Humber INCA (November 2010);
- NATS (November 2010);
- English Heritage (October 2010);
- English Heritage (September 2009);
- North Sea Regional Advisory Council – Demersal Working Group (September 2010);
- Chamber of Shipping (2009);
- MMO – March 2010;
- MCA – February 2010;
- Southern North Sea Environmental Network (Gas Developers) – September 2010;
- CEFAS (April 2010); and
- NATS, CAA, MOD, MCA, RYA – Various stakeholder surgeries at RenewableUK events (2009 and 2010).

11.3 SMart Futures Initiative

11.8 As illustrated in paragraphs 1.15 and 1.16, the Hornsea Zone will comprise of a number of future Projects which have not been fully defined at this stage. As such, the opportunity exists to assign a separate name to each of these future Projects. Naming the individual Wind Farms presents a significant local opportunity, not only in terms of awareness raising within local schools about the issues of Global Climate Change, but also in terms of highlighting the prolific and long-term-term jobs/careers opportunity.

11.9 In order to help maximise such opportunities, SMart Wind has launched a four-year initiative called SMart Futures, aimed at engaging up to fifty six local schools, in and around the Humber area, in a fun but educational programme to “name” each of the separate wind farm Blocks which comprise the Hornsea Zone. SMart Futures will initially be delivered in collaboration with local partners, Humber Engineering Training Association (HETA).

11.4 Public Information Days

11.10 Public information days will be held local community centres and will include local exhibitions, drop in sessions and workshops. The timing, location and targeted groups for each session will be finalised after consultation with Local Authorities. This will ensure all efforts are optimised for the local area in order to engage as many stakeholders as possible.
12 SCOPING QUESTIONS

12.1 Table 12-1 provides a summary of the questions that have been asked throughout this Scoping Report. By asking consultees specific questions, helps the developer to target what part of the development needs further consideration.

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<thead>
<tr>
<th>Document Section</th>
<th>Question</th>
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<tbody>
<tr>
<td>2</td>
<td>Q1: Have all the policy and legislative requirements relevant to Project One been identified and adequately described in this Section?</td>
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<tr>
<td>3</td>
<td>Q2: Do you have any comments on ZAP and its application in the Hornsea Zone?</td>
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<td></td>
<td>Q3: Do you have any comments on the criteria used to select Subzone 1?</td>
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<td>Q4: Does the description of Project One provide enough information with regards to the nature of the development at this early stage of projects’ development?</td>
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<td>4</td>
<td>Q5: Do you have any comments on the proposed EIA/ZEA approaches proposed?</td>
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<td>Q6: Do you believe these assessment methodologies will provide a robust platform for the EIA?</td>
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<tr>
<td>5</td>
<td>Q7: With regard to marine geology, bathymetry, seabed features and sediments, should any further data sources be consulted as part of the EIA process?</td>
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<tr>
<td></td>
<td>Q8: With regard to physical processes, should any further data sources be consulted as part of the EIA process?</td>
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<td>Q9: With regard to water quality, should any further data sources be consulted as part of the EIA process?</td>
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<tr>
<td>6</td>
<td>Q10: With regard to offshore and onshore nature conservation designations, should any further data sources be consulted as part of the EIA process?</td>
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<tr>
<td></td>
<td>Q11: Are these methods sufficient to inform a robust impact assessment of interest features of nature conservation designations resulting from Project One?</td>
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<tr>
<td></td>
<td>Q12: With regard to benthic and epibenthic environments, should any further data sources or guidance documents be considered as part of the EIA process?</td>
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<td>Q13: Are these methods sufficient to inform a robust assessment of impacts on benthos resulting from Project One?</td>
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<td></td>
<td>Q14: With regard to fish and shellfish ecology, should any further data sources be consulted as part of the EIA process?</td>
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<td></td>
<td>Q15: Are these methods sufficient to inform a robust assessment of impacts on fish and shellfish ecology resulting from Project One?</td>
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<td></td>
<td>Q16: With regard to ornithology, should any further data sources be consulted as part of the EIA process?</td>
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<td>Q17: Are these methods sufficient to inform a robust assessment of impacts on birds resulting from Project One?</td>
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<td>Q18: With regard to marine mammals, should any further data sources be consulted as part of the EIA process?</td>
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<td>Q19: Are these methods sufficient to inform a robust assessment of impacts on marine mammals resulting from Project One?</td>
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<td>Q20: Have all potential impacts on marine mammals resulting from Project One been identified within this scoping report?</td>
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<td>Q21: With regard to bats, should any further data sources be consulted as part of the</td>
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<td>EIA process?</td>
<td>Q22: Are these methods sufficient to inform a robust assessment of impacts on bats resulting from Project One?</td>
</tr>
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</table>
| 7                | Q23: With regard to commercial fisheries, should any further data sources be consulted as part of the EIA process?  
Q24: With regard to ports, shipping and navigation, should any further data sources be consulted as part of the EIA process?  
Q25: With regard to civil aviation and military activities, should any further data sources be consulted as part of the EIA process?  
Q26: With regard to radar and communications, should any further data sources be consulted as part of the EIA process?  
Q27: With regard to ordnance, should any further data sources be consulted as part of the EIA process?  
Q28: With regard to maritime archaeology and cultural heritage, should any further data sources be consulted as part of the EIA process?  
Q29: Is there any further guidance relating to landscape seascape and visual amenity, to your knowledge, which we should be aware of?  
Q30: Are you in agreement that it is reasonable to scope these landscape seascape and visual amenity topics out of the EIA process?  
Q31: Do you consider that these visual receptors are appropriate and are there any further visual receptors you would advise to include within the EIA process?  
Q32: With regard to infrastructure and other marine users, should any further data sources be consulted as part of the EIA process?  
Q33: With regard to geology, soils, agriculture and land use, should any further data sources be consulted as part of the EIA process?  
Q34: Do you agree with this approach or should other land uses also be covered in the assessment? If so which?  
Q35: Do you agree with the listed sensitive water resource receptors? Are any omitted? Or should any be removed from the list?  
Q36: With regard to water resources’, should any further data sources be consulted as part of the EIA process?  
Q37: With regard to air quality, should any further data sources be consulted as part of the EIA process?  
Q38: Do you agree with the proposed extent of the study area for construction related air quality impacts?  
Q39: Do you agree that no site specific air quality surveying is necessary given the limited nature of potential impacts and the availability of existing baseline air quality data?  
Q40: Do you agree that a qualitative air quality assessment is appropriate?  
Q41: With regard to terrestrial ecology and nature conservation, should any further data sources be consulted as part of the EIA process?  
Q42: Are the targeted surveys suggested for consideration appropriate for the Ecological Impact Assessment of the onshore components of Project One?  
Q43: With regard to archaeology and cultural heritage, should any further data sources be consulted as part of the EIA process?  
Q44: Are there further key features or locations you think should be covered in the
<table>
<thead>
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<th>Document Section</th>
<th>Question</th>
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| landscape, seascape and visual amenity assessment? | Q45: With regard to landscape, seascape and visual amenity, should any further data sources be consulted as part of the EIA process?  
Q46: Should the issue of flood risk be considered separately from Water Resources?  
Q47: With regard to flood risk, should any further data sources be consulted as part of the EIA process?  
Q48: With regard to traffic and transport, should any further data sources be consulted as part of the EIA process?  
Q49: With regard to noise and vibration, should any further data sources be consulted as part of the EIA process?  
Q50: Do you agree with the extent of the study area for noise sensitive receptors?  
Q51: With regard to recreation, socioeconomics and tourism, should any further data sources be consulted as part of the EIA process? |
| Appendix 1 | Q52: Are there any stakeholders not on the list that you feel should be considered for Project One? |
13 CONTACT DETAILS

13.1 The contact address for SMart Wind is:

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14 REFERENCES


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Appendix 1
Consultation List
Grimsby Ship Repairers & Engineers Association
Habrough Parish Council
Halsham Parish Council
Hanson Aggregates Marine Ltd
Hartel Shipping and Chartering B.V
Hartcliffe Parish Council
Hawerby cum Beesby Parish Council
Healing Parish Council
Health and Safety Executive
Health Protection Agency (Yorkshire and Humber)
Hedon Parish Council
Hessle Parish Council
Highways Agency
Historic Buildings and Monuments Commission for England
Hollym Parish Council
Holmpton Parish Council
Holton-le-Clay Parish Council
Hornsby Travel
Hull and Humber Chamber of Commerce, Industry and Shipping
Hull Fishing Vessel Owners Association
Humber & East Coast Inshore Fishermen's Association
Humber Coastguard
Humber Emergency Planning Service - Humber Local Resilience Forum
Humber Local County Archaeologists
Humberside Airport
Humberston Parish Council
Humbleton Parish Council
Immingham (town) Parish Council
Ingham Parish Council
International Fishing Representatives (France)
Irby Parish Council
Joint Nature Conservation Committee
Joint Nature Conservation Committee
Joint Nature Conservation Committee
Joint Nautical Archaeology Policy Committee
Joint Radio Company (JRC)
Keddington Parish Council
Keelby Parish Council
Keyingham Parish Council
Kimrmond Le Mere Parish Council
King's Lynn Conservancy Board
Kirmington and Croxton Parish Council
Laceby Parish Council
Legbourne Parish Council
Leven Parish Council
Lincolnshire Local County Archaeologists
Lincolnshire County Council
Lincolnshire Police
Little Carlton Parish Council
Local Fire and Rescue Authority (Humberside)
Local Fire and Rescue Authority (Lincolnshire)
Local Police Authority (Humberside)
Louth Parish Council
Lowestoft Fish Producers Organisation
Ludborough Parish Council
Ludford Parish Council
Mablethorpe and Sutton Parish Council
Manby Parish Council
Mapleton Parish Council
Marinet
Maritime and Coastguard Agency - Great Yarmouth Marine Office
Maritime Coastguard Agency
Marshchapel Parish Council
Marine Management Organisation (MMO)
Ministry of Defence (MOD)
MOL (Europe) Ltd
N.V.Exploitatie Vismijn Oostende
National Air Traffic Services
National Federation of Fishermen's Originsations (NFFO)
National Grid
National Grid - Gas Distribution
Natural England - Leicestershire, Lincolnshire and Northamptonshire
Natural England - Norfolk and Suffolk Area Team
Nettleton Parish Council
Network Rail
New Holland Parish Council
New Under Ten Fishermens Association
New Waltham Parish Council
Newark and Sherwood District Council
Newbald Parish Council
NHV Helicopters
Norfolk Coast Area of Outstanding Natural Beauty (AONB)
Norfolk Coast Partnership
Norfolk Line
Norfolk Ornithologists' Association
Normanby-Le-Wold Parish Council
North Cockerington Parish Council
North Cotes Parish Council
North East Lincolnshire Council
North East Lindsey Drainage Board
North Eastern Sea Fisheries Committee
North Kesteven District Council
North Killingholme Parish Council
North Lincolnshire District Council
North Ormsby Parish Council
North Sea Fishermens Organisation
North Sea Regional Advisory Council Secretariat
North Shields Fishermens Association
North Somercotes Parish Council
North Thoresby Group Parish Council
North East Lindsey Drainage Board
Northern Ireland Fish Producers Organisation
Northern Rail
OFCOM
North Yorkshire and the Humber Health Protection Unit
Office of Gas and Electricity Markets (OFGEM)
Oil and Gas UK
Orion Shipping
Ottringham Parish Council
P & O Ferries
Patrington Parish Council
Paull Parish Council
PD Ports Services
Perneco
Port Of Boston
Precision Marine Survey Ltd
Preston Parish Council
Ofwat (If project will affect the water industry)
Preston Drainage Board
Rederiet Nielsen and Bresling A/S
Rederscentrale (Belgium)
Renewable UK
Reston (North & South) Parish Council
Rettig Group (Ltd) Bore
Riby Parish Council
Rimswell Parish Council
RMS Group
Robin Hood Airport Doncaster
Roos Parish Council
Rothwell Parish Council
Royal National Lifeboats Institution (RNLI)
Royal Society for the Protection of Birds (RSPB)
Royal Wagenborg
Royal Yachting Association
Royal Yorkshire Yacht Club
RWE Dea UK
RWE Npower plc
Ryedale District Council
Saltfleetby Group
Samskip
Scallop Association
Scarborough Borough Council
Scarborough Inshore Fishermens Society
Scottish Fishermans Federation
Seacon Terminals Ltd
SEACOR Marine Ltd
Searyby cum Ownby Parish Council
Seawatch Foundation
Selby District Council
Severn Trent Water Ltd
Shell Exploration & Production in Europe
Shipping Policy (Department of Transport)
Skeffling Parish Council
Skegness Yacht Club
Skerne and Wansford Parish Council
Skidbrooke Parish Council
South Cockington Parish Council
South Holland District Council
South Killingholme Parish Council
South Somercoates Parish Council
South West Fish Producers Organisation
Southern Norway Trawlers Association (Norway)
Sproatley Parish Council
Stainton-Le-Vale Parish Council
Stallingborough Parish Council
Statoil (Sheringham Shoal)
Stena Line Limited
Stewton Parish Council
Stichting van de Nederlandse Visseij (Netherlands)
Sunk Island Parish Council
Swallow Parish Council
Swine Parish Council
Swinthorpe Parish Council
Tarmac Limited
Tetney Parish Council
The Chamber of Shipping
The Coal Authority
Rail Passenger Council (Passenger Focus)
Rail Regulation
The Commission for Rural Communities
The Commission for Sustainable Development
The Commission on Architecture and the Built Environment (CABE)
The Crown Estate Commissioners
The Fish Producers Organisation
The Disabled Persons Transport Advisory Committee
The Equality and Human Rights Commission
Theddlethorpe St Helen
Theddlethorpe All Saints
Thoresway Parish Council
Thorganby Parish Council
Thorngumbald Parish Council
Thornton Curtis Parish Council
Torbulk
TOTAL Gas & Power Ltd
Trinity House
UK Association Of Fish Producers Organisation Ltd
UK Hydrographic Office
Ulceby Parish Council
Union de Armateurs a la Peche de France (UAPF)
Union Transport
Utterby Parish Council
Venture Production plc (centrica)
Volantis Exploration
Waithe Parish Council
Walesby Parish Council
Waltham Parish Council
Warwick Energy
The Forestry Commission - East England Office
Wawne Parish Council
Welcome to Yorkshire
Welton Le Wold Parish Council
Welwick Parish Council
West Lindsey District Council
West Ravendale Parish Council
Westminster Dredging Company
Whale and Dolphin Conservation Society
Wharton Grove Wharf Ltd
Whitby Trawlersmen
Wildlife and Countryside Link
Willerby Parish Council
Willingham
Willoughton
Wilson ASA
Withem with Stain Parish Council
Withernsea Parish Council
Withernwick Parish Council
Wold Newton Parish Council
Woodmansey Parish Council
Wootton Parish Council
Worlaby Parish Council
Wyham cum Cadeby CP
Yarburgh CP
The Homes and Communities Agency
Water Management Alliance
Yorkshire and Humber Regional Planning Authority
Yorkshire Shipping Ltd
Yorkshire Tourist Board
Yorkshire Water Plc.
Yorkshire and Humber Strategic Health Authority
Yorkshire Forward

Q52: Are there any stakeholders not on the list that you feel should be considered for Project One?